WEST AFRICA BUILT ENVIRONMENT RESEARCH (WABER) CONFERENCE

12-14 August 2013
British Council, Accra, Ghana

PROCEEDINGS

Editors
A/Prof Samuel Laryea
Dr Sena Afi Agyepong
Proceedings of the West Africa Built Environment Research (WABER) Conference 2013

Accra, Ghana, 12-14 August 2013

Editors
A/Prof Samuel Laryea, University of the Witwatersrand, Johannesburg, South Africa
Dr Sena A. Agyepong, Ashesi University College, Ghana

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Please visit www.waberconference.com for more information

Declaration
All papers in this publication have been through a review process involving initial screening of abstracts, review by at least two referees, reporting of comments to authors, modifications of papers by authors and re-evaluation of re-submitted papers to ensure quality of content.
A very warm welcome to everyone attending this WABER 2013 Conference. This year’s conference is special for a number of reasons. First, it is our fifth anniversary conference. Time flies! Second, we have keynote speakers from very distinguished backgrounds. Third, we have a WABER Committee providing the academic leadership for development of the Conference. Fourth, we have participants coming from 12 different countries. Fifth, we are back in Ghana after our successful WABER 2012 conference in Abuja, Nigeria. Sixth, the person who has written the paper adjudged to be the best is winning a prize worth about £3000 (Pounds) plus an opportunity to disseminate their work and network with international researchers. This is the first time of instituting the WABER-ARCOM best paper prize and the winner will be travelling to the UK to participate in the ARCOM 2013 Conference on 2-4 September – all expenses are paid for by the Association of Researchers in Construction Management (ARCOM). These are exciting developments and I want to thank you for contributing to our success.

I thank everyone here for coming particularly those of you who keep coming from year to year since 2009. Thanks also to all authors who have successfully gone through the peer review process and had their papers accepted and published in this proceedings. The peer review process for this conference has become increasingly rigorous so please accept our congratulations if you have your paper published in this proceedings. We received a total of 232 abstracts, 172 full papers, and eventually accepted 102 papers for publication in this proceedings which represents approximately 60% of full papers submitted. This statistic provides an indication of significant participation in the WABER conference and underscores the need to congratulate successful authors. The paper publishing process would not have been possible without the usual support of our 45 scientific committee members, 12 theme leaders and 58 reviewers from various parts of the world. Thank you for supporting us. We will be building on the successes of the past 5 years to develop our African Journal for Built Environment Research and expand the WABER website to provide a range of resources and services to support your research development.

We owe a huge debt of gratitude to Doaigonal Projects Africa (DPA) Pty Ltd for serving as a major sponsor for the WABER 2013 conference. The Managing Director, Mr Moses Honu, has been very instrumental in making the collaboration between WABER and DPA possible so I wish to thank him for his passion about research and the development of the built environment field in Africa. We are also developing partnerships with RICS and John Rixs Construction Engineers & Contractors whose respective logos are featured on the front cover of this publication.

This year we have outstanding keynote speakers in the persons of Prof Chimay Anumba, Dr Ron Watermeyer and Dr Roine Leiringher. I would like to thank them for accepting our invitation to come and interact with the delegates at this conference. I cannot close without expressing gratitude to Dr Sena Agyepong – our Regional Organising Director. Her dedication and strong commitment is what sustains us from year to year. Dr Emmanuel Essah has been instrumental in helping to organize the conference logistics and financial issues.

My final and special thanks is reserved for our delegates who attend the conference. I know the difficult conditions under which many of our colleagues operate. Many of you have travelled great distances to come here. A number of you have covered your expenses from your own pockets. I want to recognize your commitment towards research development and the sacrifices you have made in order to be here. Thank you for coming and I pray you benefit greatly from the conference and go on to experience significant career progression in the coming years.

Take every chance to interact and enjoy the conference and have a safe journey back home.

A/Prof Samuel Laryea
School of Construction Economics and Management
University of the Witwatersrand, Johannesburg, South Africa
August 2013
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THEME LEADERS

We are grateful to the following academics for leading the refereeing process for papers relating to their research areas:

**Dr Emmanuel A. Essah**, University of Reading, UK – Building services, solar energy technologies, renewable energy, building physics, sustainable technologies

**Dr Haruna Moda Musa**, Manchester Metropolitan University – Sustainability in the built environment and construction materials

**Dr Noah K. Karley**, Heriot-Watt University, UK – Real Estate Development

**Dr Roine Leiringer**, University of Hong Kong, Hong Kong – Construction procurement, and organisational strategy and development

**Dr Scott Fernie**, Loughborough University, UK – Construction procurement, supply chain management, partnering and relationship management

**Dr Tyler James Frazier**, Technische Universität München, Germany – Building services, transportation and infrastructure development services

**Dr. Jian Zuo**, University of South Australia, Australia – Project management and project organisation

**Dr Yingbin Feng**, University of Western Sydney, Australia – Occupational Health and Safety, Human resources

**Stephen Ajadi**, Contemporary Initiative for Research in Design (CIRD), Nigeria – Architecture and planning

**Dr Nii Ankrah**, University of Wolverhampton, UK – HR, Culture and project organization

**Dr Aaron Anvuur**, Loughborough University, UK – Procurement and Supply Chains or Project Organisation and Management

**Dr Martin Morgan Tuuli**, Loughborough University, UK – Quantity surveying, financial management and construction economics
The peer review process for an international conference of this nature requires the expertise and voluntary contribution of a number of academics from various countries. We are grateful to the following people who assisted by carrying out the review of abstracts and papers for the WABER 2013 conference in addition to the members of our Scientific Committee.

Dr. Folake Isaacs-Sodeye, University College London, United Kingdom
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Prof George Ofori, National University of Singapore, Singapore

THANK YOU FOR YOUR CONTRIBUTION
WABER COMMITTEE

The West Africa Built Environment Research (WABER) Committee for 2012-14 comprises of the following persons:

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Dr Sena A. Agyepong, Ashesi University College, Ghana

**Financial Director**  
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Dr Martin Tuuli, Loughborough University, UK  
Prof Stella Zubairu, Federal University of Technology, Minna, Nigeria

The main responsibility of the WABER Committee is to provide the infrastructure and academic leadership for developing the WABER conference.

Our sincere thanks to the following persons who provided the infrastructure and academic leadership for developing WABER over the past four years: Dr Sena Agyepong, Mr Samuel Asare-Konadu, Dr Emmanuel Essah, Dr Chris Harty, Professor Will Hughes, Dr Samuel Laryea, Dr Roine Leiringer and Professor George Ofori.
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We wish to express our profound gratitude to the following sponsors and partners of the WABER Conference.

More information about our sponsors and partners is available on our website www.waberconference.com
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The Royal Institution of Chartered Surveyors (RICS) is an independent organisation acting in the public interest by setting and regulating the highest standards of competence and integrity amongst its members. RICS was founded in London in 1868 by 39 surveyors. Today RICS represents more than 100,000 land, property and construction professionals globally.

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“*Our firm is about delivery. It’s about the quality of work we do and the services we provide to satisfy our clients*”

*Mr Samuel Asare-Konadu, Founder and Managing Director, A-Kon Consults Ltd*

### Humble Beginnings

A-Kon Consults Ltd opened its doors for business on 21st October, 2002. After starting the company from his dining table, Samuel Asare-Konadu used all the capital he had to pay for the rent of a small 20 m² office space for $2,200. The first five years was a slow but steady walk to building a brand presence and reputation in the industry. The company often took on unpaid jobs by small contractors until the first big contract for a residential apartments’ project in an exclusive suburb of Accra. Since then, we have experienced rapid, profitable growth and expansion in projects and services.

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Our portfolio of completed projects include the Accra Sports Stadium, Cargill cocoa processing factory, office buildings for Maersk Line, Ericsson, and several residential real estate projects. Currently, A-Kon Consults Ltd is partnering with Davis Langdon, the world’s leading quantity surveyors on the first green building in Ghana, the One Airport Square project, valued at $45 million. This affirms our reputation as one the leading firms in Ghana with the capacity to deliver on innovative and environmentally sustainable designs for the built environment.

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in quantity surveying to deliver on projects and our range of services offered. This expertise is reflected in the firm’s technical excellence and dedicated pursuit of exceptional value to clients.

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A-Kon Consults Ltd is proud to be celebrating 10 years and rises to the challenge of shaping a sustainable future due to technological changes and evolution of the industry, by innovating and executing on improved solutions for its clients.

**Contact Us**

A warm welcome awaits you if you would like to contact us through any of the following coordinates:

**Location:** No. 4, Saflo Link Abelenkpe, Accra  
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**Email:** info@a-konconsults.com  
**Website:** www.a-konconsults.com

We are delighted to be part of the 5th WABER Conference taking place in Accra, Ghana on 12-14 August 2013. As a firm we always strive to drive high standards, professionalism and development of the construction industry. A vibrant and well organised construction industry can create growth and opportunity for our people. A lot of those participating in this year’s WABER Conference are future leaders of the construction industry either as academics, researchers or practitioners. You have ideas. We need your ideas and innovations to develop the industry and regional economy and take it forward to the next level. That is why we are happy to be part of this conference.


Samuel Asare-Konadu  
Managing Director  
B.Sc. (Hons), MRICS, MCIOB, MGHIS  
**Email:** sak@a-konconsults.com
PROGRAMME

MONDAY 12TH AUGUST 2013

07:30-09:00  REGISTRATION

09:00-09:45  OPENING SESSION (AUDITORIUM)
09:00-09:10  Welcome address
09:10-09:20  Remarks by Managing Director of Diagonal Projects Africa (DPA) – Moses Honu
09:20-09:40  Address by Guest of Honour – Samia Yaba Nkrumah
09:40-09:45  WABER 2013 Group Photograph

09:45-10:00  BREAK

10:00-10:40  KEYNOTE ADDRESS by PROFESSOR CHIMAY J. ANUMBA
FREng, PhD, DSc, Dr.h.c., CEng, FICE, FIStructE, FASCE, FCIOB
Department Head and Professor of Architectural Engineering, The Pennsylvania State University, USA

Title: Emerging trends in Building Information Modelling: Implications for projects in developing economies

11:00-13:00  PARALLEL SESSION (STREAM 1 - AUDITORIUM)

Chairperson: Dr Martin Tuuli, Loughborough University, UK

11:00-11:10  A case for deepened construction supply chain management in South African state-owned enterprises - FA Emuze, V Klaas and J Smallwood
11:10-11:20  Sustainable supply chain management in construction firms - Elizabeth Ojo, Charles Mbohwa and Esther T.Akinlabi
11:20-11:30  Discussion
11:30-11:40  A preliminary inquiry into the applicability of client-contractor partnering in the Ghanaian construction industry - Frederick Ababio Nuamah, Patrick Manu, and Emmanuel Manu
11:40-11:50  Contractor-subcontractor working relationships: a review of transaction cost economics and resource-based theory - Augustine Blay-Armah, Andy Ross and Raymond Abdulai
A framework for assessing the effectiveness of competitive tendering process in public works procurement at pre-contract stage in Chad: a research proposal - Sazoulang Douh

Contextualising the methodology for developing a collaborative working framework for improving construction design service delivery in Ghana – N. K. Orgen, D.K. Akhadzie, J. Ayarkwa and E Badu

Expert system and econometric entropy-based model for residential building project cost adjudication - Lekan M.AMUSAN; AYO K.Charles and Timothy O.Mosaku

Awareness of artificial intelligence (AI) methods for cost estimating in the Nigerian construction INDUSTRY - Baba Shehu Waziri

LUNCH AND NETWORKING BREAK

PARALLEL SESSION (STREAM 1 - AUDITORIUM)

Chairperson: Dr Aaron M. Anvuur, Loughborough University, UK

Governing construction project procurement to mitigate contractor’s opportunism: A conceptual framework. - Olusola Ogunsina, Deji Rufus Ogunsemi, Oluseyi Awodele

An appraisal of challenges facing competitive tendering implementation in public works procurement in Chad Republic - Sazoulang Douh, E. Badu, T. Adjei-Kumi, E. Adaniyira

Housing procurement in informal settlements: a case study of Ayobo, Lagos, Nigeria – Opoko Akunnaya Pearl and Ibem Eziyi Offia

Procurement for national transformation: adopting modern technology methods the alternative for adequate housing delivery in Nigeria - Zaki Yakubu M, Abdullahi Suraj, Musa-Haddary and Yakubu Gimson

An evaluation of public private partnership (PPP) for housing delivery in Lagos state, Nigeria - Aiyetan, Ayodeji Olatunji and Abiola-Falemu, J. Ojo

A critical review of public private partnership practice in Nigeria - Afeez Olalekan Sanni,a and Maizon Hashim

Whole life costing practice in procurement of public buildings in Nigeria: myth or reality? - Fatima M Bello, Ahmed Doko Ibrahim and Baba Adama Kolo

Bridging the finance gap in infrastructure procurement through build-operate-transfer (BOT) mechanism in Nigerian tertiary institutions - Gbadegesin, Job Taiwo and Oyewole.Mathew.O

Discussion
17:10  CLOSE AND REFRESHMENTS

MONDAY  12TH AUGUST 2013

07:30-09:00  REGISTRATION

09:00-09:45  OPENING SESSION (AUDITORIUM)

09:45-10:00  BREAK

10:00-10:40  KEYNOTE ADDRESS by PROFESSOR CHIMAY J. ANUMBA

FREng, PhD, DSc, Dr.h.c., CEng, FICE, FStructE, FASCE, FCIOB

Department Head and Professor of Architectural Engineering, The Pennsylvania State University, USA

Title: Emerging trends in Building Information Modelling: Implications for projects in developing economies

11:00-13:00  PARALLEL SESSION (STREAM 2 - SEMINAR ROOM)

Chairperson: Dr Roine Leirnger, University of Hong Kong, Hong Kong

11:00-11:10  Investigation into the costs of preliminaries and relationship between these costs and total cost of building projects - Inyang-Udoh, U. I.
11:10-11:20  Assessment of the pricing of preliminaries items in the bill of quantities - Wasiu Adeniran Bello and Afeez Adetayo
11:20-11:30  Discussion
11:30-11:40  The 10% standard or lump sum - a statistical analysis of estimating construction contingency accuracy - Omoleye B.Ojuri
11:50-12:00  Discussion
12:00-12:10  Challenges facing district assemblies’ “in-house” administered construction contracts – Sarfo Mensah and Collins Ameyaw
12:10-12:20  Reducing variability in concrete activity labour productivity to improve labour performance - John Ebhohimen Idiake, Bala Kabir and Shehu Ahmadu Bustani
12:20-12:30  Discussion
12:30-12:40  An assessment of contractor’s risks exposure within some standard forms of building contract in Nigeria - Biodun Nathaniel Obaju, Yakubu
Gimson Musa-Haddary and Baba Adama Kolo
12:40-12:50 Post-contract construction disputes in the Ghana health sector: causes and effects - Sarfo Mensah and Collins Ameyaw
12:50-13:00 Discussion

13:00-14:15 LUNCH AND NETWORKING BREAK

14:15-14:55 KEYNOTE ADDRESS by Dr RON WATERMEYER

DEng, CEng, PrEng, PrCM, PrCPM, FSAICE, FIstructE, FICE
Convenor of the International Standardisation Organisation’s (ISO) Technical Committee TC 59 (Building and Construction) Working Group 2 for Construction Procurement (ISO 10845)

Title: Value for money in the delivery of public infrastructure

15:00-17:30 PARALLEL SESSION (STREAM 2 - SEMINAR ROOM)

Chairperson: Professor Wellington D. Thwala, University of Johannesburg, South Africa

15:00-15:10 Identification of Construction Delay Factors: Perception of Multinational and Indigenous Construction Firms in Nigeria - Abisuga Abiodun Olatunji and Salisu Harfiz Adewale
15:10-15:20 Delays to large construction projects in Ghana: a risk overview - Joseph Ignatius Teye Buertey, Miezah, Augustine Kaku, THEOPHILUS Adjei Kumi
15:20-15:30 Discussion
15:30-15:40 Effects of management practices on the completion time of building projects in Ghana - Anita Asamoah-Duodu, Kwame Danso and Collins Ameyaw
15:50-16:00 Effect of bid bond on construction project performance in Nigeria - Oke, A.E., Ogunsemi, D. R., Aje I.O. and Ogundimu, A.F.
16:00-16:10 Discussion
16:10-16:20 The problems and prospects of the Tagwai dam, Minna, Niger State, Nigeria - Musa Dalil
16:20-16:30 Managing end-users’ satisfaction during capital developments by adopting value engineering as project management tool - Ogbeifun, E, Pretorius, J.H. and Mbohwa, C.
16:30-16:40 Discussion
16:40-16:50 Exploring the benefits of e-tendering for infrastructure project procurement in Nigeria - Alhassan Dahiru, Sani Usman Kunya and Ahmed Isah Gumel
16:50-17:00 Cost of tendering in Ghana- client’s perspective - Collins Ameyaw, SARFO Mensah and Johmark Asubonteng
17:00-17:10 Discussion
CLOSE AND REFRESHMENTS

TUESDAY 13TH AUGUST 2013

PARALLEL SESSION (STREAM 1 – AUDITORIUM)

Chairperson: Dr Cynthia Adeokun, Covenant University, Nigeria

09:00-09:10  A paradigm shift in urban economic theories: the re-examination of land and housing values determinants - Ilechukwu, V.U
09:10-09:20  Improving land governance in Nigeria: the case of compulsory acquisition and compensation practice - Odebode, Adedayo Ayodeji, Olaleye, Abel and Oladokun, Timothy Tunde
09:20-09:30  Discussion
09:30-09:40  Reconciling the provisions of the land use act and the Kwara State land charge law - Atilola Moses Idowu
09:40-09:50  Factors affecting the implementation of building regulations (L.I.1630) in GHANA - Simon Ofori Ametepey and Samuel Kwame Ansah
09:50-10:00  Discussion
10:10-10:20  Appraisal of the development control activities of Oriade local government planning authority, Osun State, Nigeria - Ogundahunsi, D. S.
10:20-10:30  Implication of housing development on wetland loss in Eti Osa local government area of Lagos State, Nigeria – Muraina Alimi Musibau and Iyanda Oladimeji
10:30-10:40  Discussion
10:40-11:00  REFRESHMENTS AND NETWORKING BREAK

Chairperson: Dr Gabriel Nani, KNUST, Kumasi, Ghana

11:00-11:10  Amoebic urbanization: the Lagos-Ota nexus - Taofiki SALAU, Taibat LAWANSON AND Omoayena Yadua
11:10-11:20  Go-ahead element of domestic architecture: socio-economic and cultural characteristics of the residents in Benin - Ekhaese Eghosa Noel
11:20-11:30  Discussion
11:30-11:40  Determining the unique features of mass housing projects (MHPs) - E. Adinyira, D. Ahadzie, T. E. Kwofie
11:40-11:50  Towards efficient provision of physical infrastructure in residential areas of Makurdi, Nigeria - Patience Adzande
11:50-12:00  Discussion
12:00-12:10  Poverty and socio-economic adaptation strategies in Lagos metropolis, Nigeria - Taibat Lawanson and Leke Oduwayne
12:10-12:20  Sharing, cooperation and conflicts: Multihabitation as an urban low income housing strategy in Accra - Irene Appeaning Addo
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12:30-12:40  Impact of road transportation on regional development of Igbomina Region Of Osun State, Nigeria – Adedotun S.B.
12:40-12:50  Post occupancy evaluation of public secondary schools facilities - Abisuga Abiodun Olatunji
12:50-13:00  Discussion
13:00-14:15  LUNCH AND NETWORKING BREAK

14:20-14:55  KEYNOTE ADDRESS by DR ROINE LEIRINGER (AUDITORIUM)

Co-editor of Construction Management and Economics journal & Associate Professor in the Department of Real Estate and Construction at The University of Hong Kong

Title: Research development

15:00-17:30  PARALLEL SESSION (STREAM 1 - AUDITORIUM)

Chairperson: Professor G.W.K. Intsiful, KNUST, Kumasi, Ghana

15:00-15:10  Perception of the financial sector towards real estate investment in Sub Saharan Africa: a case study Ghana - Enyonam Offeibea Megbenu, Frederick Ababio Nuamah and Michael Mwineoro Muomaalal

15:10-15:20  A study of liquidity in residential property sales transaction in Lagos state Nigeria - Odebode Adedayo Ayodeji

15:20-15:30  Discussion


15:50-16:00  Effective sites and services scheme as a means of solving low-income housing need in Nigerian cities - Bello Nurudeen Akinsola, Oladokun Timothy Tunde and Adegunle Tomisi Olusegun

16:00-16:10  Discussion

16:10-16:20  Correlates between construction company size and corporate performance: an exploratory study - George Cyril Tucker, ABIMBOLA O Windapo, Keith S Cattell

16:20-16:30  Reversing the business failure rate among small and medium size construction firms in South Africa: a progressive study - L Wentzel, F A Emuze and J J Smallwood

16:30-16:40  Discussion

16:40-16:50  The missing links between construction sector and development in Nigeria: a polycentric planning perspective - Samson Akinola, Moses Ogunbiyi, Adesokan Adeleye and Ayodeji Ajayi

16:50-17:00  The inflation hedging potential of commercial property investments in Ibadan, Nigeria - Ogunba Olusegun Adebayo, Obiyomi Olawale Oluwatosin and Dugeri Terzungwe

17:00-17:10  Inflationary trends and the prices of some selected construction plants – D.O. Mac-Barango

17:10-17:20  Development of a design-related computer-based model for estimating building material quantities - Blondel Aibaitey, John Dadzie and Godfred Fobiri

17:20-17:30  Discussion
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09:10-09:20  Redesigning buildings for efficient utilization of solar energy source in Kaura Namoda, Nigeria - Nghai Ezekiel Suleman and Edwin Albert Umoh
09:20-09:30  Discussion
09:30-09:40  A case for improved indoor environmental quality (IEQ) in multi-use buildings - FA Emuze, H Matshili and B Botha
09:40-09:50  Operation green Lagos programme and its implication for sustainable development - Isidore C. Ezema
09:50-10:00  Discussion
10:10-10:20  Spatial analysis of fire disaster and emergency service location in Jos metropolis - Ozigis S. M, Gajere E. N, Emmanuel E. A and Hylpambuwa Y
10:20-10:30  Geospatial analysis of pre and post 2012 flood disaster in Lokoja and environs, Nigeria – Achema E. Emmaneul, Ojigi M.Lazarus and Adeleke A.Jude
10:30-10:40  Discussion
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12:40-12:50 Application of Semi-Quantitative Risk Based Inspection Technique in Prioritizing Defects Severity of a Residential Building Systems - Dabo B. Hammad and Ali Garba Rishi
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Co-editor of Construction Management and Economics journal & Associate Professor in the Department of Real Estate and Construction at The University of Hong Kong
Title: Research development

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Facilitator: Professor Chimay J. Anumba

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12:00-12:10 How domestic space embodies status: a comparative study of kitchens and culinary practice in Ile-Ife, Nigeria - Folake Ekundayo Isaacs-Sodeye
12:10-12:20 The Orowa house: a typology of traditional Yoruba architecture in Ile-Ife, Nigeria - Cynthia O.Adeokun
12:20-12:30 Discussion
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12:50-13:00 Discussion
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14:30-17:00  RESEARCH SKILLS WORKSHOP ON QUALITATIVE AND QUANTITATIVE DATA ANALYSIS TECHNIQUES (AUDITORIUM AND SEMINAR ROOM)
Facilitators: Dr Martin Tuuli & Dr Aaron M. Anvuur

17:00-17:15  Conference Summary - Dr Roine Leiringer (AUDITORIUM)
17:15-17:45  Presentation of certificates and prizes – Samuel Laryea and Sena Agyepong (AUDITORIUM)

17:45  CLOSE AND REFRESHMENTS

WEDNESDAY  14TH AUGUST 2013

09:00-11:00  WORKSHOP ON RESEARCH GRANT PROPOSAL WRITING
Facilitator: Professor Chimay J. Anumba

11:00-11:30  REFRESHMENTS AND NETWORKING BREAK

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Professor Chimay J. Anumba¹

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The Developments in Building Information Modelling (BIM) have resulted in significant industry interest and uptake. Many new building projects are increasingly dependent on BIM for resolving coordination, schedule, integration, estimating and other functions. Advances in information and communications technologies (ICT) are continuing to open up new opportunities and applications. As such, more needs to be done to fully exploit the potential of these technologies and to meet the requirements of increasingly complex projects. This Keynote Lecture will provide a historical perspective on BIM, discuss some current developments, and explore potential future directions for BIM. The role of integrated project delivery and other collaborative systems will be highlighted. An insight into potential future developments and applications (for example, in healthcare facilities) will also be provided. The implications of these developments for projects in developing economies will be discussed in the concluding part of the lecture.

Keywords: Building information modelling, developing economies.

Professor Chimay J. Anumba – Bio-Sketch

Professor Chimay Anumba is a Fellow of the Royal Academy of Engineering. He holds a Ph.D. in Civil Engineering from the University of Leeds, UK; a higher doctorate – D.Sc. (Doctor of Science) - from Loughborough University, UK; and an Honorary Doctorate (Dr.h.c.) from Delft University of Technology in The Netherlands for outstanding scientific contributions to Building and Construction Engineering. His research interests are in the fields of advanced engineering informatics, concurrent engineering, knowledge management, distributed collaboration systems, and intelligent systems. He has over 450 scientific publications in these fields and his work has received support worth over £100m from a variety of sources. He has also supervised more than 40 doctoral graduates and mentored over 20 postdoctoral scholars. He is a Chartered Engineer and Fellow of the ICE, IStructE, ASCE and CIOB.

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VALUE FOR MONEY IN THE DELIVERY OF PUBLIC INFRASTRUCTURE

Dr Ron Watermeyer¹

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Public infrastructure, which is central to the economy of a country, has little inherent value, but creates value through the economic and social activities it supports. The economic downturn has put the spotlight on the value for money proposition that planned and delivered public infrastructure provide. A number of different organisations have over the last few years began to put in place processes and procedures to deliver value for money. Others have identified the drivers of value for money. Approaches to monitoring and assessing value for money have also been recently documented. It is important to not only have a clear understanding of what is meant by value for money but also how value for money can be demonstrated or confirmed in the context of infrastructure delivery. Such an understanding enables a strategic approach to be taken in the design and implementation of a procurement and delivery management system for infrastructure. This paper outlines current thinking around what constitutes value for money and how it is assessed. It also indicates how procurement and delivery management systems need to be designed and implemented to support of this imperative.

Keywords: value for money, procurement, delivery management, infrastructure.

INTRODUCTION

People are surrounded by economic infrastructure (fixed capital investment including construction works) which are foundational to a better life for all. Investment in economic infrastructure occurs in expectation of demand or in reaction to demand for capacity. When it happens, it has the following three impacts (Watermeyer, 2011a):

1) an initial growth in demand for people, equipment and materials on the project, which lasts as long as it takes to create the asset;
2) a demand on resources over the lifespan of the project to maintain the asset; and
3) a productivity impact in the overall economy, either producing more or producing it better due to more efficient infrastructure (or simply the availability of capacity like harbour capacity and electricity).

Expenditure on economic infrastructure will not necessarily lead to economic growth. Infrastructure which provides improvements or efficiencies in services, production or export capabilities and which is delivered and maintained in a manner which minimizes waste of materials, time, and effort in order to generate the maximum possible amount of value, is most likely to contribute to economic growth.

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The failure of or the lack of sufficient infrastructure puts the spotlight on government whose goal is to deliver a better life for all. The tackling of poverty and underdevelopment in Africa is being hampered by shortcomings in the delivery and maintenance of infrastructure as evidenced in a recent World Bank report (Foster, 2008) which examined infrastructure in 24 countries that together account for 85% of GDP, population and infrastructure aid flows of Sub-Saharan Africa. This report found that:

- in some countries infrastructure provision is not focussed where it is most needed;
- countries typically only manage to spend about two thirds of the budget allocated to investment in infrastructure; and
- about 30% of infrastructure assets are in need of rehabilitation.

The global financial crisis has caused governments to rethink the management of their procurement and delivery management systems in the wake of massive fiscal stimulus packages. Governments need to manage these expenditures wisely in order to obtain value for money, sustain public and private confidence that public funds are being well spent and demonstrate financial stewardship and lasting benefits (Schooner and Yukins, 2011).

The key question that is currently being asked whenever new public infrastructure is contemplated or delivered is “does the investment represent value for money?”

**THE VALUE FOR MONEY CONCEPT**

**Principles**

The Office of the Auditor-General of New Zealand (2008) defined value for money in a procurement context as “using resources effectively, economically, and without waste, with due regard for the total costs and benefits of an arrangement, and its contribution to the outcomes the entity is trying to achieve.” This office stressed that value for money in a procurement context does not necessarily mean selecting the lowest price but rather the best possible outcome for the total cost of ownership (or whole-of-life cost).

Barnett *et al* (2010) consider value for money to be a term generally used to describe an explicit commitment to ensuring that the best results possible are obtained from the money spent. They furthermore point out that such a term reflects a concern for more transparency and accountability in spending public funds, and for obtaining the maximum benefit from the resources available. The UK National Audit Office (2010) defines “good value for money” as the “optimal use of resources to achieve the intended outcomes.” The Department for International Development (DFID) (2011) views value for money as a means for developing a better understanding (and better articulation) of costs and results so that more informed, evidence-based choices can be made.
Table 1: Interpreting the 4 E’s associated with value for money

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<tr>
<td>Economy</td>
<td>Economy focuses on the reduction of the cost of resources used for an activity with a regard for maintaining quality. It relates to how cost-effectively financial, human or material resources are acquired and used. It speaks to acquiring inputs of the right quality at the right price.</td>
<td>Can the same or equivalent inputs be obtained for less money? Would using less expensive different / alternative inputs risk effectiveness, including sustainability? Would using less expensive inputs risk greater maintenance costs over the life of the project? What are the cost inputs and the whole life costs?</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Efficiency focuses on the increasing of an output for a given input, or minimising input for a given output, with a regard for maintaining quality. It is a measure of productivity as it relates to how resourcefully inputs are converted into outputs and subsequent outcomes. It speaks to how well inputs are converted to outputs.</td>
<td>Can the same results be achieved while saving on how the activities are managed? Would making savings on how the project is managed risk a reduction in effectiveness or incur other costs? Would different pathways in delivery achieve different outcomes? How much is got out in relation to what is put in?</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Effectiveness focuses on the successful achievement of the intended outcomes from an activity. It relates to how successfully an intervention achieves its intended outcomes and subsequent impacts are realised. It speaks to how well outputs achieve desired outcomes.</td>
<td>What outcomes have been achieved? What is the gap between what has been achieved and what was intended? Is the performance acceptable? What are the qualitative and quantitative measures of increase or decrease in outcomes that demonstrate that a project is effective in delivering its intended objectives?</td>
</tr>
<tr>
<td>Equity</td>
<td>Equity focuses on the selection of resources and targeting strategies to promote secondary objectives. It relates to the potential to generate business and employment opportunities for targeted groups. It speaks to what equity can be leveraged through a project.</td>
<td>Who benefits from the business and employment opportunities generated by economic activity? What targeting strategies are applied to promote secondary objectives? How is health and safety performance improved?</td>
</tr>
</tbody>
</table>

Jackson (2012) argues that value for money is about “striking the best balance between the “three E’s” – economy, efficiency and effectiveness” and is “not a tool or a method, but a way of thinking about using resources well.” Jackson also points out that a “fourth “E” – equity – is now also sometimes used to ensure that value-for-money analysis accounts for the importance of reaching different groups.” DFID (2011) views “equity” in the context of value for money as “making sure our development results are targeted at the poorest and include sufficient targeting of women and girls.” Equity, from a developing country perspective can also relate to the establishment and strengthening of indigenous building materials and methods and the
promotion of construction technologies that increase employment; all of which ensure local participation in projects. Accordingly economy, efficiency and effectiveness relate to the primary objectives of a project whereas equity relates to the secondary objectives of the project i.e. what can be promoted through the delivery of the product e.g. the alleviation and reduction of poverty, job creation or the promotion of health and safety performance beyond statutory requirements (Watermeyer, 2012a and b).

Table 1 interprets the 4“Es” associated with value for money based on Adam Smith International (2012), Department of International Development (2011), Jackson (2012), National Audit Office (2010) and Watermeyer and Pham (2011).

**Monitoring and evaluating value for money**

Adam Smith International (2011) point out that donors including the Department for International Development (DFID) generally use a “results-based management” approach to monitor and evaluate the performance of their activities and to focus on whether or not their support creates positive, lasting changes (see Figure 1). The funding and deliverables of the activities are in terms of this approach are a means to an end.

![Figure 1: Results chain framework (after DFID, 2011)](image)

<table>
<thead>
<tr>
<th>Cost</th>
<th>Sum of money required to fund the intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Inputs cover all the materially significant financial, human and material resources used for a development intervention</td>
</tr>
<tr>
<td>Activities</td>
<td>Activities are used to deliver outputs</td>
</tr>
<tr>
<td>Outputs</td>
<td>Outputs relate to products, capital assets and services which result from a development intervention. Outputs are limited to the specific, direct deliverable of the intervention.</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Outcomes are the likely or realised short-term/medium-term effects of the outputs of any intervention. Outcomes are used to identify (a) what will change, (b) who will benefit and (c) how it will contribute to poverty reduction and/or the Millennium Development Goals</td>
</tr>
<tr>
<td>Impact</td>
<td>Longer-term effects are produced, directly or indirectly, by a development intervention. Impact refers to higher level identified achievements that the intervention will contribute towards</td>
</tr>
</tbody>
</table>
An alternative way of looking at Figure 1 is to consider it as a quality management system. ISO 9000 (2005) in this regard defines quality as the “degree to which a set of inherent characteristics fulfils requirements” and a quality management system as a “management system to direct and control an organisation with regard to quality.” It also defines efficiency as the “relationship between the result achieved and the resources used” and effectiveness as the “extent to which planned activities are realised and planned results achieved.”

The UK National Audit Office (2010) offers a practical analytical framework within which judgements regarding good value for money can be made in a consistent manner i.e. whether or not optimal use of resources was made to achieve the intended outcomes, using the following six steps and the process outlined in Figure 2:

1) Establish what is optimal (i.e. “the most desirable possible given expressed or implied restrictions or constraints”) by considering what reasonable constraints need to be taken into account in respect of planning (what is wanted), implementation (delivering or procuring well) and monitoring (being able to assess performance).
2) Capture the scale of resources initially in the plans and later, as outturn.
3) Identify expected and actual outcomes by considering the planned achievements and later actual achievements.
4) Establish the consequences for value for money by comparing expected and achieved outcomes or what could have been achieved.
5) Draw an overall conclusion on the value for money achieved with these resources (external comparison) by comparing performance with appropriate external benchmarks such as alternative actions, accepted good practice or internal/external industry benchmarks, past performance and shareholder expectations.
6) Make recommendations to secure improved outcomes.

**Delivering value for money through projects**

The management approach to delivering value for money over the life of a project is summarised in Figure 2. The critical starting point is to clearly define objectives and expected outcomes as well as parameters such as the time lines, cost and levels of uncertainty. This frames the value for money proposition that needs to be implemented at the point in time that a decision is taken to proceed with a project i.e. it establishes “economy” and identifies “equity”. The end point is to compare the projected outcomes against the actual outcomes i.e. to confirm the “effectiveness” of the project in delivering value for money.

The implementation of infrastructure projects needs to be responsive to the project objectives, deliver the expected outcomes and remain as far as possible within the confines of the parameters upon which the decision to proceed with the project were based. Cost overruns and lower-than-predicted income streams frequently place project viability at risk and turn projects that were initially perceived to be vehicles to
economic growth into obstacles to such growth (Allport, 2011). Accordingly, implementation which sits between “economy” and “effectiveness” in the results chain framework needs to be executed “efficiently” so that time delays, scope creep and unproductive costs and the effects of uncertainty on objectives (risks) are minimised in order to maintain the value for money proposition formulated at the outset of the project. This necessitates that the implementer of the project exercise due care and reasonableness during implementation. Failure to do so may result in substandard or unacceptable performance which results in a gap between intended and achieved outcomes. This puts value for money for a project at risk.

Figure 2: Framework of questions for assessing value for money (National Audit Office, 2010)
Due care speaks to the care that an ordinary and reasonable person would normally exercise under circumstances such as those under consideration. The concept of due care is used as a test of liability for negligence i.e. a breach of duty of care which results in loss to the person or entity the duty is owed. Negligence usually includes doing something that an ordinary, reasonable and prudent person would not do, or not doing something such a person would do considering the circumstances and situation. Reasonableness on the other hand applies to that which is appropriate for a particular situation, circumstance or context and the way a rational person would have acted.

Accordingly, an implementer that implements projects with due care needs to:

- put in place a suitable and appropriate procurement and delivery management system,
- allocate tasks and responsibilities and provide the necessary financial and human resources to enable the system to be effectively implemented;
- have in place delivery policies; and
- take corrective action to meet objectives when it became clear that some of the objective might not be met.

**INHIBITERS OF VALUE FOR MONEY**

Flyvbjerg *et al* (2003) have identified two root causes for lack of success, namely:

- optimism bias - the human mind’s cognitive bias in presenting the future in a positive light; and
- strategic misrepresentation – behaviour that deliberately underestimates costs and overestimates benefits for strategic advantage usually in response to incentives during the budget process.

HM Treasury (2011) has cited the two main causes of optimism bias in estimates of capital costs as:

- *poor definition of the scope and objectives of projects in the business case, due to poor identification of stakeholder requirements, resulting in the omission of costs during project costing; and*
- *poor management of projects during implementation, so that schedules are not adhered to and risks are not mitigated.*

Hawkins and McKittrick (2012) in their report on the pilot countries in Construction Sector Transparency Initiative (CoST) programme found that in the 145 projects sampled in eight countries, 31% exhibited poor management of time and cost with at least 55% being over budget and 8% being more than 100% over budget. They observed that, apart from pilot study countries being greatly challenged to disclose the 31 items of information required in terms of the CoST programme, procuring entities rarely met even their legal requirements for disclosure (See Figure 3). In most of the countries assurance teamshad to assume responsibility for the collection and collation
of the information for disclosure. It is therefore not surprising that Jackson (2012) cites the lack of data upon which to base decisions as a key challenge in delivering value for money.

![Figure 4: Information disclosure in the CoST pilot countries (after Hawkins and McKittrick (2012) and CoST (2011))](image)

**DRIVERS OF VALUE FOR MONEY**

A scan of recent publications suggests project outcomes can be improved in a number of ways. DFID (2011) have identified skills and behaviours, transparency, internal scrutiny, external scrutiny, results and value for money tools, systems development and influencing partners as being drivers of value for money. Dobbs et al (2013), suggest that boosting infrastructure productivity could save $1 trillion dollars a year and cites the following main levers to delivery potential savings, namely:

- improve project selection and optimise infrastructure portfolios;
- streamline delivery;
- make the most of existing infrastructure assets; and
- upgrade infrastructure governance systems to ensure close co-ordination between different infrastructure authorities, clear separation of political and technical responsibilities, broad public-private sector co-operation, trust-based engagement of stakeholders throughout the process to avoid suboptimal solutions and unnecessary delays, the availability of reliable data on which to base day-to-day oversight and long term planning and strong public-sector capabilities across the value chain of planning, delivery and operations.
The South African Planning Commission’s *National Development Plan 2030: Our future – make it work* proposes that the following five areas be focused on in designing a procurement system that is better able to deliver value for money, while minimising the scope for corruption (Watermeyer *et al.*, 2013):

1) differentiate between the different types of procurement which pose different challenges and require different skills sets;
2) adopt a strategic approach to procurement above the project level to balance competing objectives and priorities rather than viewing each project in isolation;
3) build relationships of trust and understanding with the private sector;
4) develop professional supply chain management capacity through training and accreditation; and
5) incorporate oversight functions to assess value for money.

The George Washington University Law School (Schooner and Yukins, 2012) have expressed the view that proper management of government procurement systems is critical if massive fiscal stimulus packages in the wake of the global crisis are to deliver value for money. They stress that leaders, in order to fulfil their fiduciary responsibilities, need to maximise competition among the global economy’s most qualified firms, strive to purge corruption from procurement, and build (or restore) capacity in their public procurement systems. They point out that the current economic downturn present governments with a unique opportunity to invest in rebuilding their professional acquisition workforces by aggressively recruiting the best talent, bolstering skills-based training, improving retention and incentives, and identifying best practices for efficient procurement.

The Construction Sector Transparency Initiative (CoST) is a country-centred initiative which seeks to improve value for money on projects. It does this by increasing transparency in the delivery of construction projects by ensuring that basic information associated with projects is disclosed to the public at key points throughout the project cycle. CoST complements rather than replaces a country’s supervision, audit, regulatory, investigative, and judicial functions by putting in place a multi-stakeholder group to verify and interpret disclosed information along the full value chain on large projects. Stakeholders can then use this knowledge as a basis for holding the responsible parties accountable. This results in improved performance which in the long term is expected to improve value for money from investments in infrastructure as indicated in Figure 3. CoST in essence brings key stakeholder groups together on neutral ground and assists them to form and pursue shared objectives in improving value for money in construction projects and in improving efficiency and effectiveness.

Watermeyer (2011) points out that a procurement system is always designed around a set of system objectives. These typically relate to good governance (primary objectives) and, particularly in developing countries, to the use of procurement to promote social and national agendas (secondary or non-commercial objectives). Procurement systems such as those which are based on the following system objective
provide a platform to achieve fair competition, reduce the possibilities for abuse and improve predictability in procurement outcomes are therefore most likely to realise value for money:

- primary objectives: the procurement system shall be fair, equitable, transparent, competitive and cost-effective.
- secondary objectives: the procurement system may, subject to applicable legislation, promote objectives additional to those associated with the immediate objective of the procurement itself.

Figure 3: Results chain for the CoST Programme (Construction Sector Transparency Initiative, 2013)

Watermeyer (2011b) points out that there are a number of different approaches to procuring goods, services and works, each of which can result in different outcomes. Procurement strategy is all about the choices made in determining what is to be delivered through a particular contract, the procurement and contracting arrangements and how secondary procurement objectives are to be promoted. Resources and objectives need to be matched to the choices made regarding the manner in which needs are to be met in order to achieve optimal outcomes.

DFID (2013) has recently issued a statement which sets out how their suppliers are expected to demonstrate delivery on value for money. Forms of contract which provide open book approaches to the costing of changes due to the occurrence of risk
events, are drafted on a relational contracting basis, based on the belief that collaboration and teamwork across the whole supply chain optimises the likely project outcomes, provide pricing arrangements that align payments to results and reflect a more balanced sharing of performance risk are most likely to enable suppliers to deliver on DFID’s expectations.

The Society of Construction and Law (2002) has published a protocol for determining extensions of time and compensation for delay and disruption. It exists to provide guidance in the form of 21 core principles to all parties to the construction process when dealing with time or delay matters. It recognises that transparency of information and methodology is central to both dispute prevention and dispute resolution. Forms of contract which contain provisions dealing with unforeseen events that can give rise to an extension of time or compensation for the additional time spent and the resources employed in a manner which is consistent with this protocol are most likely to deliver value for money.

Lichtig (2006) has indicated that in order to provide higher value and less waste the fragmentation in design needs to be addressed, preferably before 25% of the design is complete. Target cost contracts can be used to facilitate early contractor involvement in terms of the design by employer, develop and construct and design and construct contracting strategies. Accordingly forms of contract which make provision for cost based pricing strategies can be effectively used to deliver value for money (Watermeyer, 2012b).

**A MODEL FOR THE DELIVERY OF INFRASTRUCTURE**

The critical starting point in delivering value for money through infrastructure projects is to clearly define objectives and expected outcomes as well as parameters such as the time lines, cost and levels of uncertainty. This frames the value for money proposition that needs to be implemented at the point in time that a decision is taken to proceed with a project i.e. it establishes “economy” and identifies “equity”. The end point is to compare the projected outcomes against the actual outcomes i.e. to confirm the “effectiveness” of the project in delivering value for money.

The implementation of infrastructure projects needs to be responsive to the project objectives, deliver the expected outcomes and remain as far as possible within the confines of the parameters upon which the decision to proceed with the project was based. Implementation sits between “economy” and “effectiveness” in the results chain framework. It needs to be executed “efficiently” in order to minimise time delays, scope creep and unproductive costs and to mitigate the effects of uncertainty on objectives (risks) so as to maintain the value for money proposition formulated at the outset of the project. This necessitates that the implementer of the project exercise due care and reasonableness during implementation. Failure to do so may result in substandard or unacceptable performance which results in a gap between intended and achieved outcomes. This gap puts value for money for a project at risk.
Due care speaks to the care that an ordinary and reasonable person would normally exercise under circumstances such as those under consideration. The concept of due care is used as a test of liability for negligence i.e. a breach of duty of care which results in loss to the person or entity the duty is owed. Negligence usually includes doing something that an ordinary, reasonable and prudent person would not do, or not doing something such a person would do considering the circumstances and situation. Reasonableness on the other hand applies to that which is appropriate for a particular situation, circumstance or context and the way a rational person would have acted.

Accordingly, an implementer that implements projects with due care needs to:

- document and put in place a suitable and appropriate procurement and delivery management system;
- allocate tasks and responsibilities and provide the necessary financial and human resources to enable the system to be effectively implemented; and
- take corrective action to meet objectives when it becomes clear that some of the objective might not be met.

**DESIGNING A PROCUREMENT AND DELIVERY MANAGEMENT SYSTEM TO DELIVER VALUE FOR MONEY**

The review of the literature in this paper suggests that project outcomes can be improved by embracing the following in the design of an infrastructure delivery management system:

- adopt a strategic approach to procurement and delivery management above the project level;
- establish trust-based engagement of stakeholders throughout the process to avoid suboptimal solutions and unnecessary delays;
- put in place governance systems which incorporate oversight functions to assess aspects of value for money throughout the project cycle in a systematic manner;
- put in place rigorous project selection processes;
- differentiate between the different types of procurement which pose different challenges and require different skills sets (see Figure 4);
- standardise delivery in a manner which enables risks to be proactively managed and responsibilities to be clearly established;
- build relationships of trust and understanding with the private sector;
- put in place reliable data gathering systems on which to base day-to-day oversight and long term planning;
- develop strong public-sector capabilities across the value chain of planning, delivery and operations; and
- increase transparency through the disclosure of information which is subjected to internal and external scrutiny.

Procurement system needs to be designed around objectives which speak to “economy”, “efficiency” and “equity” and contain a wide range of procurement
procedures which enable best value for money in a number of different circumstances. Forms of contract, which form an integral part of any procurement system, need to support open book approaches to the costing of changes due to the occurrence of risk events, foster collaborative working relationships, provide pricing structures that align payments to results and reflect a balanced sharing of performance risk and deal with delays and disruptions efficiently and effectively. Furthermore they should be sufficiently flexible to accommodate both price-based and cost-based pricing strategies with any level of design responsibility.

The delivery of construction works needs to be managed and controlled in a logical, methodical and auditable manner. The starting point in the development of any delivery management system is to identify the information which needs to be developed and accepted by the client at a particular point in the delivery process to enable a project to be advanced i.e. at a control point (or gate). The stages in the delivery of construction works can then be defined as the activities that need to take place between such points. These stages enable the work flow (sequence of connected activities) toward the attainment of an end of stage deliverable to be developed and culminate in gates (control points) which can be used to provide assurance that the proposed works (Watermeyer, 2012a):

- remains within agreed mandates;
- aligns with the purpose for which it was conceived, and
- can progress successfully from one stage to the next.

Table 2 illustrates the stages on a project involving the delivery of infrastructure or scheduled maintenance and how they relate to the dimensions relating to value for money and the sequence of activities. Control points (gates) can be located within or at the end of the processes shown in Figure 4. This creates a control framework which ensures that positive control is exercised over processes. It also ensures that supporting information is gathered systematically (Watermeyer et al, 2012).

Poor decisions or analysis during the portfolio planning stage can have significant cost ramifications downstream. Accordingly, a project and economic appraisal needs to be undertaken during the portfolio planning phases to establish the “economy” and “equity” dimension in the value for money proposition which projects have to offer. Thereafter proposed projects need to be prioritised so that only those that are most likely to satisfy stated objectives and yield value for money are delivered.

It is important to continue with planning processes at a project or contract level before authorizing implementation. This allows:

- sufficient design concepts or solutions to be developed to establish the feasibility of the works or to select a particular conceptual approach to pursue;
- the design or solution at the end the planning stage to be “frozen” ahead of implementation;
• residual risks to be identified and their potential impact on project outcomes to be understood;
• the time, cost and scope of the project to be confirmed and adjusted to remain within the desired value for money parameter upon which the initial decision making was based; and
• informed decisions regarding implementation to be made.

Thereafter the delivery of construction works needs to be managed and controlled in a logical, methodical and auditable manner to ensure “efficiency” and “effectiveness” in implementation.

Figure 4: Commonly encountered public sector supply chains (after Watermeyer et al, 2012)
Table 2: Stages in the delivery of new infrastructure (After Watermeyer et al, 2012)

<table>
<thead>
<tr>
<th>Dimension of value for money</th>
<th>Processes</th>
<th>Gate</th>
<th>Stage description</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>Planning at a portfolio level</td>
<td>G1</td>
<td>Infrastructure planning</td>
<td>Client approved infrastructure plan which identifies needs and links prioritised needs to a forecasted budget</td>
</tr>
<tr>
<td></td>
<td>Planning at a package level</td>
<td>G2</td>
<td>Procurement planning</td>
<td>Client accepted construction procurement strategy for implementing the infrastructure plan in the medium term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G3</td>
<td>Package preparation</td>
<td>Client accepted strategic brief for the works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G4</td>
<td>Package definition</td>
<td>Client accepted concept report setting out the integrated concept for the works</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Detailed design</td>
<td>G5</td>
<td>Design development</td>
<td>Client accepted design development report setting out the integrated developed design for the works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G6A</td>
<td>Design documentation (Production information)</td>
<td>Completed and client accepted production information for the works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G6B</td>
<td>Design documentation (Manufacture, fabrication and construction information)</td>
<td>Client accepted manufacture, fabrication and construction information for the works</td>
</tr>
<tr>
<td></td>
<td>Site</td>
<td>G7</td>
<td>Works</td>
<td>Completed works which are capable of being occupied or used and accepted by the client.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G8</td>
<td>Hand over</td>
<td>Works which have been taken over by the user complete with record information</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Close out</td>
<td>G9A</td>
<td>Asset data</td>
<td>Archived record information and updated asset register</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G9B</td>
<td>Package completion</td>
<td>Completed contract or package order complete with closeout information</td>
</tr>
</tbody>
</table>
CONCLUSIONS

Value for money may be regarded as the optimal use of resources to achieve the intended outcomes. Underlying value for money is an explicit commitment to ensuring that the best results possible are obtained from the money spent or maximum benefit is derived from the resources available. It is a means for developing a better understanding (and better articulation) of costs and results so that more informed, evidence-based choices can be made. Value for money is about striking the balance between three “E’s” – economy, efficiency and effectiveness” whilst being mindful of a fourth “E” – equity.

Current procurement and delivery management systems needs to be reviewed and possibly redesigned to ensure that they deliver on the three “Es” and promote aspects of the fourth “E”. This may require a culture and mind set change to embrace new and emerging procurement and delivery management practices which are designed to support value for money outcomes.

Evidence based research is required to enable informed and effective decision to be made in order to deliver value for money on the basis of solid evidence, proof of effectiveness and the integration of experience and judgement. Such research is required not only to guide and shape value for money practices but also to transfer knowledge into practice.

Training and education is also required to support those engaged in the infrastructure supply chain to understand the value for money concept and their role in supporting this imperative.

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SECTION 2: CONFERENCE PAPERS
A CASE FOR DEEPENED CONSTRUCTION SUPPLY CHAIN MANAGEMENT IN SOUTH AFRICAN STATE-OWNED ENTERPRISES

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The purpose of this paper is to present the preliminary literature findings of a research project. The main project is set out to identify, analyse and report on performance requirements, mechanisms and actions required to address the performance of construction related small and medium size enterprises (SMEs) that are providing services for state owned enterprises (SOEs) in South Africa. The need for the project arose from the view that the absence of performance evaluation mechanism leads to the poor management of the performance of organisations involved in most SOE supply chain. This inevitably lead to none creation of expected value in the system. Through a related literature study, the findings that have emerged so far suggest that it is notable that the SMEs related programmes in SOEs have not address performance and relationship management within their supply chain strategy in explicit terms as there is less or no means to record, measure and enhance SME contributions. These SMEs also recognise the fact that when their performances are poor and / or good, there is no difference and / or feedback mechanism to record it.

Keywords: construction, supply chain management, South Africa

BACKGROUND

There are many initiatives by private and public organisations that are committed to developing SMEs in South Africa. Major firms are assisting their suppliers to become more sustainable; not just in terms of providing services to them, but also with respect to economic viability. This area of responsibility does, however, pose business strategic challenges to corporations with regards to supply chain management (SCM) (Axelsson, Lerpoold, Nordbrand and Sjostrom 2010). PetroSA is a leader in an initiative called the Supplier Developments Programme (SDP) in South Africa. The programme is aimed at assisting Historically Disadvantaged Individuals (HDIs) that own most SMEs to gain entry into the oil and gas sector (Turner and Townsend, 2010). PetroSA operates and owns 45 000 barrels per day plant in Mossel Bay, which uses indigenous gas resources as base feedstock. This base feedstock is supplemented by imported reformate and light condensate (PetroSA, 2010). To operate and / or carry out its day to day business and focus on its core business at the plant, there are construction related maintenance services that

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were found feasible to be outsourced by PetroSA. In asset intensive industries, such as automotive, metals, mining, oil and gas, process manufacturing, utilities, and the public sector, the reliability and productivity of capital assets is essential to an organization’s financial success. Maintenance of these assets can dramatically impact the overall performance and useful life of an asset (Aberdeen Group, 2006). Such services in PetroSA are not limited to scaffolding, industrial painting, insulation and cladding, fabrication and fire equipment services.

The activities involved to execute maintenance are complex and interdependent and require different resources, specialities and / or disciplines. These complex and intensive activities opens the door of opportunities for SMEs involved in the SDP. The programme, thus far, has led to the establishment of five black owned, controlled and managed businesses. Support provided by PetroSA includes business skills training, mentoring and coaching, technical support, as well as feasibility and viability study support. Despite these gains and greater exposure among senior management of these SMEs, there is still a lack of strategic focus and some firms still fail to think, and act, beyond performance metrics that are based on price driven measures (Cousins and Spekman, 2008). There is clear evidence that the failures to accurately measure, evaluate, and manage the performance of project partners could increase costs, damage product quality, and hinder competitiveness in the marketplace (Aberdeen Group, 2006). Performance measurement of both the customer and the supplier is an important activity to ensure that the contract is delivering against specific objectives and organisational goals.

As an illustration, when major client organizations demand multiple services from a single SME, the outcome of such endeavours may fall short of expectations. Examples of such organisations include State Owned Enterprises (SOEs) in South Africa. SOEs are essential contributors in the South African economy and are active in international markets for the sourcing of capital equipment, and finance. These SOEs depend on a multitude of SMEs services in order to fulfil their organisational mandates. Thus, SME performance impact directly on the performance of SOEs and it is therefore vital for both the SOEs and SMEs to understand the manner in which they should manage performance required in an enterprise. Although small businesses fail due to a variety of reasons arising from the macro and micro market environments, common problems that are often cited and / or researched as major contributors to failure is managerial incompetence, lack of access to information, knowledge, business skills and difficulties in accessing finance.

However, limited research efforts have investigated the failure rate caused by performance related matters among SMEs in the South African context. As mentioned that there are many initiatives by private and public organisations locally that are committed to development SMEs in South Africa, it is very noticeable that the programmes and / or initiatives initiated did not address performance management within supply chains. There are less or no means to record suppliers’ contributions. It is important that suppliers recognise the fact that their performance can be regarded as either poor or excellent through feedback. The absence of monitoring and verification of performance by both suppliers and their clients gives room for negligence within SME organisations. Hence, the overarching aim of this research project is to identify, analyse and report on mechanisms required to address performance management from the perspective of SCM.

This is necessary as PetroSA and other SOEs continue to struggle with performance management within their supply chains. It however notable that this particular paper
relies on the literature to make a case for the study as the research project is still at the conceptual stage.

**The Rationale for the Study**

The SCM literature shows that procuring the services of SMEs remains a very critical and attractive option, not only because it a job creation tool that supports economic growth plans of governments. The South African government, as a major shareholder in SOEs, has mandated them to change the economic landscape by developing and creating a platform for SMEs to develop into national and international suppliers. To this end, there is a responsibility to monitor the process of engaging and managing SMEs and benchmarking their performance. Despite concerted government focus on the SMEs, SOEs find themselves in a very interesting and attention-drawing position where they are rated by supplier development initiatives while observers and researchers raise serious concern about SMEs and their performance.

Shakantu et al. (2007) contend that reduced main contractor size and increased subcontracting has manifested in the reduction of scope of operations that each firm can meaningfully undertake. They noted that this effects of this occurrences can be seen when smaller firms operates tactically and focus on micro view of the business world. Thus the impact is that such firms are not always open to embracing best practices that would engender performance improvement in construction. Despite this apparent draw back, the media have vividly elucidated what is expected of SOEs in term of SME development and management. Although SMEs fail due to a variety of reasons, the significance of the study is to add to the existing knowledge base in SCM and to ultimately realise a base for system development for PetroSA and other organisations wishing to adopt and / or introduce supplier performance management (SPM) in their organisations. It should be noted that this will serve as a base and provide assistance to both SMEs and their customers in terms of creating systems and / or programmes to address future and long term growth plans. Furthermore, the research project may become a starting point for PetroSA in terms of realising its current position in the supplier management perspective and recommend and / or establish ways to focus and deal with performance management requirements within contract validity periods.

**An Overview of SMEs in construction**

The lack of managerial skills has been highlighted as a major deficiency of SMEs. A lot of SMEs are not familiar with quantitative management techniques such as bar charts, critical path analysis, probabilistic PERT analysis, resource planning, cost control, and performance management. The need to acquire competencies and capabilities necessary to managing contracts efficiently is particularly important as firms often do not compete manufacturer to manufacturer; rather the true competitive battle occurs from supply chain to supply chain (Pryke, 2012). A company is as strong as its weakest supply chain partner (Cousins and Spekman, 2008).

Upgrading the skills of all types of workers, including managers, is central to firm performance in knowledge-based economies. The quality of management is particularly important for SMEs, which must be able to adapt quickly to evolving markets and changing circumstances, but which often have limited resources. This demands that managers capitalise on emerging trends and are receptive to new ideas, are armed with strategic goals and challenges and make informed choices.
In addition, managers need to take cognisance of the current organisational culture and the competencies of the existing leadership when engaging in strategy formulation and implementation (Parumasur and Govender, 2009). Additional challenges that can be seen in the literature concerning SMEs include (O’Callaghan, 2008):

Strategy is not always clear, defined or formalised by top management of firms;

Decisions are not taken to lower levels (‘family business’ syndrome);

Few resources and finances are a constant source of worry;

Little support from external sources;

Limited managerial skills can be found in firms, and

The ‘we do fine’ syndrome is pervasive.

As a result of these features of SMEs, PetroSA’s long-term goal is to involve SMEs in its business through the supply chain route that is synonymous with imported goods or services to a reasonable level in order to support its corporate strategy, while promoting local industries. It must be noted that not all localised services and goods results in direct cost reduction, but they should result in lower transport costs, shortened lead times and improved relationships with SMEs. As mentioned above, a lack of managerial skills and expertise is eradicating the benefits of localising the supply chain and is a major constraint impeding the progress of SMEs and PetroSA’s projects. The primary area that had shown to be very poor within SME environment at PetroSA is planning. The management process starts with planning and it is through planning that the owner or manager decides what activities to undertake, when, how long and what is to be done next. Business planning needs to be the first step and should reflect future intentions which may take variety of forms. It can take variety from informal to formalised plans or structures. Since the planning function of management is responsible for defining the work to be managed, planning can be said to provide a basis for performance management. It can then be considered the most important practice within an operating environment.

Why Manage an SME populated Supply Chain?

The last decade have witnessed emphasis on SCM in terms of how organizations are shifting towards more proactive decision making strategies while exploiting innovative governance structures. Often the issues under scrutiny pertain to whether SMEs add value to overall organizational growth. The literatures in the subject area suggest that SMEs are encouraged to participate in building formalized systems that would enhance their compliance and performance in various business entities.

Thus, SCM is a set of synchronized decisions and activities utilized to efficiently integrate suppliers, manufacturers, transporters, retailers, and customers so that the right product or service is distributed at the right quantities, to the right locations and at the right time in order to minimize system-wide costs while satisfying customer service level requirements (Li, 2007). Chen and Paulraj (2004 cited in Axelson et al., 2010) define a supply chain as a system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Hence, the creation of added value in a process depends on the entire members of a chain as opposed to a single member of the chain. Handfield and Nichols (2002) noted the importance of value systems in their definition of (SCM) when they suggest that SCM is the integration and management of supply chain organisations and activities through cooperative organisational relationships, effective
business processes and high levels of information sharing to create high-performing value systems that provide member organisations with a sustainable competitive advantage.

Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. Businesses rely on their supply base and customers to survive. Increasingly, business people are expected to know that their suppliers are as mindful of their environmental and social responsibilities as they are or should be. However, it appears that this is not always easy to do with local suppliers, while it is even harder with suppliers from other countries. Nevertheless, SCM can effectively support the management of supplier networks with respect to the identification of supplier selection criteria, supplier selection decisions and monitoring supplier performance (Martinez-Martinez and Gerardo, 2007). Since the planning function of management is responsible for defining the work to be managed, performance planning can be said to provide the basis for the performance of other supplier management functions and can therefore be considered to be very important as an SCM function.

One of the primary goals of SCM is to coordinate the flow of raw materials, parts or components from various suppliers to manufacturers for the purpose of producing products that meet customers’ value expectations (Enyinda, Dunu and Gebremikael, 2010). In the context of a single client firm, SCM is concerned with the flow of goods and services through the organisation with the aim of making the firm more competitive (Cousins and Spekman, 2008). Cited literatures in Enyinda, Dunu, Gebremikael (2010) observe that strategic partnerships with the right suppliers must be integrated within supply chains in order to contain costs by eliminating waste, improving quality, improving flexibility to meet customer’s value expectation and reducing lead time at different stages of the supply chain. Collaborative planning is essential and requires both clients and supplier to ensure sustainability and long-term relationships are enjoyed. It is vital for managers (in SMEs and clients firms) to understand and utilize sound techniques to assist them with planning, implementation and monitoring activities. Because of the value prepositions associated with SCM, it is fundamental that clients pay attention to the performance of firms that constitute their suppliers. As part of the strategic plan of the institution, resources required for the fulfilment of its obligations should be clearly analysed. This includes a detailed analysis of the goods, works and services required, such as how much can be accomplished, how quickly and with what materials, and equipment.

Performance Management Considerations

Performance Management is the process of defining clear objectives and targets for individuals and teams, and the regular review of actual achievement and eventual rewarding for target achievement (O'Callaghan, 2008). Aberdeen Group (2006) define supplier performance management as the process of measuring, analysing and managing supplier performance for the purposes of reducing costs, mitigating risk and driving continuous improvement. This definition suggests that the performance of SMEs that form a significant number of the supplier base of most SOEs in South Africa should be managed.

The literature (cited in Wiesner, McDonald and Banham, 2007) shows that there is a link between high performance management practices and the financial performance of firms. However, it appears SMEs are not able to take advantage of this opportunity. Wiesner, McDonald and Banham (2007) noted that the overall outlook regarding the
incidence of high performance practices in Australian SMEs looks bleak because of the perceived inability to direct efforts to organisational change initiatives due to limited human, material and financial resources that continue to pose major hurdles for SMEs. The nature and characteristics of SMEs thus necessitate the deployment of effective processes for strategic performance management development so that they can become competitive (Hudson, Smart and Bourne, 2001).

Consequently, it is envisaged that supply chain departments in South African SOEs should plan and control purchases to ensure that purchased products and/or services meet performance requirements of quality, health and safety (H&S), and other considerations without sacrificing timely delivery at competitive prices and/or costs. This is vital as there appear to be clear evidence that the failure to accurately measure, evaluate and manage the performance of SMEs contributes to their failure rate mentioned by Brink and Cant (2003). This failure can increase SOEs’ operating costs, damage its product and/or service quality and hinder its competitiveness in the marketplace at large. According to O’Callaghan (2008), in order to ensure that the performance of SMEs are managed effectively, it is important for a performance management strategy to be simple, formalised, linked to key business objectives and available to resources that can render assistance.

The Proposed Primary Data Collection Strategy

Pure research is undertaken to develop knowledge, to contribute to the body of the theory that exists, while applied research seeks to address issue of applications in order to solve practical problems with contribution to knowledge for as secondary consideration (Fellows and Liu, 2008). To this end, the MSc dissertation intends to make a significant contribution to the field of SCM by providing insights and guidance for SMEs and SOEs in South Africa in terms of performance management.

Three main approaches that shall be explored in the field work include: interviewing participants; study of current reports, and development of a questionnaire as means of data gathering. The unit of analysis for the research are the SMEs contracted to PetroSA. The primary data shall be obtained through responses from the SME participants. The objective is to obtain an appropriate set of data that will be executed using the descriptive format of research.

Descriptive research involves either identifying the characteristics of an observed phenomenon or exploring possible correlation among two or more phenomena (Leedy and Ormrod, 2010). This is done through semi structured questionnaires and recorded interviews to ensure correct information is collected. The data collection will be expedited by means of interviews with managers from PetroSA, its suppliers, and customers and surveys conducted among contractors and subcontractors contracted to PetroSA.

All contracted parties (with PetroSA) that are involved in construction related activities shall be included in the field work so as to allow them to share their knowledge and experience while addressing questions pertaining to this subject. Interviewing is a critical investigative tool. Interviewing will be done to provide evidence and validate the act, concealment and conclusions, as well as to document intent, motive and fill out other investigative gaps.

The research shall endeavour to gather responses from each SME contracted to PetroSA. In order to ensure uniformity, the focus shall remain with contractors who share common challenges, exposure and conditions. Since a high rate of failure has
been found as a common, if not the biggest challenges among SMEs, it is of great importance to focus on the matters identified as problems in the literature.

**Discussion and Concluding Thoughts**

Although there is a plethora of research in and around performance measurement and business failure concerning SMEs, this is not so in the developing countries. As a result, this research endeavour is envisage to bridge knowledge gaps in this context as it has identified an area that has considerable room for growth and expansion. The review of related literature that has been conducted so far suggests that the study has the potential to make a significant impact upon existing knowledge and understanding of factors that induce failure within SMEs; explore the potential of performance management systems that are currently being implemented and measure how effective these are; and develop new insights into how these performance measurement criteria can be improved upon. In other words, the importance of the study is based on the examination of an existing issue from a different perspective. For instance, supplier management as an issue has been investigated widely, although not always from the performance perspective. This perspective is what makes the work different. To this end, the research project intends to differentiate between performance and some of the other metrics so that the contribution of the work can stand out.

The case for the study is corroborated by Hudson, Smart and Bourne (2001), who contend that performance measures in SMEs are developed: with limited reference to any existing measures in place; with no reference to strategy; in an ad hoc manner by managers / employees; without deleting obsolete measures; and with a lack of employee understanding of new measures. In other words, SME performance measures are always not strategic, unclear with the use of complex / obsolete data, historically focussed, and only measures flexibility and human resources (Hudson, Smart and Bourne, 2001). Nevertheless, the research methodological design and execution of this particular study requires further refinement before the actual field work can proceed. The literature review equally need to take into account the contributions of extant academics in business theory. Thus, future research shall take into account these limitations so as to rigorously produce a significant contribution in the subject area.

**References**


A CASE FOR IMPROVED INDOOR ENVIRONMENTAL QUALITY (IEQ) IN MULTI USE BUILDINGS

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The purpose of this paper is to present the findings of a research project aimed at determining the level of satisfaction of building occupants’ in terms of Indoor Environmental Quality (IEQ). The findings were derived from the views of the occupants residing in a Country Club Estate in Johannesburg, South Africa. The questions addressed how poor air quality, lack of access to daylight, unpleasant acoustic conditions, and control over lighting and thermal comfort leads to dissatisfaction with the IEQ of buildings. The data were collected during August and September 2012. Questionnaires were sent to ten office blocks within Country Club Estate complex in Johannesburg, South Africa. A total of 126 questionnaires were sent out and 102 replies were received. Observations from the data led to the view that the satisfactory level of IEQ awareness is low among the occupants. Organisational structure needs to be formed that will enlighten occupants about factors that contribute to poor indoor air quality (IAQ). Organisational procedures also point to the fact that the level of IEQ is low. The inconsistent ratings that were recorded suggest that there appears to be a major scope for addressing post occupancy evaluated (POE) related matters in the complex.

Keywords: buildings, indoor environmental quality, post occupancy evaluation.

INTRODUCTION

An office building should satisfy occupants’ needs and promote efficiency of indoor environmental quality (IEQ). The success or failure of a building depends on the implementation and sustainability of the IEQ. The building should be designed with the aim of producing a high-quality interior environment, so that the health and safety (H&S) of the occupants or employees are not compromised. The IEQ addresses the indoor air quality and the ability of the infrastructure to deal with the airborne contaminants as well as H&S and lighting (LaSalle, 2011).

It is the duty of the building owners to keep evaluating IEQ in order to keep the occupants motivated and satisfied with the building in use. With regards to Post Occupancy Evaluation (POE), occupants of a building evaluate the facility to determine whether the building is functioning in accordance with its intended purpose (Nawawi and Khalil, 2008). If IEQ is not improved, this will lead to high rate of absenteeism among employees. An office building that is not properly planned, designed or maintained will cause discomfort and poor air quality, which may result in

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illness of the employees. When an office building successfully meets the provisions of IEQ, this will enable the occupants to increase their productivity, and absenteeism will occur less frequently (Cho and Lee, 2010). It is thus imperative that office buildings are evaluated from time to time to determine whether it meets the required H&S standards (Cho and Lee, 2010).

POE is the process whereby a building has to be evaluated in an accurate manner after it has been built and occupied for some time (Carthey, 2006). POE has come to represent a broad range of activities aimed at understanding how buildings perform once they are built, and how satisfied building users are with the environment that was created (Hewitt et al., 2005). The idea of POE was established in relations to the problems arising from the building industry, especially in care facilities such as mental hospitals, nursing homes and correctional services (Riley et al., 2010). Although the term seems to suggest that it occurs after people leave the building and it seems to emphasise evaluation done at a single point in the process, new buildings do not only need to preserve energy during construction and operation, but also, they must provide satisfactory indoor environment for occupants (Birt and Newsham, 2009). It is however notable that POE is relatively new in the built environment in South Africa. A literature search shows limited literature in the subject area and facility management texts fail to provide needed South African based knowledge. Thus, an explorative study was conducted in Johannesburg, South Africa. A problem statement and corresponding objectives are formulated below.

The Problem Statement:
The efficiency of a building’s IEQ (indoor environmental quality) contributes to workers’ productivity, and then, how a building is viewed by its occupants. Hence, during the life cycle of a building, it is vital to evaluate if the building is functioning according to the intended use. Therefore, the problem statement for the study states that ‘the lack of adequate evaluation of the performance of buildings after the completion of its construction hinders optimum management of built facilities’.

The Research Objectives:
The study was conducted to:
Determine the level of satisfaction of the building occupants’ in terms of IEQ, and
Proffer solutions to identified problems so that the building performance can be improved, and similar future buildings can be improved upon in terms of IEQ.
The overall aim of the study is to emphasize that working environments should be conducive for workers and other users.

THE REVIEW OF IEQ RELATED LITERATURE
Air pollutants, ergonomics, lighting and temperature may cause a deterioration of health of the occupants of the building (Kamaruzzaman et al., 2010). Sub-standard IAQ (indoor air quality), noise, vibration, poor seating and incorrect lighting may lead to occupants’ dissatisfaction, which may cost the employer more because absenteeism will increase. This dissatisfaction in the buildings contributes to stress, which may develop due to poor IEQ in the buildings. Therefore, employers should ensure that the workplace is a stress-free environment (Davies, 2010).

As an illustration, IAQ in this study refers to the physical, chemical and biological characteristics of the air in the indoor working environment. IAQ deals with how well
the indoor air satisfies the occupants of the building. Inadequate ventilation increases indoor pollutants by not allowing enough outdoor air to dilute emissions from indoor sources. The IAQ problem may also originate from office machines and chemical cleaning materials that may be harmful to human health (Burroughs and Hansen, 2011). An example of such an air pollutant is carbon monoxide, which is an odourless and colourless gas, and causes a blockage in the transportation of oxygen to the human body. These blockages often cause dizziness, nausea and fatigue to the occupants of the office (Bluysen et al., 2011). Improved air quality evaluation in buildings is necessary to avoid the formation of air pollutants that are harmful to human body.

Having to improve IEQ in the building should be a partnership between occupants and the management of a building. Occupants’ well-being should be part of the company mission and vision strategy to ensure that good IAQ is maintained (Cho and Lee, 2010). Lighting can pose health challenges to human body and can affect the overall service of the employees to the organisation. Poor lighting in buildings could lead to poor vision among occupants of a building. Lighting should be included at the initial design stage to ensure that the required level of lighting is adhered to (De Carli and De Giuli, 2009). Inadequate lighting in the building may reduce productivity among occupants. Different tasks require certain levels of lighting. Office light is supposed to support both the paper-based work and computer-based work, which makes it difficult for the occupants to adjust the lights to meet both requirements. Light emitted by the computer also contributes some challenges to the occupants’ health if the screen light is not set correctly (AL-Anzi, 2009). Incorrect lighting leads to headaches, stress, dizziness and loss of productivity. Quality of lighting in the office building is linked to productivity, because without high-quality lights in the building the productivity drops (Samani, 2011). Constant evaluation of the building’s performance is necessary to yield an improved IEQ, which may boost the quality of life of the occupants (Cho and Lee, 2010). This indoor air problem may lead to a total dysfunction in an organisation if it is not prioritised at the earliest stage, since it would reduce the productivity of the organisation (Antikainen et al., 2008). Proper precautions should be taken regarding the efficiency of the IEQ in order to safeguard the lives of the occupants in the office against diseases that may be caused by poor lighting.

Thermal comfort is the comfort of occupants when they feel satisfied with the level of heat or cold. The lack of evaluation of buildings regarding the thermal comfort may lead to occupants being uncomfortable if the building is too hot or too cold. If the evaluation of the building is done at certain intervals, occupants are enabled to choose the type of clothing that is suitable to the temperature of the building (Hassanain, 2008). AL-Anzi (2009) identifies some effects of high and low temperatures on the occupants in the office. A high temperature causes occupants to become tired, whereas low temperatures may affect occupants with flu, especially occupants with weak or compromised antibodies.

Ergonomics is the study whereby it is determined whether an occupant is in a place where it suits or fit him or her so that a work can be performed without any disturbances. Ergonomics aims to improve the occupant’s comfort, safety and work efficiency (Mustafa et al., 2009). Improved IEQ is not complete without addressing ergonomics in buildings or any office environment. Poor ergonomics may cause work-related diseases called musculoskeletal disorders (MSD). Workspace designs should be done in a manner that satisfies the occupant’s work needs. The designs must comply with the highest standards of IEQ, which will stimulate the occupant’s morale.
and satisfaction. IEQ for workspace must be taken seriously when employers choose workspace, as these may have a serious impact on the occupants’ health (Vischer, 2008). It is important that the employer creates a workspace that is suitable for occupants so that they will feel valued and inspired by their employer, and be proud of the work they do. Workspace psychology may play an important part, whereby motivation and commitment could influence occupants to be more productive. Working in an unhygienic workplace will reduce the morale and increase job dissatisfaction among the occupants (Davies, 2010).

There would be job satisfaction among occupants, which would lead to a rise in productivity. Failure to achieve effective ergonomics in the workplace results in low productivity and poor quality of work. Sound ergonomics will also ensure that occupants perform work faster (AL-Anzi, 2009). Office noise disturbances prevent occupants from concentrating on their work. Many researchers have acknowledged that noise may lead to stress, headaches and other disorders (AL-Anzi, 2009). Designers are therefore required to design projects that include acoustic materials to be used for the projects. Designers should be able to analyse the way that occupants will be placed in the office space. Office wall-panel height must be considered to ensure that at least minimum privacy is maintained, even though it is an open-space office. An employer should be in a position to select an acoustic office design that will control for noise management and reduction within the workstation. Strategic thinking is required if the employer wants to reduce the level of noise by increasing the room’s capacity for absorption, increasing screen height and increasing the masking of the sound level (Hongisto, 2008).

**PRIMARY DATA COLLECTION**

The paper focuses on commercial office buildings inside the Country Club Estate (CCE) in the suburb of Woodmead, Johannesburg, South Africa. Johannesburg’s status as the economic hub of South Africa requires secure space for conducting business activities. The office park (CCE) is equipped with 24 hours security monitoring. It is situated near busy national roads / arteries / highways in South Africa. It is approximately a 30 minutes’ drive to the OR Tambo International Airport in Johannesburg in normal traffic. To obtain perceptions of the occupants’ feelings regarding the IEQ, questionnaires were formulated and distributed to occupants in the CCE. The structured questionnaires were distributed inside ten blocks in the CCE. The questionnaire was in seven sections (A-G). The designs of the questionnaire envisage a maximum of 20 minutes for its completion.

Section A elicited for responses to occupants’ personal information in terms of age, gender, profession, term of employment and so on. Section B helped to evaluate the level of satisfaction with IEQ of the buildings. This section addressed IEQ in the buildings with respect to cleanliness of the buildings, whether the air in the building is fresh or stale, rate of air circulation, control of ventilation, temperature in the buildings, noise in the buildings as well as artificial lighting in the buildings. Section C helped to determine whether the building is satisfactory to its occupants. The emphasis was on the interior of the buildings. Section C focussed on the lighting in the buildings, access control of the building, visibility of the security personnel in the buildings and accessibility of building from the street. Section D helped out to reveal whether the IEQ affects the productivity and performance of the occupants. Section E assisted in revealing whether office space influence employee performance and productivity. It further stated if the quality of space provided to occupant has an effect
on performance as well the satisfaction of space flexibility allocated to the occupant. Section F gave an indication whether occupants are satisfied with location of the building, while Section G deals with the communication within the building.

One hundred and twenty-six (126) questionnaires were distributed and 102 were received. Out of 102 respondents, 53% were female, while 47% were male. Of the total respondents that the questionnaires were given to, 38% of them were in administrative positions, while 21% were in various technical positions. The survey revealed that 33% of the respondents indicated that they are in various professional fields, while 5% of the respondents were in executive positions of the various companies within CCE. 90% of the respondents (92) are permanently employed in their respective organisations within the complex. Contract employees were students that were mostly on internship in organisations resident in the CCE. Respondents age group revealed that 35% were between 20 - 30 years, 40% were between 30 - 40 years, 14% were between 40 - 50 years, and 11% of them were 50 years and older.

RESULTS AND DISCUSSIONS

On whether quality of air has effects on occupant’s performances and productivity, recorded responses indicated that 31% of the respondents said that the quality of air has a “minor effect”, while 28% of respondents viewed the effects to be “somewhat”. However, 12% perceive that the quality of air has contributed significantly towards their work performances and productivity positively. When the respondents were asked about how they rate the air within the building, 50% of them opined that they rate the air within building as normal, while 24% cited it as fresh and 13% rate it as very stale (Figure 1). However, 21% observe that the air in the building is dry. The results show that 26% of the respondents indicated that there is slight circulation of air in the building and 51% of the occupants suggest that there is good circulation of air within the building. Further, the findings also show that 33% of respondents indicated that they have no control of air ventilation in their offices, while 37% of the respondents indicated that they have fair control of air ventilation in their offices and 30% of the respondents said that they have full control of air ventilation in their offices.

![Figure 1: Extent of air freshness or staleness in the building](image)

In terms of thermal comfort (Figure 2), 52% of the respondents said that it is warm, while 22% said that it is hot during summer in their offices. The findings equally show that 50% of respondents indicated that it is warm during winter in their offices, while 16% indicated that it is very cold during winter. 25% responded that is fairly cold during winter, while 7% of the respondents indicated that it is hot during winter. Furthermore, 27% of the respondents contend that the temperature in the office has
minor effect on their performances and productivity, while 30% of the reply said that temperature has some effect. A limited number of the respondents (30%) maintain that the temperature in their office has a near major / major effect on their performance and productivity.

Figure 2: Perceived room temperatures in summer and winter

Concerning noise pollution, 26% of the respondents indicate that they hear noise that leads to significant distractions from outside, while 25% do not hear such noise from outside. A sizeable number of the respondents (36%) indicate that noise distraction has effects on their performance and productivity, while 23% said that noise distraction only has some effects. Some of the respondents (43%) said that noise from outside is not significantly distracting from work, while 6% opined that noise from outside do affect them very significantly when executing their work.

Figure 3: Extent of natural light in the building

Regarding the quality of lighting in building, results reveal that 37% of the occupants suggest that it has a minor effect when it comes to performance and productivity pertaining to their work, while 27% of the respondents said that it has some effects. The result further show that 70% of the respondents indicated that there is moderate natural light in the office building and 21% of them suggest that there is little natural light (Figure 3). The findings show that 51% of respondents indicated that there is moderate artificial light in the building, while 35% said that there is high artificial light in the building. With regard to natural light in the offices, 57% of respondents opine that there are effective blinds for blocking out the natural light, while 15% of
the respondents said that there is more effective of blocking out of the natural light by blinds or shutters. However, of the total respondents that the questionnaires were distributed to, 40% indicated that they do not have control over artificial lighting in their offices in the complex. In addition, 23% of respondents said that they do have control of artificial lighting in the office complex, while 14% indicated that they do have a full control over artificial lighting in the complex.

In terms of the level of satisfaction expressed by the occupants regarding safety in the building (Figure 4), the results reveal that 55% of them were satisfied, while 21% were more than satisfied with the safety in the buildings. Another question that was asked show that the respondents were of the opinion that the quality of space have minor (36%) and some (27%) effects on work performance. The results show that 10% of the respondents were not satisfied with space flexibility at their workplace, while 23% indicated that they are less satisfied with it. 28% of the respondents also said that they are satisfied with the flexibility of space provided, while 19% of the respondents are fairly satisfied.

![Figure 4: Extent of occupants’ satisfaction concerning safety in the building](image)

**CONCLUDING REMARKS**

This paper gives an insight with regard to the indoor environmental quality in terms of POE and its effects when it is not addressed adequately. Given that a similar study in the South African context was not identified during the literature search, the study is deemed to be explorative in nature. Using a multi-use estate as a case study, POE evaluation was conducted in order to come up with the primary data of the study. In other words, this was done since POE is often utilised as diagnostic tool to evaluate the efficiency of IEQ in multi-use buildings.

The findings of the study suggested that much needs to be done to improve the IEQ in the buildings in the CCE complex according to employees. Based on the responses received, it can be argued that the inadequate attention to IEQ in the buildings could reduce the productivity and performance of employees working in the complex. Building owners should evaluate IAQ to ensure that air pollutants do not emerge as these poses a serious health risks to employees. In addition, the views of the occupants suggest that it appears there is a lack of proper control of lighting in most of the buildings. If this is the case, discomfort and unhappiness that would lead to reduce productivity among occupants may become prevalent in the complex.

Likewise, workspace design in buildings is an IEQ critical factor that appears to stimulate occupants’ satisfaction. Management of the buildings should thus ensure
that they engage or interact with occupants prior to space allocation with aim of getting the views / buy-in of their employees. Due to the open office configuration, noise level is high and it disturbs occupants’ concentration and affects performance and productivity negatively. Management should devise rules that will reduce noise to acceptable level. Occupants do not have control over lighting in the office building, which may increase risks of absenteeism because of the time infected employees will spend consulting health practitioners.

POE should contribute meaningfully to increased organisational productivity and performance in the construction sector on the one hand; and enhance the well-being of workers in South Africa on the other hand. Limited occurrence of health related work stoppages should affect the profitability of organisations that occupy facilities that ensure lightings, energy and air circulation are positively used.

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A CRITICAL REVIEW OF PUBLIC PRIVATE PARTNERSHIP PRACTICE IN NIGERIA

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The use of Public Private Partnerships (PPP) in Nigeria as a procurement method for the public projects came with great expectation that the critical social and economic infrastructures would be addressed soon. But after a decade, there is still no appreciable progress in exploring the PPP method to develop the critical public infrastructure. This paper critically reviewed the implementation of PPP in Nigeria so that the system could be improved to meet the acceptable best practice. The study revealed that delays in negotiation, high participation costs, attitude of public officers, poor performance of PPP projects, low level of technology, social-cultural issues and macro-economic environment are the critical challenges that are affecting the smooth management of the PPP projects in Nigeria. Therefore, it is recommended that the government should create opportunities for training and re-training of the participants in the implementation of PPP projects. The interest of the residents should be a priority before and during the implementation of PPP projects in their domain.

Keywords: PPP, project performance, participation costs, infrastructure.

INTRODUCTION

Nigeria with a population of 167 million and the third largest economy in Africa placed her as an important economy in the world. The inadequacy of public facilities in the country is of great concern and there is need to increase the provision of social and economic infrastructures in order to meet the target of Millennium Development Goals (MDGs). In addressing the infrastructure deficit, the Nigerian government adopted the use of Public Private Partnership (PPP) as an alternative method for the development of public facilities through private sector. The Infrastructure Concession Regulatory Commission (ICRC) Act was enacted in 2005 to provide guidance for the conduct of using PPP in Nigeria. The expected increase in the delivery of public services through private sector involvement is at low ebb. The Nigeria’s blue-print for transformation, the Vision 2020, was designed to ‘make Nigeria one of the 20 largest economies in the world, consolidate its leadership role in Africa and establish itself as a significant player in the global economic and political arena’ (ADF, 2010). This Vision is being threatened by the lack of basic amenities for the majority of its population. The country needs to fast-track the development of the social and economic infrastructure in order to maintain its current growth rate and be able to cope with the increase in demand as a result of its population and economic growth.

The use of Public Private Partnership (PPP) as a procurement system for the acquisition of public services is about a decade old in Nigeria. The expected growth in

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the delivery of public projects by private sector is not yet achieved. Surely, the adoption of the Public Private Partnership procurement arrangement to deliver public works and services across continents has been on the increase (Tieva and Junnonen, 2009; Li et al, 2005). Public Private Partnership is being given more consideration due to the ‘inherent benefits’ and that PPP is being ‘portrayed as a vehicle of change and a panacea for the construction sector at large’ (Leiringer, 2006). The increase in population and public awareness couple with the coming up of elected governments across the sub-Saharan Africa countries had resulted in the increase in demand for public services (Awodele et al, 2010 and Gidado, 2010). The provision of these services by governments, especially in the developing countries, has been very difficult due to the limited fund. The other factors such as lack of expertise in public sector and official corruption are part of the problems being faced by individual government in providing new infrastructure and maintaining the existing facilities (Awodele et al, 2010).

In order to provide legal and regulatory framework for the implementation of PPP in Nigeria, the board of the Infrastructure Concession Regulatory Commission (ICRC) was inaugurated in 2008. The Commission derives its power from the ICRC Act of 2005. The functions of the Commission is to regulate, monitor and supervise the contracts entered into by the Ministries, Departments and Agencies (MDAs) with the private sector for the financing, construction, operation and maintenance of infrastructure projects (Dahiru, 2012). Two infrastructural PPP projects were successfully delivered in a decade through PPP in Nigeria while several others are at various stages of negotiation and construction (NPPPR 2012). This is short of expectation of the citizens who are in dear need of government interventions in social and economic infrastructures. Therefore, the government is being challenged to rehabilitate the existing infrastructure which are in deplorable situations and at the same time provide new facilities that would meet up with the increasing demand due to population explosion. The focus of this study is to critically assess the challenges being faced during the implementation stage of PPP projects with the aim of improving the procurement system so as to encourage further participation of private sectors in the provision of public works and services.

PUBLIC PRIVATE PARTNERSHIPS (PPP)

Public Private Partnerships became new procurement options in early 1980s in United Kingdom (UK). In 1992, the UK government developed PPP through private finance initiative (PFI) system and came up with new policy that provides guideline in promoting private sector’s involvement in infrastructure and public services provision (Li et al, 2005). PPP has been given different definitions by many authors and institutions. In Austria, despite the fact that the PPP is being used to deliver public infrastructures, there are still varied perceptions and definitions of PPP (Susilawati et al, 2009). Though the term public-private partnership has different meaning from country to country but ‘it is essentially a form of collaboration between the public and private sectors’ (Anadzi and Bowles, 2004). The Canadian Council for Public Private Partnerships (2012) defined “Public Private Partnerships as a co-operative venture between the public and private sectors, built on the expertise of each partner that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards”. In the submission of Boussabaine (2007), he advised that there should be uniformity in the meaning of PPP when contract agreement is being drafted to avoid confusion and contractual dispute. In order to avoid contractual dispute, there should be mutual understanding in the appropriate meaning of each term of the
agreement and that it is better to draft the agreement with simple and unambiguous words (ibid).

The essential fixture of public-private partnership is that the services requirements are defined by the client (public sector) while the private sector investor undertakes the design, building, financing and operation of the facility and hands over the asset at the end of concession period (Akintoye et al, 2001). The private sector investor also referred to as Special Purpose Vehicle (SPV) company engages the professionals as well as entered into sub-contracts with various sub-contractors to undertake works for the construction, maintenance and managing the public asset for a specific period. They assist the SPV Company to discharge its obligation under the PPP contract agreement. The private sector has assumed the responsibility of providing infrastructure and services which is naturally the responsibility of public sector. Because the available resources are not adequate to meet up with the current and future demands, the public sector opted for this model of procurement so as to respond to the increasing demand for public infrastructure (Li et al, 2001). In the report of RICS (2011), the procurement of public works and services through public-private partnerships still remain comparatively low in percentage to the total public investments in infrastructural facilities.

The introduction of PPP in Nigeria began in 2003 with the signing of concession arrangement for the re-construction and modernization of domestic terminal of the Muritala Muhammed International Airport (MMA) Lagos by the Federal Government (Awodele et al, 2010). Since then, many State governments and as well as Local government in the country are now considering the adoption of the new method for procuring social and economic infrastructure in their respective jurisdictions (Udechuckwu, 2012). Having realized the need to improve the PPP method of procurement, the Federal Government of Nigeria is carrying out a three year programme for the capacity building of public officers for the implementation of PPP projects in the Ministries, Departments and Agencies (MDAs) at the federal and state levels. The aim is to ‘increase institutional capacity to prepare and successfully implement PPP projects in the power and transport sectors and strengthen cooperation between federal and state government institutions in charge of infrastructure delivery’ (ADF, 2010).

CHALLENGES TO THE IMPLEMENTATION OF PPP PROJECTS IN NIGERIA

The study was carried out by reviewing the PPP projects implementation in Nigeria from the inception in 2003. The review was carried out through desktop review of the reports, public documents on PPPs and the projects that used PPP procurement method. From the foregoing, the key issues that hinder the smooth implementation of the contract provisions of the PPP projects in Nigeria include the following:

Delays in Negotiation

The lengthy of negotiations of PPP transactions between the government agencies in Nigeria and the private investors is one of the major challenges in the implementation of the PPP procurement method. For example, the project for the re-construction of Lagos-Ibadan Road failed to reach financial close after the negotiation between Ministry of Works and Bi-Courtney Highways Services Ltd went on for about four year. The project was eventually revoked in 2012. In an earlier study carried out by Oyewobi et al (2012), the lengthy delays in either negotiation or approval due to the
political, social or legal issues was considered as most significant negative factor for adopting PPP as procurement option in Nigeria.

**High Participation Costs**

The participation of both public and private sectors in the PPP contract negotiation requires the inputs from various professionals associated with the project. The engagement of consultants to prepare contract documents and manage of the procurement process comes with high participating costs to both the government and the private investors. This process makes the PPP procurement method not viable for the small projects. Also, due to a longer period that the participants spend at the negotiation stage for PPP contracts, then more time are spent on the PPP projects. The period of four years spent in the negotiation for the Lagos-Ibadan Road reconstruction must have come with attendant costs to both parties and in particular the private sector participants.

**Attitude of Public Officers**

The public officers are the custodian of the implementation of PPP projects. Therefore, their conducts and attitudes towards the process would impact on the success of the procurement system. They are in the position to implement the policy set out by the government and they also serve as advisers to the politicians in government. One of the major challenges being experienced in the management of BOT contract of the Muritala Muhammed Airport Terminal 2 (MMA2) is the lack of diligence in the managing the PPP transaction between the Federal Aviation Authority of Nigeria (FAAN) and the Special Purpose Vehicle (SPV) company for the project. Awodele et al (2012a) had earlier concluded in their study carried out in Lagos State, Nigeria that ‘the greed and corruption among the public officers remain the most significant problem to successful implementation of the procurement system’.

**Poor Performance of PPP Projects**

In a study carried out by Awodele et al (2012) to assess the infrastructure investment needs of the Lagos city, they found out that there was poor performance in the PPP arrangements in the state. This could be a replica of what obtained in most states that had adopted the use of PPP as procurement method to address infrastructure deficit in their respective localities. If the system has performed to the expectation of the people, there would have be an appreciable increase in the delivery of public works and services in the country. The Tinapa resort in Calabar that was conceived and completed by the Cross Rivers state in 2007 and has performed below the expectation. The project which is the first free trade zone (FTZ) in Nigeria is supposed to be a world market place that would attract visitors from all over the world and be a catalyst for the growth of the nation’s economy.

**Low Level of Technology**

Nigeria, being a developing economy with little technological development, is a country that operates with imported technology in every sector with particular reference to the construction industry. Since the construction sector works with imported materials, there is little or difficulty for bringing out innovation in the provision of public services. For example, the electronic toll payment system being introduced in the ongoing re-construction and expansion of Lekki-Epe Road in Lagos is an example of imported technology which must come with attendant problems in the operation which may not be handled in Nigeria. Awodele et al (2012) confirmed
this in their earlier study that unavailability of appropriate technology is among the top ranking challenges in the implementation of PPP in Lagos.

**Social-cultural Issues**

The co-operation of the citizens who are to benefit and use the services being provided by the PPP arrangements is very important to the success of such projects. The Lekki Concession Company, the SPV on the re-construction and modernization of Lekki-Epe Road had some challenges at the commencement of toll collection. That situation almost affected the implementation of the PPP contract when the users threatened and protested on the toll system being offered by the company. It showed that the government did not consider and carried the citizens of the area who are the eventual users of the facility along during the conceptualization process of the contract.

**Macro-economic environment**

Since the private investors in PPP projects are in the business to make profit and be able to pay the loan with huge interests, there must be a favourable environment for them to recoup their investments within the concession period. For the PPP contracts to be viable for the investing private sector participants there must be good and favourable conditions for the services being offered so that the citizens could be able to afford and patronize the firm providing the services. This is possible if the considerable number of the citizens is buoyant enough to patronize the company. The users of the facilities must be able to pay for the services being rendered by the concessionaires so that the PPP project could be successful.

**DISCUSSION**

The review showed clearly that the implementation of PPP projects had not achieved a reasonable progress to deliver public works and services. The system could not attract more private investors from both within and outside the country. There is no doubt that the private sector involvement is needed to assist the government in delivery public facilities through mobilization of funds, expert management and create innovation in the business. Apart from MMA2 and Lekki-Epe Road, there is no other infrastructural facility that had been delivered in Nigeria through PPP since the inception in 2003. That showed clearly that those challenges are having major impact on the implementation of PPP procurement method. The table 1 showed the various challenges as they affect the PPP projects that were reviewed for this study. The MMA2 project showed that the attitude of the public officers in the management of the contractual relationships led the various litigations between the government agency and the SPV company. The table also showed that construction of the Lekki-Epe Road had brought about conflict with the residents on the collection of toll for the section of the road completed and in use. The proposed Lagos-Ibadan re-construction project had various challenges like delays in negotiation, high participation costs, poor performance due to finance and the social-cultural issues.

Previous researches on the use of PPP procurement system had highlighted areas of concern. One of them is that the policy framework does not include all sectors and that the modalities for the participation of foreign investors are not provided for in the document (Dahiru, 2012). Also, in the report of the Infrastructure Concession Regulatory Commission (ICRC), it was recognized that there are shortcomings in the law regulating the implementation of PPP in Nigeria (NPPPR, 2012). Another study carried out by Ibem and Aduwo (2012) found out that the institutional framework for the implementation of PPP projects makes no provision for the inclusion of non-
governmental organizations, voluntary organizations and non-corporate private developers. In the study carried out by Awodele et al (2012a) to appraise the participation of the private sector in the provision of infrastructure in Nigeria, they found out that greed and corruption, unavailability of appropriate technology and high procurement cost are the three main problems encountered in the implementation of PPP procurement system in Nigeria.

Table 1: Reviewed PPP Projects

<table>
<thead>
<tr>
<th>PPP Projects</th>
<th>Value (US$)</th>
<th>Status</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMA2 between public agency</td>
<td>200million</td>
<td>Operation</td>
<td>Conflict and the private operator</td>
</tr>
<tr>
<td>Lekki-Epe Road residents</td>
<td>200million</td>
<td>Operation/ Construction</td>
<td>Conflict between residents, Construction operator and government</td>
</tr>
<tr>
<td>Lagos-Ibadan Road negotiation</td>
<td>560million</td>
<td>Failed</td>
<td>Delay in participation costs, poor social-cultural issues</td>
</tr>
<tr>
<td>Lagos-Urban Rail negotiation</td>
<td>550million</td>
<td>Negotiation</td>
<td>Delay in participation costs</td>
</tr>
</tbody>
</table>

Experience from the UK’s PFI market has showed that there are inadequacies in the implementation (Carrillo et al, 2006). They pointed out that there are new challenges for system which ‘includes inefficiencies in PFI project processes as a result of the inadequate capture and transfer of expertise, significant transaction costs associated with longer negotiations and time schedules to deliver large-scale, often complex schemes, variable quality of facilities, high levels of investment and risks involved. Grimsey and Lewis (2007) concluded that ‘in most cases PPP may be beyond the capacity of the public sector agency to implement and manage’. The report of RICS in 2011 also stated that ‘lack of a consistent regulatory framework has been identified as a key barrier to the roll out of PPP projects in United States’. In Singapore, the study carried out by Hwang et al (2012) concluded that lengthy delays in negotiation, high participation costs, confusion on government objectives and criteria evaluation and lack of experience or appropriate skills were the top four negative factors for PPP projects. While lack of support from government, availability of finance, construction time delay, inadequate experience in PPP and unstable government were the top five critical risk factors in PPP projects in Singapore.
CONCLUSSION
This paper reviewed the implementation of PPP projects in Nigeria with focus on the infrastructural facilities to determine the critical challenges in the management of the PPP contract. It was revealed that delays in negotiation, high participation costs, attitude of public officers, poor performance of PPP projects, low level of technology, social-cultural issues and macro-economic environment are the critical challenges that are affecting the smooth management of the PPP projects in Nigeria. Therefore, it is recommended that the government should create opportunities for training and re-training of the public officers participating in the implementation of PPP projects. They should see the management of the procurement process as a call to service in order to use the PPP as a vehicle to improve to the social-economic situation in the country through the increase in public infrastructure. The residents should be carried along before and during the implementation of PPP projects in their domain especially those projects that would require them to pay before enjoying the facility. That suggested that the public interest should be ultimate priority of the government in the delivery of PPP projects. The findings would help public and private participants aware of the challenges ahead in order to accommodate them in their planning for future PPP projects.

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Effective implementation of competitive tendering has the potential for assuring transparency, accountability, fairness, justice and ethical standards in public works procurement. It promotes sound contract practices and growth of indigenous technology by providing a reliable environment for all industry operators. Furthermore, it can reduce time and cost, promote competition, hamper corruption, and strengthen the public service system. Although, competitive tendering appears to be the most acceptable method of selecting contractors everywhere, its implementation in Chad is facing many challenges despite the reforms put in place in 2003 resulting in a very poor performance of government procurement. Field survey reveals that lack of effectiveness assessment of the tendering processes at pre-contract stage is one of the main causes. Therefore, this research project aims at developing a Framework for Assessing the Effectiveness Assessment of Competitive Tendering Process with following specific objectives: (1) To identify the Major Challenges facing the implementation of Competitive Tendering Method in Chad; (2) To determine relevant Factors Underpinning the Effectiveness of Competitive Tendering Method in Chad; (3) To establish key Indicators for the determination of the Effectiveness of Competitive Tendering Process in Chad; (4) To develop a Framework for Assessing the Effectiveness of Competitive Tendering Process in Chad; (5) To Validate the developed Framework by a focus group workshop. The study uses mixed (quantitative and qualitative) approach with interview and questionnaire as main instruments for data collection. The targeted population comprises 56 institutions deeply involved in public procurement in Chad.

Key words: Framework, Effectiveness assessment, Public Procurement, Competitive Tendering, Chad

INTRODUCTION

This paper is a research proposal and highlights the research background and the problem statement. The aim and objectives of the study are also included and subsequently followed by the need of the study, scope and assumptions, methodology to be adopted, and finally the organization of the chapters. Before tackling the background, following key words and expressions are specified to have a sound understanding of the topic: Framework is a methodological approach of performing a process assessment sequence after sequence. Assessment is a part of the Management

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Cycle that consists in measuring process performance in order to taking remedy action to improve the final achievement. Effectiveness is a process characteristic indicating the degree to which the process output conforms to the pre-determined requirements. The measure of effectiveness determines if the right things are being done independently of means of achievement. Consequently, Assessing the Effectiveness means measuring the actual overall performance of the process with regard to the expected one based on key attributes. Competitive Tendering Process is a procurement activity consisting in contractor selection through competition that starts with the development of procurement plan up to the award of contract. However, the study focuses at Pre-Contract Stage that ends at the pre-award meeting. In other words, the topic means therefore, the development of a procedural management tool for measuring the overall performance of competitive tendering process in public works procurement at pre-contract stage.

The objective of this paper is to submit this research proposal to an informed public of the area in order to obtain their comments and inputs for its improvement.

**BACKGROUND**

The most important and broadly accepted principle underlying any procurement system is open competition (UNDP, 2004). In construction industry, Competitive Tendering (CT) is a procurement method whereby contractors are invited to make a firm and unequivocal offer of the price and terms which on acceptance shall be the basis of subsequent contract (Oladapo, 2000). So, competitive bids are submitted on the same basis, under the same conditions and using the same criteria for evaluation (Adetola, 2000). Consequently, CT is widely recognized as an attractive procurement mechanism and is commonly advocated by international organizations like World Bank (WB), European Union (EU), African Development Bank (AfBD), and the Organization for Economic Co-operation and Development (OECD). As a result, the majority of developing countries prescribed CT as the prime method of public procurement due to its widespread benefits. These include promoting competition and hampering corruption (Steven and Patrick, 2006), reducing cost by broadly 20% (Simon et al., 2005) and providing the enabling environment for effective utilization of scarce resources in the economy (Dikko, 2000). Furthermore, one important hallmark of a high standard of public governance is a well-developed, effective and efficient system of government procurement (David, 2007). An Effective system is characterized by the degree to which its output conforms to the pre-determined requirements (Oxford Dictionary, 2000). Richard (2006) added that a Measure of Effectiveness (MOE) concerns how well a system tracks against its purpose or normative behavior. Though Effectiveness reflects the quality of the actual result compared to the expected one (CINTERFOR/ILO, 2007), it also determines if the right things are being done and can be considered invariant to means of achievement (Richard, 2006). Besides that, Oladapo (2000) among others asserted that an effective Competitive Tendering Process (CTP) has to be open, transparent, fair, timely and cost effective and comply with rules, regulations and procedures. So, if these effectiveness attributes are assessed earlier prior to the award of contract, the results can help the final decision making in mitigating the risk associated.

Although CT appears to be the most acceptable method of selecting contractors in the world (Akubueze, 2000) and the most beneficial to local construction industries (Oladapo, 2000), its implementation has been the most difficult in developing countries (Dikko, 2000). Despite the profound reforms of the Public Procurement Policies, Acts, Regulations and Procedures, effected at the beginning of 2000s in
many developing countries with the aid and support of WB and OECD, public procurement practices remain still questionable (OECD, 2010). In fact, CT does not benefit fully to developing countries as expected (WB, 2010) due to following challenges: excessive delay, massive violation of laws and regulations, weak institutions and structures, poor performance of personnel, generalized fraud and corruption practices, and above all the lack of good performance management (Collins et al, 2011; Patrice, 2008). Therefore, developing a framework for assessing the effectiveness of Competitive Tendering Process (CTP) may be a starting point of the improvement of public procurement performance in any developing country.

**PROBLEM STATEMENT**

In Chad, Design-Bid-Build (DBB) method using CT is predominately used for public works procurement in compliance with the prescriptions of the Public Procurement Act 2003 (Act 503). But, challenges enumerated above are preventing it from yielding the expected widespread benefits. For instance, many contracts fail to meet government expectations (abandoned sites or doubtful works quality) due to poor performance of tendering procedures (CCSRP, 2009). As a result, more than 70% of loose of time and cost during construction phase were attributed to biased award of contracts (CCSRP, 2009). In addition, when analyzing the causes of delay in construction project delivery through Open Competitive Tendering in Chad, Patrice (2008) identified up to 49 steps prescribed by the Act 503. It appears then clear that such very long process is responsible of excessive delays in contract award, hence project delivery. Furthermore, massive use of negotiations than competition (52%), award of many contracts (3 to 8 a year) to incapable contractors or to a single contractor, projects’ overprices (40%), are constantly reported as poor results of CT implementation in Chad (OCMP, 2008; CSCRP, 2006 to 2009). However, effectiveness assessment of the achievements of CT process prior to the approval of contract will certainly mitigate negative effects and abuses mentioned above. In addition to that, the evaluation of the tendering process effectiveness is identified as one of success factors in public procurement in Chad (Patrice, 2008). As Richard (2006) states, effectiveness assessment provide decision makers feedback on the impact of deliberate actions and affect critical issues such as allocation of scarce resources, as well as whether to maintain or change existing strategy. Again, according to Patrick (2011), there is still a knowledge gap on how the procurement process can contribute to improved performance of the procurement function in developing countries.

From the foregoing, therefore, developing an appropriate tool that helps public contracting authorities to assess the effectiveness of every project at pre-contract phase will result in a substantial improvement of the performance of Competitive Tendering Process. Thus, the local construction industry will further benefit from it. In an attempt to make progress in this regard, and consistent with the aim and objectives of the study described below, the following questions have been articulated to drive the research effort: What are the major challenges facing the implementation of CT Method in Chad? What are the relevant factors underpinning the Effectiveness of CT Method in Chad? What are the key indicators for the determination of the Effectiveness of CT Process in Chad? How to assess the Effectiveness of CT Process in public works procurement in Chad?
AIM AND OBJECTIVES

The study aims at developing a Procedural Framework for Assessing the Effectiveness of Competitive Tendering Process in Public Works Procurement at pre-contract stage in Chad. The specific objectives of the study are fivefold: (1) To identify the Major Challenges facing the implementation of Competitive Tendering Method in Chad; (2) To determine relevant Factors Underpinning the Effectiveness of Competitive Tendering Method in Chad; (3) To establish key Indicators for the determination of the Effectiveness of Competitive Tendering Process in Chad; (4) To develop a Framework for Assessing the Effectiveness of Competitive Tendering Process in Chad; (5) To Validate the developed Framework by a focus group workshop.

NEED FOR THE STUDY

In developing economies, it is clearly established that the contribution of public procurement to GDP varies between 15 to 25% (Tano, 2009; OECD, 2010); therefore public procurement is viewed as an important area which deserves special attention from government (Haldea, 2011). Unfortunately, questionable public procurement practices depicted earlier do persist and have led to Paris Declaration on the Aid Effectiveness for partner countries; which declaration stressed the urgent need for improvement of public procurement practices (OECD/ACD, 2005). To backup this action, the OECD (2010) has estimated that losses due to inappropriate procedures at 20 to 30% of aids granted. Not only that, US National Performance Review (2007), claims that the effectiveness of tendering process impacts directly on the value for money and also, the implementation of performance evaluation stimulates the systemic documentation of every stage of the process. So, transparency and public accountability which are relevant performance indicators are enhanced. Owing to what precedes on one hand, and to various advantages offered by CT method on the other hand, any improvement in effective implementation of CT Process is therefore welcomed in developing countries.

Apart from that, different aspects of Open and Competitive Tendering were elicited in many papers presented by experts at a workshop organized by the Nigeria Institute of Quantity Surveyors held in Lagos, Nigeria in 2000 but the effectiveness evaluation aspect was not treated. Again, many researches were carried out on building projects performance at pre and post occupancy stages based on golden triangle (time, cost, quality) but little has particularly taken into consideration multiple and balanced other criteria and at pre-contract phase (Kogoliou, 2007). Recently, Patrice (2008) studied specially the effectiveness of government contracts procedures in Chad but the resulting report shows that no studies have been addressing specifically the development of a management tool for assessing the effectiveness of CT Process. Therefore, the present work intends to fill this gap too.

In the light of the above exposition, it is indisputable that there is a need for developing appropriate framework for assessing the effectiveness of CT Process in public works procurement in Chad.

SCOPE AND ASSUMPTIONS

First, the study is limited to Competitive Tendering method for the following reasons: (i) CT is predominant and popular in construction field, (ii) CT is implemented in the majority of developing countries, (iii) CT process is more elaborated and can be considered as objective, and (iv) CT is the most suitable procurement method in ordinary public projects. Then, the present work focuses on CT Process set by the PP Act 503 enacted on 5th
Competitive tendering

December 2003, currently in application in Chad. Subsequently, Competitive Tendering Process starts from the development of procurement plan and ends at the pre-award meeting. Finally, in the frame of the present work, the Effectiveness is assumed as Performance and the two words are often interchangeable.

RESEARCH METHODOLOGY

With the intention of solving a problem, the present study is a descriptive survey research using both qualitative and quantitative strategies. However, according to Pana et al. (2010), research philosophies differ on the goals and the way to achieve them. Indeed, regarding the ongoing debates concerning which paradigm is suitable for the research in Construction Management; there is empirical evidence that this field is classified under the category of social studies (Patrick et al. (2011). But, Pana et al. (2010) argue that Construction Management is a relatively new area of research compared to the fundamental sciences. As a result, it is tossed among Positivism and Constructivism with the dominance for the first paradigm (Tero, 2006; De-graft, 2008; Pana et al, 2010; etc). Considering the preceding arguments and In line with the aim and objectives, the present study is positioned in the school of thought of positivists for core issues affecting the effectiveness of CT Process are real and not the fabrications of the researcher.

Research Paradigm and strategy

Although, literature review reveals that research strategy frequently used in positivist paradigm is quantitative approach, the strategy adopted is multiple. The mixed approach (quantitative and qualitative) is adopted by many researchers in the field of Construction Management (Kumar, 2005; Mohamed, 2007; Pana et al, 2010). The above mentioned authors argued that the two approaches are even complementary in some researches. In fact, Qualitative approach, using in-deep interview technique, gives opportunity to interact with practitioners and obtains information in people's minds including their impressions and understanding of the subject (Mohamed, 2007). More detailed data can be elicited only through interview. Interaction with interviewees will allow the researcher to explain fully the meaning of questions and to add supporting contextual evidence added Pana et al (2010). However, Quantitative strategy is based on the idea that social phenomena can be quantified, measured and expressed numerically (Tero, 2006). In other words, the information about a social phenomenon is expressed in numeric terms that can be analyzed by statistical methods to deduct facts based on past realities and established truths. In addition, quantitative approach offers the possibility to limit personal feeling and perceptions reflecting on results.

In short, interview is the most suitable approach to investigate into major challenges facing the implementation of CTP (objective 1) and the relevant factors underpinning the effectiveness (objective 2); while the quantitative approach is used in the establishment and ranking of identified variables. Key indicators are found through literature research and tested through questionnaire for their establishment. Lastly, According to Morgan (1997), Focus group method through Expert workshop is appropriate for the validation of the framework and the test of key indicators. These reasons have definitively motivated the adoption of the mixed strategy.

Targeted population and Sample design

The targeted population comprises mainly public structures involved in public works procurement. An inventory realized by the author in June 2012 identified 36 fully
operational structures distributed as follows: 3 public procurement bodies, 9 contracting authorities (ministries), 9 procurement entities, 9 tender committees, and 3 control units.

However, to gain other non-public structures perception, 20 other structures are purposively selected according to experience and degree of involvement in public procurement practices and added to the 36. These are 5 consulting firms, 5 contractor firms, 5 sponsors and 5 independent experts in the field. In total, the population size is 56 institutions and the whole population was considered as a sample for study.

Data collection and processing

A literature review will be conducted to identify the existing body of knowledge within the purview and remit of this research to expand and reinforce a thorough understanding of the related concepts. Hence, prior and recent researches in the area of interest will be compiled and reviewed to develop the research theoretical framework. Besides, primary data will be mainly collected through interviews and questionnaires.

A five-point Likert rating scale (where 1= not very important, 2= not important, 3= average, 4= important and 5= very important) will be used. Automatic means of processing data like Microsoft Excel and SPSS will be privileged. Following statistical means are proposed for the analysis: Frequencies (F), Mean Weighted Rating (M), Severity Index (SI), Standard deviation (Std) and Coefficient of Variation (COV). A variable scoring a SI of of 70% or more will be considered as very important (Elhag and Boussabaine, 2002). The COV will be used to compare relative variability of different responses. The t-test and factor analysis will then be used to analyse the variables so that they could be incorporated into the development of the framework.

Framework Design and Validation

Based on the major findings, a framework will be designed. Then, the drafted framework will be submitted for validation by an Experts Group workshop.

Briefly, the methodology adopted for the research will follow successive steps summarized as follows in chronological order: Preliminary studies for Problem statement, Literature review and documents study, Interview design and implementation, Questionnaire design, testing, and final development, Data collection and processing, Framework design and validation.

ORGANIZATION OF CHAPTERS

The dissertation report will be organized into nine chapters as follows: The chapter one is the General Introduction to the research and the second is devoted to the Conceptual Framework. The third chapter deals with the relevant Factors underpinning the Effectiveness of CTP when the chapter four is consecrated to Challenges facing the implementation of CTM in Chad. The chapter five treats Research Methodology followed by the Results presentation, Analysis and Interpretation. The chapter seven describes the developed Framework whilst the chapter eight presents validation Results and adopted Framework; and the last includes Summary of findings, Conclusions and Recommendations.

The relationships of the adopted methodology process with the research objectives and chapters’ organization are schematized in the figure 1 below.
CONCLUSION

In the light of what precedes, it appears that the study is in progress. However, owing to the various advantages offered by Competitive Tendering method, any improvement in its effective implementation is welcomed in developing countries as well as in Chad. Therefore, developing an appropriate management tool for evaluating the effectiveness of Competitive Tendering process in public procurement in Chad will be a starting point of the improvement of public procurement performance elsewhere.

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A PARADIGM SHIFT IN URBAN ECONOMIC THEORIES: THE RE-EXAMINATION OF LAND AND HOUSING VALUES DETERMINANTS

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The past urban economic studies have shown that land and housing values are largely determined by location factors such as distance from Central Business District (CBD), ignoring the non-location factors like time of land purchase, zoning policy, housing quality and neighbourhood infrastructures. Therefore, this paper examined the relative importance of location and non-location factors in the determination of land and housing values, by posting Onitsha city as a case study. Eight hundred and fifty residential housing units were selected and questionnaire administered to the landlords through multi-stage sampling technique. The regression analysis results showed that non-location factors, especially, time of land purchase ($R^2 = 0.478$, $p < 0.05$) and number of rooms ($R^2 = 0.325$, $p < 0.05$) were more important determinants of land and housing values than the location factors. Also, Land and housing values increased with distance from the CBD because of the effects of non-location factors. Therefore, the paper suggested the need to include non location factors in the revision of the urban economic theories for better understanding of the determinants of land and housing values, especially in Onitsha.

Key words: Urban land value, housing value, location factors, non location factors, Onitsha

INTRODUCTION

Land is a major component of the production of housing, which everyone needs and equally essential as production facilities, which we all depend on for our livelihood. For example, land is a primary commodity that provides space for human and economic activities and is seen as the sources of wealth and power (Abdulai, 2010). Therefore, it is not surprising that in many countries in the developing world, landed property accounts for about 50% to 75% of the national wealth (Bell, 2006). Furthermore, Klaus et al (2006) explained that land has been incorporated in economic theories in various ways starting with land used for agriculture to other land use categories such as residential, industrial etc. Today, residential land use, among the various competing urban land uses, is the largest consumer of land in urban areas and the most focus of many urban researchers like Burgess (1924), Mabogunje (1962), Sada (1968), Frishman (1977) Olaore (1991) Onakerhoroye (1984), Olaiyiwola et al (2006).

Housing has been defined in various forms by social scientists in urban studies. The most comprehensive definition was given by Harvey (1972). According to Harvey (1972), housing is fixed in geographic space, it changes hands infrequently, it is a

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commodity which we cannot do without and it is a form of stored wealth which is subject to speculative activities in the market. In addition, a house has various forms of value for the user and above all, it is the point from which the user relates to every other aspect of the urban scene. Arising from this definition, Kim and Park (2005) explained that housing is a composite and a very heterogeneous commodity because a lot of macro-economic variables, spatial differences, characteristics of community structure, the environment and neighbourhood amenities affect the housing market.

Furthermore, Knox (1995) maintained that housing is a commodity whose resultant market values are determined not only by the location of the physical building itself but also by a variety of actors (private developers, land owners, builders etc) operating within different political and institutional contexts. In the later definitions, Eke (2004) argued that housing includes the physical building (whether residential, commercial, industrial, etc) as well as the totality of the environment and the neighbourhood amenities within which the building situates. Also, Agbola (2005) views housing as the shell or structure of dwellings including its design and basic built – in equipments such as the amount and allocation of space, the heating, lighting, sanitary and similar facilities.

There is significant relationship between land and housing which Grimes and Aitken (2007) confirmed that their values are relevant to developers in deciding the willingness to invest or develop. They maintained that the price of a house is a function of land cost, building costs (material and labour) and cost of finance (determined by nominal interest rate). From this vantage of expression relationship, land value or cost is the price offered by a purchaser who is aware of price being paid for and asked for other plots or pieces of land in the vicinity at a time when the availability of land is known widely (Lewis, 1979) and housing value or cost is therefore the estimated cost of a building (including cost of land, materials, finance) in order to determine its selling price (Ilechukwu, 2012). The crucial importance of land and housing values to both individual and national development call for the awareness of their determinants to the owner, investors and decision makers. Urban economic theories or studies have shown that the consumer’s decision to pay for land or a house is guided by urban economic theories such as the bid rent theory and hedonic price theory. For instance, the bid rent theory says that land or housing values increase with distance near the Central Business District (CBD), with emphasis more on distant or location factors and the CBD (Alonso, 1964). The hedonic pricing model is based on the premise that the price/value of a good is determined by the utility that the various attributes of the particular product bears (Rosen, 1974; Fan et al., 2006; Wilhelmsson, 2009). Housing, for instance, is a composite commodity made up of different physical characteristics as well as locational and neighbourhood attributes (Owusu – Ansah, 2012). Therefore, its value, according to the model, is determined by its structural, neighbourhood and location attributes.

In most developing countries (Nigeria inclusive), the factors responsible for the growing disaffection and public outcry against increasing urban land and housing values have been a contentious issue in the literature. The dominant position identified locational factors such as distance from the Central Business District (CBD) and distance from major roads as major determinants. The conclusion is that land or housing value increase with distance to the CBD and major roads. This perspective is limited by the fact that non-locational factors such as time of purchase, zoning policy, housing and neighbourhood qualities were also important determinants of these values. For instance in Onitsha in Nigeria, Land and housing values increased with
distance from the CBD and from major roads because of the effects of non-locational factors. Average Land value (15m x 30m plot) is ₦1.05 million (USD 5,730) at distances less than 1km from the CBD and ₦1.89 million (USD 10,315) between 4km and 5km from CBD (Ilechukwu, 2012). However, in Accra, Asabere (1981) found that land values increase at distances near the CBD. The application of the hedonic pricing model has had its fair share with studies in Nigeria. Megbolugbe (1986) examined housing trait prices using hedonic price function and found that the means of water supply to the house, nature of road system in a neighbourhood, availability of essential facilities in accommodation, building gross area, number of floors and number of rooms in a building to affect the price one pays for a house in the city of Jos in Nigeria. Also Arimah (1992a) estimated the demand for a set of housing characteristics using data from Ibadan, Nigeria. Furthermore, housing prices are found to be associated with land use regulations (approval delays) in a study of 250 major US cities (Eicher, 2008) while land values are estimated from variations in the selling prices of housing by making assumptions about the production function for housing (Davis and Heathcote, 2007).

Arising from these contentions, this paper examined the relative importance of location and non location factors in the determination of land and housing values; and the extent to which land and housing values were determined by non location factors, using Onitsha city in Nigeria as a case study. Therefore, it is hypothesized that location factors are not more important than the non location factors in the determination of land and housing values. From the findings, the paper argued the need for a paradigm shift in urban economic theories by the re-examination of the determinants of land and housing values particularly in Onitsha, Nigeria.

EMPIRICAL AND THEORETICAL ISSUES

In the area of urban land and housing values, many studies have assumed that these values are determined by their location or distances in relation to the central business district (CBD), thus making land and housing values a function of distance to the CBD. The studies are confirmed by the early works of Hurd (1903), Burgess (1924), Hoyt (1933) and later works of Alonso (1964), Yeasts (1965), Brodsky (1970), Kain and Quigley (1970), Ball (1973), Wilkinson (1974), Smith (1976), Ball and Kirwan (1977), Li and Brown (1980), Asabere (1981) and Butler (1982).

These studies emphasized the role of competitive bidding for land in determining urban land uses and the influence of accessibility on land values. In a single centre, space will be used most intensively in the core and the density of use will tend to decline with increasing distance from it. Burgess (1924), influenced by ecology, suggested that human beings compete for scarce resources such as land and raw materials, with the aim of satisfying their different economic and social needs. As in ecology, the competition for such resources is constantly changing (Balchin 2000). Alonso’s (1964) development of the bid rent function with his work in Michigan in the U.S formalizes the trade – off between accessibility and land costs. Each activity or land use has a family of bid rent curves which shows what a given activity is prepared to pay at each site. The activities with steeper bid rent curves capture the central locations because they are prepared to pay more for central sites. Households also have a bid rent function – a trade – off between housing costs and journey to work costs, which generally assume that a household has a fixed budget that it can allocate to some combination of these two items. Alonso’s bid rent concept implies that with an increase in urban population and / or increase in total urban income, the
demand for land would increase, raising bid rents throughout the urban area, which in turn would result in each land use invading the next outer zone (Balchin 2000).

Supporting the influence of accessibility or distance factor, Asabere (1981) examined the determinants of land values in an African city and concluded that a clear understanding of the determinants of land values in Accra, Ghana, must precede the formulation and implementation of all land related policies. The model or hypothesis of his study states that the value of any given lot is determined by the following variables: location in terms of distance to the CBD, distance to the sea, and the presence of major or class – A roads, governmental zoning, culturally rooted determinants like land tenure (who owns or sells land), ethnic clustering (homogeneity), and the type of interest attached to land (freehold or leasehold), time of sale, the size of the lot and whether the lot has site services or not. Asabere’s (1981) findings reveal that land values decrease away from the CBD but increase away from the sea because of erosion, corrosion, noise pollution and other reasons. Also, the distance to road variable shows that land values are higher close to class A roads, while governmental zoning regulations restrict the form of development to be undertaken by any zone by imposing constraints upon its use, height and minimum environmental standards and these have potential impacts on land values.

These studies, however, are somehow biased in according the CBD and distance from it more importance than they really deserve, while the effects of non-location variables are neglected. Some empirical works in U.K have shown that, the impact of the planning system is of course a powerful determinant of land values, which does not always take into account the natural tendencies of market forces which underpin the theoretical models. For instance, deliberate shortage in land supply or accessibility brings about increase in land values. In his report to the Scottish Government, Evans (2002) argues that planning regulations can push up the price of land if they constrain its supply, thus impacting on the elasticity of the housing supply. Also, Cheshire and Sheppard (2000) still maintain that planning system or regulations often result in price differentials in land and housing development.

Cheshire and Sheppard (2000) recognized many factors which impact on the price of an individual plot of land and house. For instance, they stated that it has long been recognized that housing is a composite good. The price that is paid for a house reflects various characteristics of the house – its floor area, the facilities it enjoys, its age and design. A house, however, is not only composed of characteristics relating to its structure but also of the characteristics determined by its location such as the quality of local public goods like schools, hospitals and amenities in the immediate neighbourhood, which the location provides access to.

However, recent studies have shown that fundamentals such as lending interest rates and psychological factors like behavioral expectations are useful in the explanations of variations in land and housing values. Mayer and Sinai (2007) in explaining variations in house prices in U S, found that interest rates are the most important determinants of variations in housing values and lending market efficiency also is capitalized into house prices, with higher prices associated with lower origination costs and greater use of subprime mortgage. Case and Shiller (2007) showed that the expectation of future price appreciation by the households is psychological. They observed that recent buyers in Los Angles expected much higher long term price appreciation than households in Milwaukee, where house prices were flat in the 1980s. In a subsequent survey, Smith and Smith (2006) concluded that run-up in
prices was not fully justified by fundamentals but that pricing inefficiencies are due to high transaction costs that limit arbitrage opportunities for rational investors.

Megbolugbe’s (1983) study of urban housing market in Jos in Nigeria, observed structural and neighbourhood attributes as major determinants of housing values. Arimah (1990) observed that Megbolugbe’s (1983) study neglected location attributes in his estimate of housing values and concluded that the implicit price of housing values are determined by the structural, neighbourhood and location attributes in his analyses of urban housing market in Ibadan, Nigeria. He found that the variables, number of rooms occupied (structural attributes), road or presence of school (neighbourhood attributes) and distance to CBD (location attributes) are the important determinants of rental values in both the indigenous and modern parts of the city.

Olaore (1991) studied ‘the values of land and rentage of shelter in Nigerian’s urban areas’, with a case study of Kaduna. He attempted to determine the factors responsible for the growing disaffection and public outcry against soaring urban land values and the rental values of housing. With regard to residential land value, the important factors were age of a neighbourhood district, infrastructural index, residential accessibility index and distance from the CBD. On the rental value of shelter, the infrastructural index, distance from the CBD, and residential accessibility were factors considered important. Furthermore, Olayiwola et al (2006) used the principal component technique to analyse spatial variation in residential land value determinants in Lagos. They identified accessibility, rent, transport improvement, quality of neighbourhood, infrastructural facilities and government regulation with particular reference to zoning as determinants of residential land value.

The empirical studies so far reviewed highlighted both location and non location factors as determinants of urban land and housing values. This clearly showed that the determinants of these values are still contentious. The early and dominant position identified location factors such as distance from the CBD and major roads as the important determinants. But this position has been contested in the sense that non location factors such as government regulation, housing and neighbourhood qualities, time expectation, interest rate, etc, were also important determinants. Therefore, the dominance of this earlier position is hereby contested.

It is widely recognized that many theories have been formulated in the study of urban systems to explain the determinants of the urban land and housing values. Examples of these theories are the bid rent theory and hedonic price theory. The bid rent theory developed by Alonso (1964) explained the competition for space among various land uses (commercial, industrial, residential) in a way that maximizes their utility. It is also used in the analysis of housing demand to explain that housing units are sold to those consumers offering the highest for them, a process which in equilibrium is tantamount to maximizing individual utilities (Wheat 1977).

Bid-rent theory is a geographic economic theory that refers to how the price and demand on real estate or land changes as the distance from the CBD increases. The bid rent theory begins with some basic assumptions: that all parcels of land are uniform apart from their relative distances from one another, transport is a direct function of the linear distances between places, that CBD is the only single center for all the employment opportunities, that people are rational in their market transactions.

Based on these assumptions, the argument proceeds as follows. For all types of land use, the most central sites will be the most attractive. As a result, competition for central sites will be intense, and the prices offered for them will be higher than those
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for less central sites. Different types of land users will place different financial evaluations on the utility of centrality, depending on their particular schedule of expected income and expenditure (i.e. budget). For example, given two distinct households – high and low income, when their bid rent curves are plotted, an important relationship is exposed. Those with higher incomes will have steeper bid rent curves and so end up nearer the city centre, while the lowest income groups will end up on the periphery. However, this argument is contested by what we have seen about the suburbanization of both the high and middle income groups due to increase in residential plot size, floor space, number and size of rooms and other space related housing attributes with distance from CBD, which is facilitated by improved transportation technology.

Another urban economic theory that explains determinants of urban land and housing values is the hedonic price theory. Due to criticisms of the bid rent theory, the non location factors were included in the formulation of the hedonic price theory. The theory sees price as a measure of values attached to land and housing in the urban housing market. The hedonic technique was first suggested by Court (1939), but was developed by Griliches (1971) initially for the purpose of estimating the value of quality change in consumer goods. The thrust of the theory is to subdivide each commodity into as many separate components as are deemed necessary, in order to reflect adequately the existing quality differentials and treat each sub – division as a separate product. Rosen (1974) used the concept to analyse the supply and demand of the characteristics which differentiate products in competitive markets. When the theory is applied to housing as a multi-dimensional good, housing is differentiated into a bundle of attributes that vary in both quantity and quality.

The classical hedonic price theory shows that there is a relationship between housing prices and the attributes. The housing attributes can be classified into three categories; structural attributes (such as number of rooms, building age, roof cover and plumbing fixtures, etc.) denoted by S , neighbourhood attributes (such as school quality, road quality and availability of electricity, water and other vital public services) denoted by N, and location attributes covering access to economic, social and political facilities(such as distance to CBD, shopping centres, parks and other recreational facilities) denoted by L. This relationship is expressed as $P = f (S, N, L)$. Where, $P$ is the hedonic or implicit price function of any of the attributes. The implicit price of a particular attribute can be found by differentiating the implicit price function with respect to that attribute, when all other attributes are held constant.

THE STUDY AREA AND RESEARCH METHODOLOGY

Onitsha in Anambra State is located in the south eastern part of Nigeria, bounded on the east, west, north and south by Enugu, Delta, Enugu and Imo States respectively (Figure 1). In the state, Onitsha is bounded in the east, north and south by Idemili, Oyi and Ogbaru Local Government Areas respectively and by the River Niger in the west (Figure 2). The town of Onitsha or Onitsha metropolis comprises mainly the Onitsha North and South Local Government Areas, with the Inland Town and Fegge as the Headquarters respectively. Onitsha metropolis covers the town itself and a long narrow area of low-lying land generally situated between the Niger River and the Owerri road extending southwards. Onitsha metropolis consists of 11 layouts, namely Fegge, Odoakpu, Okpoko, Woliwo, Otu, Inland town, Awada, Omoba, American Quarter, G.R.A. and newly established Nkisi Layouts (Figure 3).
Despite the conflicting and often contradicting estimates of the population of Onitsha, the population size has increased from 13,000 people in 1857 to 160,000 before the civil war and 256,447 people in 1991. The 2006 census figure was not published at the onset of the field work in 2008, hence the reliance on the 1978 and 1991 figures for this study.

The choice of the study area is because of its well defined land use pattern, depicting clearly areas of low, medium and high density residential developments which have implications for land and housing values. Also, as a commercial town, it has specified central area and sub areas for commercial activities as well as industrial whose pattern equally has influence on land and housing values. The existing land use pattern in Onitsha is well defined. The commercial heart (or the CBD) is located in Otu around the main market in the triangle between the Niger River, Old Market road and New Market road. This busy commercial hub (CBD) and mixed use area is surrounded by the high density residential areas of Odoakpu and Fegge and low/medium density residential area of American Quarters. The low densities residential areas of G.R.A. and Trans Nkisi are found in the north while in the east are the medium density residential areas of Omogba, Woliwo and Inland Town. Most large scale and new industrial development is concentrated around the Niger Bridge Head and the more accessible new roads (Expressway) between Niger Bridge, Iweka Roundabout and Owerri Road. Secondary commercial centers are located along Iweka Road (Ochanja market), at Iweka Roundabout (New Relief Market), and at the specialized Bridge Head Market dealing mainly in building materials and pharmaceutical drugs. Other areas in Onitsha metropolis are the medium density residential area of Awada located in Obosi to the east and the high density residential area of Okpoko in Ogbaru Local Government Area, to the south of Onitsha.

Fig 1. Nigeria Showing Anambra State
Source: Federal Survey, 2011
According to the Onitsha Master Plan (1978), the existing housing stock comprises a total of about 24,500 dwellings within the town plus a further 6,500 or so in the unauthorized development at Okpoko. However, with development of Omoagba, Awada and Trans Nkisi Layouts, the NPC (1991) estimate of the dwelling units is a further 11,500. Therefore, the present total housing stock in Onitsha Metropolis is 42,500. Table 1 show the distribution of this stock among the layouts in Onitsha metropolis. There are some characteristics of these dwelling units that have implications for land and housing values in the town. For instance, there is a high incidence of sharing between more than one family, and occupancy rates are generally high. Overcrowding and lack of proper services and amenities represent the most
acute problems with the general physical condition of the buildings giving a little cause for concern.

Table 1. Residential housing stock per layout

<table>
<thead>
<tr>
<th>S/N</th>
<th>Layouts</th>
<th>Housing units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fegge</td>
<td>10,750</td>
</tr>
<tr>
<td>2</td>
<td>Woliwo</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td>Odoakpu</td>
<td>8,000</td>
</tr>
<tr>
<td>4</td>
<td>Inland Town</td>
<td>5,400</td>
</tr>
<tr>
<td>5</td>
<td>Otu</td>
<td>2,550</td>
</tr>
<tr>
<td>6</td>
<td>Omogba</td>
<td>2,500</td>
</tr>
<tr>
<td>7</td>
<td>American Quarters</td>
<td>2,050</td>
</tr>
<tr>
<td>8</td>
<td>G.R.A</td>
<td>1,500</td>
</tr>
<tr>
<td>9</td>
<td>Trans Nkisi</td>
<td>1,000</td>
</tr>
<tr>
<td>10</td>
<td>Awada</td>
<td>1,500</td>
</tr>
<tr>
<td>11</td>
<td>Okpoko</td>
<td>5,250</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>42,500</strong></td>
</tr>
</tbody>
</table>


The study adopted a survey design drawing on urban microeconomic perspectives such as bid rent and hedonic price theories. This is because most past studies adopting bid rent model emphasized locational factors as the most important determinants than the non locational factors. In contesting this, the paper examined hedonic price models using hedonic regression analysis to show that non location factors are also important determinants. This issue has also been contested using other models. According to Kok et al. (2011), analyses of the determinants of land prices in urban areas typically base inferences on housing transactions which combine payments for land and long lived improvements. They adopted Davis and Palumbo (2008) aggregate index of land prices and found that the variations in transaction based land prices is a function of the physical capital embedded in the house and the land it occupies. Furthermore, supply and demand relationships are approximated by a model that provides the foundation to the determinants of land and housing values. This methodological foundation as presented by Malpezzi (1996), O’Sullivan (2003) and Green et al. (2005) shows that land and housing values are also determined by demand and supply functions. The demand function includes the price of the home, income and demographic factors while supply function contains the price of the home, land use regulation and prices of all inputs. In equilibrium, therefore, the housing prices or values are a function of land use regulations, income and demographic variables.

Using multi stage sampling technique, the 11 layouts of the study area were first identified and classified into high, medium and low density residential zones. Major wards in each of these layouts were selected in the second stage by simple random sampling while in the third stage streets were selected in the chosen wards based on their grades. Every third housing unit was then systematically selected in each of the streets for questionnaire administration. A structured questionnaire was administered on landlords (or balloted in case of multiple landlords) of 850 residential housing units. Table 2 shows the sampling procedure and sample size distribution.

Data collected include the socio-economic characteristics of the land and house owners, land, housing and neighbourhood data. Land and housing data pertained to how land was acquired, land size and cost, time of land purchase, housing type, size and number of rooms, date of development, housing construction materials, housing
facilities such as water supply, solid waste disposal system, types of bathrooms, toilets, kitchens. Information was also sought on the condition of the houses such as the state of walls, floors and roofs, in order to determine their quality. Data were collected on housing cost and rent for bungalow, block of flats and duplexes. Neighbourhood data include age, condition of road, community facilities (for example number of primary schools, number of health facilities, number of security organizations) as well as types of pollution and crime, and reasons for locating in the neighbourhood, and the distances of houses from the CBD and major roads. These distances were determined using the street or layout map of Onitsha, obtained from the local planning authority. With this, direct measurement of linear distances of houses in each selected street and ward, to the CBD and the identified major roads, were obtained.

The data collected for this study were analyzed using descriptive technique (frequency, mean, standard deviation) and inferential using regression analysis.

Table 2. Sampling procedure and sample size distribution

<table>
<thead>
<tr>
<th>Density class</th>
<th>Layouts</th>
<th>Selected Wards</th>
<th>Selected Streets</th>
<th>Total Questionnaire</th>
<th>Retrieved Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>High density</td>
<td>Fegge</td>
<td>4</td>
<td>21</td>
<td>215</td>
<td>208</td>
</tr>
<tr>
<td></td>
<td>Odoakpu</td>
<td>3</td>
<td></td>
<td>15</td>
<td>160</td>
</tr>
<tr>
<td>154</td>
<td>Woliwo</td>
<td>1</td>
<td>3</td>
<td>40</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Okpoko</td>
<td>1</td>
<td>3</td>
<td>105</td>
<td>32</td>
</tr>
<tr>
<td>Medium Density</td>
<td>Omogba</td>
<td>1</td>
<td></td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>Awada</td>
<td>1</td>
<td>2</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Inland Town</td>
<td>3</td>
<td>12</td>
<td>108</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Otu</td>
<td>1</td>
<td>4</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>Low density</td>
<td>American Quarters</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td>35</td>
<td>G.R.A</td>
<td>1</td>
<td>3</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Trans Nkisi</td>
<td>1</td>
<td></td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>TOTAL</td>
<td>18</td>
<td>72</td>
<td>850</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s Field Work, 2008

DATA ANALYSIS AND FINDINGS

Summary descriptive analysis of the socio-economic characteristics, land, housing and neighbourhood data collected are presented in Table 3 and later subjected to regression analysis. This is to examine the relative importance of location and non location factors in the determination of land and housing values as well as the extent to which land and housing values were determined by the non location factors.

The variables consist of quantitative and qualitative or dummy data. The quantitative data are land and housing values. The land and housing values were the original costs as at the date of purchase and development respectively, and were obtained by asking the landlords or their representatives. Others are distances from the CBD and major roads, plot size, room size, number of rooms, time of land purchase, date of development, age of layout, income per month, number of primary schools, number of health facilities and number of security organizations. The qualitative or dummy
variables include place of origin, density type, house type, kitchen type, bathroom type, toilet type, housing wall and roof conditions and road condition.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land value, LV</td>
<td>Cost per plot of land (in million naira)</td>
<td>1.42</td>
<td>0.902</td>
</tr>
<tr>
<td>Housing value, HV</td>
<td>Cost per building type (in million naira)</td>
<td>9.24</td>
<td>5.532</td>
</tr>
<tr>
<td>Distance from CBD, dCBD</td>
<td>(Distances of houses from CBD, in Kilometre)</td>
<td>2.4</td>
<td>1.622</td>
</tr>
<tr>
<td>Distance from Major Roads, dMR</td>
<td>(Distances of houses from major roads, metre)</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>Plot size, PLS</td>
<td>Area of a plot of land (m$^2$)</td>
<td>594.84</td>
<td>496.191</td>
</tr>
<tr>
<td>Room size, RMS</td>
<td>Area of a room in building (m$^2$)</td>
<td>13.32</td>
<td>6.962</td>
</tr>
<tr>
<td>Number of rooms, NRM</td>
<td>Number of rooms in building</td>
<td>7.56</td>
<td>3.980</td>
</tr>
<tr>
<td>Time of land purchase, TLP</td>
<td>Period of time of land purchase(years)</td>
<td>25.71</td>
<td>15.922</td>
</tr>
<tr>
<td>Date of development, DOD</td>
<td>Period of housing development (years)</td>
<td>25.38</td>
<td>15.523</td>
</tr>
<tr>
<td>Age of Layout, AOL</td>
<td>Age of layout (years)</td>
<td>75.73</td>
<td>46.685</td>
</tr>
<tr>
<td>Income per month, INC</td>
<td>Amount of money earned per month</td>
<td>71134.56</td>
<td>59966.653</td>
</tr>
<tr>
<td>Place of Origin, POO</td>
<td>= 1 if respondent is none native*</td>
<td>0.79</td>
<td>0.406</td>
</tr>
<tr>
<td>Density of zone type</td>
<td>= 1 if location in low density zone, LDZ*</td>
<td>0.12</td>
<td>0.322</td>
</tr>
<tr>
<td></td>
<td>= 1 if location in medium density zone, MDZ*</td>
<td>0.37</td>
<td>0.484</td>
</tr>
<tr>
<td></td>
<td>= 1 if location in high density zone, HDZ*</td>
<td>0.51</td>
<td>0.500</td>
</tr>
<tr>
<td>House type, HOT</td>
<td>= 1 if Blocks of flats*</td>
<td>0.44</td>
<td>0.496</td>
</tr>
<tr>
<td>Kitchen type, KIT</td>
<td>= 1 if kitchen is separate*</td>
<td>0.59</td>
<td>0.492</td>
</tr>
<tr>
<td>Bathroom type, BAT</td>
<td>= 1 if bathroom is tub with shower*</td>
<td>0.47</td>
<td>0.499</td>
</tr>
<tr>
<td>Toilet type, TOT</td>
<td>= 1 if toilet is water closet*</td>
<td>0.99</td>
<td>0.081</td>
</tr>
<tr>
<td>Housing wall condition, HWC</td>
<td>= 1 if wall is not cracked*</td>
<td>0.94</td>
<td>0.239</td>
</tr>
<tr>
<td>Housing roof condition, HRC</td>
<td>= 1 if roof is not leaking*</td>
<td>0.97</td>
<td>0.172</td>
</tr>
<tr>
<td>Road condition, ROC</td>
<td>= 1 if road is tarred*</td>
<td>0.67</td>
<td>0.469</td>
</tr>
<tr>
<td>Number of primary school, NPS</td>
<td>Number of primary schools</td>
<td>2.55</td>
<td>1.580</td>
</tr>
<tr>
<td>Number of health facilities, NHF</td>
<td>Number of health facilities</td>
<td>1.39</td>
<td>0.630</td>
</tr>
<tr>
<td>Number of security groups, NSG</td>
<td>Number of security groups</td>
<td>2.21</td>
<td>1.430</td>
</tr>
</tbody>
</table>

*0 otherwise

The survey shows that the average value of land per plot is 1.42 million naira (USD 7,750) and the housing value is 9.24 million naira (USD 57,750). The average distance of houses from the CBD and major roads are 2.4 km and 102 m respectively. The average area of a plot of land and a room is respectively 594.84 m$^2$ and 13.32m$^2$ while there are average of eight (8) rooms in a building. The time of land purchase and date of development is approximately the same on the average (25 years) which implies that land is developed as soon as purchased. The average age of the layouts is 75 years, which means that none of these lands were purchased or houses developed in the layouts that are not more than 25 years. The income per month of the land and home owners is above 70,000 naira (USD 450) with 79% of them being non natives. There are average of 2 primary schools, 1 health facility and 2 security groups in each layout.

The density distribution shows that 51% of the lands and houses are in high density zone, 37% in medium density and 12% in low density. The dominant buildings are the blocks of flats (44%), out of which 59% of them have separate or private kitchens, 47% have tub with shower bathroom and nearly all have water closet type of toilet.
Less than 4% of the houses have crack walls and leaking roofs. About 67% of roads in each of the layout are paved or tarred.

Using regression analysis, the distance (location factors) and the non-distance (non-location factors) variables are examined in relation to land and housing values to confirm the most important determinants of variations in these values. The results of this analysis for land and housing values are presented in Tables 4 and 5.

The results of the regression analysis presented in Table 4 show that the F-value of 109.893 for land values is highly significant at 0.05 level and the $R^2$ statistics of 0.612 means that the eleven variables collectively account for 61.2% of variations in land values and that the $R^2$ values obtained are not chance occurrences. The $R^2$ change shows that the most important variable is time of land purchase (TLP), which accounts for 47.8% of the spatial variations in the land values. The TLP coefficient indicates that land value has a negative relationship with the period when land is purchased. The time value of money shows that land purchased more than 25 years ago is valued lower than the one bought less than 15 years ago. This is followed by age of layout (AOL), road condition (ROC) and number of security groups (NSG) which respectively contribute 6.3%, 2.5% and 1.5% to the explanation of the variations in land values. The AOL variable accounts for 6.3% of the variations in land values and its coefficient shows that a unit increase in the age of layout would result in a 0.213 decrease in the land values. This means that land values are high in younger or new layouts.

<table>
<thead>
<tr>
<th>Step</th>
<th>Variables</th>
<th>Multiple R</th>
<th>$R^2$</th>
<th>$R^2$ change</th>
<th>Regression coefficient</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>TLP</td>
<td>0.692</td>
<td>0.478</td>
<td>0.478</td>
<td>-0.360</td>
<td>-5.642</td>
</tr>
<tr>
<td>2</td>
<td>AOL</td>
<td>0.736</td>
<td>0.541</td>
<td>0.063</td>
<td>-0.213</td>
<td>-6.215</td>
</tr>
<tr>
<td>3</td>
<td>ROC</td>
<td>0.754</td>
<td>0.566</td>
<td>0.025</td>
<td>0.163</td>
<td>5.342</td>
</tr>
<tr>
<td>4</td>
<td>NSG</td>
<td>0.767</td>
<td>0.581</td>
<td>0.015</td>
<td>0.234</td>
<td>6.023</td>
</tr>
<tr>
<td>5</td>
<td>HOT</td>
<td>0.770</td>
<td>0.590</td>
<td>0.009</td>
<td>0.092</td>
<td>3.801</td>
</tr>
<tr>
<td>6</td>
<td>INC</td>
<td>0.774</td>
<td>0.596</td>
<td>0.006</td>
<td>0.086</td>
<td>2.936</td>
</tr>
<tr>
<td>7</td>
<td>KIT</td>
<td>0.778</td>
<td>0.602</td>
<td>0.006</td>
<td>0.171</td>
<td>3.678</td>
</tr>
<tr>
<td>8</td>
<td>dCBD</td>
<td>0.782</td>
<td>0.607</td>
<td>0.005</td>
<td>0.073</td>
<td>3.176</td>
</tr>
<tr>
<td>9</td>
<td>BAT</td>
<td>0.783</td>
<td>0.609</td>
<td>0.002</td>
<td>0.086</td>
<td>3.129</td>
</tr>
<tr>
<td>10</td>
<td>LDZ</td>
<td>0.785</td>
<td>0.612</td>
<td>0.003</td>
<td>0.084</td>
<td>2.451</td>
</tr>
<tr>
<td>11</td>
<td>DOD</td>
<td>0.787</td>
<td>0.614</td>
<td>0.002</td>
<td>-0.145</td>
<td>-2.250</td>
</tr>
</tbody>
</table>

$R^2 = 0.612$, $F$-value $= 109.893$ probability of $F <, = 0.05$

Furthermore, the ROC variable accounts for 2.5% of variation in land values and the coefficient means that a unit increase in number of paved roads would lead to a 0.163 increase in land values. This means that land values are high for lands along the tarred roads. In addition, land values are affected by the level of security as it accounts for 1.5% of the variations. The NSG coefficient means that an increase in the number of
security groups would result in a 0.234 increase in land values. In other words land values increase with number of security groups in the layouts.

The other seven variables are not too significant and important because they contribute less than 1% of the variations in land values. The HOT variable has no meaningful explanation despite the positive relationship with land values. The INC coefficient shows that increase in the amount of money earned per month would result in a 0.086 increase in land values. This implies that only the high income earners can afford to pay for higher land values. The KIT and BAT variables have no meaningful explanation to the variation in land values despite their positive association. Distance from the CBD (dCBD) was the only location factor entered, which accounts for only 0.5% of variation in land values. The dCBD coefficient means that a unit increase in the distance of houses from the CBD would result in a 0.073 increase in land values. This means that land values increase with distance from the CBD contrary to the past studies. Furthermore, other variables including distance from roads (dMR) were excluded in the stepwise regression analysis because they were highly insignificant and not relevant. It is the condition of roads that are relevant and not distance. For example, distance from roads factor exclusion could be due to its unattractiveness to residential areas because of noise/fumes from traffic or due to improved technology (ICT) that enables every location to be accessible.

\[
\begin{array}{cccccc}
\text{Step} & \text{Variables} & \text{Multiple R} & R^2 & R^2 \text{ change} & \text{Regression t – value} \\
1 & \text{NRM} & 0.571 & 0.325 & 0.325 & 0.343 & 10.106 \\
2 & \text{AOL} & 0.658 & 0.431 & 0.106 & -0.136 & -4.117 \\
3 & \text{INC} & 0.684 & 0.465 & 0.034 & 0.176 & 5.551 \\
4 & \text{MDZ} & 0.710 & 0.502 & 0.037 & 0.228 & 6.838 \\
5 & \text{NPS} & 0.722 & 0.518 & 0.016 & 0.132 & 3.704 \\
6 & \text{BAT} & 0.731 & 0.530 & 0.012 & 0.131 & 3.804 \\
7 & \text{ROC} & 0.737 & 0.540 & 0.007 & 0.070 & 2.430 \\
8 & \text{dCBD} & 0.740 & 0.543 & 0.003 & 0.061 & 2.465 \\
9 & \text{NSG} & 0.743 & 0.546 & 0.003 & 0.113 & 3.014 \\
10 & \text{LDZ} & 0.740 & 0.550 & 0.004 & 0.130 & 3.058 \\
11 & \text{TLP} & 0.748 & 0.552 & 0.002 & -0.074 & -2.288 \\
\end{array}
\]

\[ R^2 = 0.551, \ F – value = 85.617 \quad \text{probability of } F < , = 0.05 \]

From this analysis, the only significant variables entered were the non location factors, with the TLP contributing more to the variations in land values. Therefore, the conclusion is that non location factors, especially time of land purchase and
neighbourhood qualities were more important determinants of land values than the location factors.

For the housing values, the results of the regression analysis are presented in Table 5. The overall performance of the analysis is significant as indicated by $R^2$ value of 0.551 and $F$ – value of 85.617, which means that 55.1% of variations in housing values are accounted for by the eleven variables entered and the $R^2$ values could not have occurred by chance. Out of the eleven variables, the most important variable as shown by $R^2$ change is the number of rooms (NRM). This variable accounts for 32.5% of the variations in housing values. The NRM coefficient shows that a unit increase in number of rooms in a house would result in a 0.343 increase in housing values. This is expected because houses, especially blocks of flats, with more rooms are costlier.

The second most important variable is age of layout (AOL), which accounts for 10.6% of the variations in housing values. The AOL coefficient shows that a unit increase in the age of a layout would result in a 0.136 decrease in housing values. This implies that housing values are high if the layouts are new.

The next most important variable after the second step is income per month (INC) and this account for 3.4% of the variations. The INC coefficient indicates that a unit increase in the amount of money earned per month would bring about a 0.176 increase in housing values. This means that high cost buildings are only provided or afforded by the higher income earners.

Location in medium density zone (MDZ) is the fourth most important variable and it accounts for 3.7% of the variations in housing values. The sign coefficient of MDZ shows that housing value has positive a association with density type. This means that housing values are high if the houses are located in medium density zone. Number of primary schools (NPS) and bathroom type (BAT) respectively account for 1.6% and 1.2% of variations in housing values. The NPS coefficient shows that housing value has a positive association with number of primary schools, which implies that housing values are high in neighbourhoods with more primary schools. Also, the coefficient of BAT indicates that housing value has a positive relationship with type of bathroom in a house. This means that housing values are high in houses with tub and shower bathroom facilities.

From the seventh to eleventh step, the variables account for less than 1% of variations and are considered not too important in the explanation of the variations in housing values. Among these variables is the distance from CBD (dCBD), which is a location factor and accounts for only 0.3% of variation. Again, the dCBD coefficient means that a unit increase in the distance of houses from the CBD would result in a 0.061 increase in housing values. This further confirmed that housing values increase with distance from the CBD contrary to the past studies. The ROC, NSG and TLP coefficients show that housing value has a positive relationship with condition of roads, number of security groups but negative association with time of land purchase. Housing values are high for houses located along tarred roads and in neighbourhoods with more security groups.

The regression results reveal that the determinants of the variations in housing values are number of rooms (housing attribute), age of layout (time attribute), income per month (socio – economic attribute) location in medium density zone (policy attribute), number of primary schools (neighbourhood attribute), bathroom type (housing attribute) and road condition (neighbourhood attribute). All these are non location factors. Therefore, non location factors, especially number of rooms (NRM) in
buildings are more important determinants of the variation in housing values than the location factors.

**CONCLUSION AND RECOMMENDATION**

This paper has analyzised the location and non location factors influencing land and housing values in Onitsha city. This has been done with respect to the different residential neighbourhoods during which reasons for the observed views were established. The use of the regression analysis made it possible to establish the relative importance of the location and non location factors in the explanation of the spatial variations in land and housing values as well as the extent to which land and housing values were determined by non location factors. Non-location factors including time of land purchase, housing quality and neighbourhood infrastructures significantly determined variations in land and housing values with distance from the CBD in Onitsha. The implication is that non-location factors should be recognized as important determinants of urban land and housing values in Nigeria. Moreover, the land and housing values were observed to increase with distance from the CBD contrary to the past studies.

Therefore, the assumptions of the urban economic theories, especially the bid rent theory need to be re-examined. The bid rent theory is based on the works of Alonso (1964) which explains that land values are determined by the distance from the CBD. That is, land values would decrease with distance from the CBD. However, the findings revealed that the distance variable is not the most important determinant of land values in the study area. Specifically, time of land purchase is considered as the most important determinant of the variations in land values and as such time variable should have been considered in the assumptions of the theory. In addition, the assumptions that all employment opportunities are provided only at one centre, all land surrounding the centre is identical and all households have identical utility functions and income levels are not realistic in contemporary development. For instance, the assumption concerning the location of all employment opportunities at the centre (in this case, Onitsha Main Market), probably cannot be true in the study area. This is because of the other competing market centers such as Ochanja market, New Relief market, Head Bridge market and other commercial centers in the area. Thus, there are other choices where to trade and not necessarily the Main Market. This also affects the choice of where to live or buy land and house. In other words, the values of land and housing are influenced by these other commercial centers. This is why the study predicted a positive, instead of, negative relationship between land and housing values and the distance from the CBD. That is, land and housing values increase with distance from the CBD.

Moreover, land is not identical in both physical and economic senses as claimed by the bid rent theory. This is because, in the study area, zoning policy makes the networks of streets and roads in some areas better while the structural or neighbourhood characteristics make some areas more or less protected. For these reasons, land values would vary, not because of distance from the CBD alone.

The hedonic price theory has been used by some scholars (Rosen, 1974; Megbolugbe, 1983; Arimah, 1990; Cheshire et al, 1998), to explain variations in housing values based on the structural, neighbourhood and location attributes of the housing stock. But, the findings of this study indicate that structural and neighbourhood attributes are the most important determinants. That is, factors such as the number of rooms, housing facilities, roads condition and type of density zone are considered most
significantly. This is because the values of land and house paid are mainly functions of the non-location variables, especially structural attributes and not the distance variable alone. In this case, increase in housing values could be attributed to improvement in housing facilities such as spacious rooms, separate kitchen, better bathrooms and toilets as well as decent and aesthetic house type, irrespective of its distance from the CBD.

It is then recommended that the bid rent theory should incorporate not only location factors but more importantly non-location factors. Also, the application of the hedonic price theory should focus more on the stock or structural attributes of the area than location attributes. These modifications in the urban economic theories would provide a clearer understanding of the variations in the land and housing values of residential housing. Therefore, the urban economic theories such as the bid rent theory, need to be revised to represent conditions in developing countries, especially in Nigeria and Onitsha in particular. However, for a more general revision of the theories, there is need for further research on the non-locational factors.

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A PRELIMINARY INQUIRY INTO THE APPLICABILITY OF CLIENT-CONTRACTOR PARTNERING IN THE GHANAIAN CONSTRUCTION INDUSTRY

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Construction projects in Ghana are predominantly procured through the traditional route which has been reported to be characterised by adversarial client-contractor relationships. In an effort to engender more collaboration in client-contractor relationships, studies have often advocated for projects to be procured through partnering arrangements. Clearly, central to the use of client-contractor partnering in a context such as Ghanaian construction industry where there is no report of client-contractor partnering is its perceived applicability. A pilot questionnaire survey of clients and contractors and subsequent analyses rather suggest that client-contractor relationships are not just adversarial but are even more paternalistic in nature. The analyses further suggest that partnering is applicable in the Ghanaian construction industry despite the predominant adversarial and paternalistic client-contractor relationships. Although these findings are not conclusive given the limited scope of the survey, they provide a preliminary positive indication of the use of partnering in Ghana.

Keywords: Ghana, partnering, procurement.

INTRODUCTION

With the exception of cultural differences, local climatic conditions, economic climate, purpose to construct, stakeholders and local techniques, the construction industry globally has a lot of things in common including the numerous problems that confront the industry. As a result of information technology the world undoubtedly has become a global village, which goes on to establish the fact that we are confronted with a common problem. Therefore a theory or practice which is tried and tested in one country can serve as a useful reference for another country through the transfer of knowledge with the necessary adjustments.

The majority of construction activities in Ghana are organised around traditional procurement method (Anvuur et al, 2006). This method has entrenched a certain culture where client-contractor relationships are often adversarial. These common problems found in the construction industry can also be attributed to the direct
consequences of the fragmented nature and lack of integration within the industry (Dansoh, 2005). Partnering which has a lot of workable strategies can be adopted to address some of these problems in the construction industry as has been applied in the United States and United Kingdom (Latham, 1994; Egan, 1998).

Since 1994, there has been an increase in awareness of the application of partnering in the construction industry particularly in the UK following major successes in countries such as Japan and USA (Construction Industry Board, 1997). According to the Egan report (1998, pp.12), ‘partnering involves two or more organisations working together to improve performance through agreeing mutual objectives, whilst devising ways of resolving any disputes, and committing themselves to continuous improvement, measuring progress and sharing gains’. Although other forms of long standing relationships such as design and build, negotiated contracts, alliance and ideal supplier arrangements exists, none of these relationships has the pedigree of a partnering relationship. Through the use of partnering under the right circumstances, firms will be able to work in a more committed collaborative manner in the general interest of the respective parties to enhance outcomes and alienate antagonistic attitudes within the team. With this manner of relationship it is anticipated that the gains and pains of any particular project will be willingly embraced by both parties without remorse. Whilst partnering has been implemented to some degree of success in other countries, little is known as to its applicability in the Ghanaian context. This study therefore seeks to assess the applicability of Client-Contractor partnering in the Ghanaian construction industry as an alternative approach in search of solutions to some of the problems encountered within the industry, such as identified above. The study commences by reviewing literature on partnering (its background, benefits and problems). An overview of the state of client-contractor relationship in the Ghanaian construction industry is subsequently presented to set the stage for the empirical aspect of the study. The research method applied in the study, the findings and the concluding remarks are subsequently presented.

BACKGROUND OF PARTNERING

Originally partnering was developed in North American manufacturing companies in the 1980’s and 1990’s (Bennet and Peace, 2006). After an extensive research into the Japanese construction practice, the concept was adopted in the USA and then UK construction industries respectively (Bennet and Peace, 2006). Partnering in construction in the United States was adopted by the US Army Corps of Engineers through the efforts of Charles Cowan in the 1980’s (McGeorge and Palmer, 1997). Prior to the introduction of the concept, it was observed that the traditional methods of competitive tendering, one-sided contracts, and ineffective administration frequently lead to late completions, project cost overruns and litigation. The Corps initiated the concept intended to be a post-procurement selection process designed to minimise risk and maximise profit (Mason, 2007). The two parties openly discuss their expectations, goals, potential challenges and then conclude with a project charter based on the agreed principles and goals. The achievements of partnering steadily gained the support of both government and private organisations such as the Construction Industry Institute in Texas, the Associated General Contractors of America and the US Army Corps of Engineers (Koraltan and Dikbas, 2002).

In 1994, Sir Michael Latham was commissioned by the UK government to conduct an independent assessment of the under-performing construction industry (Latham, 1994). The central message of his report “Constructing the Team” was that, teamwork and cooperation were principal to achieving client satisfaction, hence clients should be
at the core of the construction process (Latham, 1994). In his report project partnering was recommended as one specific method of improving client satisfaction. He also suggested that implementation of partnering could be achieved through the application of the New Engineering Contract (NEC) from the Institute of Civil Engineers (ICE), since it is the most suitable form of contract for project partnering (Latham, 1994; ICE, 2001; Kaluarachchi and Jones, 2007). A year after Latham’s report, the Centre for Strategic Studies in Construction in Conjunction with the Reading Construction Forum also published “Trusting the Team: the Best Practice Guide to Partnering in Construction” by Bennet and Jayes (1995). Trusting the Team was primarily based on an in-depth study into Japanese construction, case studies of partnering in US, and its significant role in the establishment of partnering in the UK.

In addition to the UK, other countries where partnering has been implemented include Australia, Hong Kong, Holland and a number of the Nordic Countries (Stephenson, 2000; Baird and Bennet, 2001; Bayliss, 2002; Kaluarachchi and Jones, 2007).

**PARTNERING: BENEFITS AND PROBLEMS**

Partnering in construction is perceived to be a very formidable approach to improving construction project performance through the direct benefit it can bring to both clients and contractors (Barlow et al, 1997; Bresnen and Marshall, 2000; Eriksson and Pesamaa, 2007; Yeung et al, 2008).

The benefits associated with the use of partnering are non-speculative. Among some of the reported benefits of partnering is reduction of cost of construction to as much as 35% against benchmarked cost upon completion of a project (Barlow et al, 1997; Egan, 1998; Wood, 2005; Auchterlounie, 2006). Also improved briefing characteristic of partnering can directly reduce the number of variations on projects which is able to catapult into cost reduction. Through the use of construction management principles such as KPIs, benchmarking, lean construction and continuous improvement as enforced by partnering, practitioners have assessed that they are able to get things right at the first time and this has greatly reduced construction time as recorded in Barlow et al. (1997) and the Construction Industry Board (1997). Also through partnering, client requirements are much understood through an improved briefing attained at the initial workshop and the subsequent ones during construction (Barlow et al, 1997; Bennet and Peace, 2006). The environment created by partnering is reportedly less stressful and less antagonistic, and particularly where successful workshops have generally instilled a can-do attitude into participants, a team spirit very critical to the success of the partnering phenomenon is achieved (Construction Industry Board, 1997).

The guaranteed work status enjoyed by the contractor, according to Barlow et al (1997) and Wood (2005), is considered to be the most important benefit gained by the contractor in a partnering arrangement. However, other benefits to the contractor include stabilised turnover and profit, organisational learning, better working environment and reduced disputes.

In spite of its benefits, there are a number of barriers to partnering. Among the commonly reported barriers are mistrust, lack of honesty and openness, lowest pre-contract price mentality, and dictation by powerful partners (Wood, 2005; Mason, 2007). Other barriers/obstacles include inflated expectations of what is possible regarding the use of partnering, rigid/preconceived attitudes about specific partners or sectors and also the negative attitude of scepticism (Tennyson, 2003).
CONSTRUCTION INDUSTRY IN GHANA

Ghana has very limited resources, unstable business environment, rapidly changing markets hence changes in sources of funding, business cycles, constant multiplicity of government regulations and competition (Dansoh, 2005). Nevertheless, a persisting spectre of adversarial contracting, sub-optimal outcomes and the decline in the quality of construction workforce, health and safety performances have threatened to wreck efforts intended at delivering value for money in the construction industry (Anvuur et al, 2006). The level of performance of construction in Ghana is generally poor especially in the public sector. A number of reports have decried the public sector of lacking the necessary commercial edge in the exercise of its procurement functions (Anvuur et al, 2006). For the private sector little has been written about it, although they also contribute to the overall performance of the industry. In the construction industry, the extent of performance is largely dependent on the client-contractor relationships, which is often adversarial. In order to improve performance, a more collaborative relationship will be essential and hence the need to look into ways of achieving that. As partnering generally fosters collaborative relationship it is important to consider adapting this practice to the Ghanaian context. However, this must be preceded by empirical studies to ascertain the level of awareness of partnering and also to ascertain the extent to which it is applicable to the Ghanaian construction industry. The following sections address these.

RESEARCH METHODOLOGY

As the aim of the research suggests measurement (i.e. assessment of extent of awareness and applicability), a quantitative research strategy was adopted. As noted by Fellows and Lui (2008) quantitative research is appropriate for measurement and hence suitable for addressing research questions/aims relating to how much or how many.

Also a number of researchers such as Kaluarachchi and Jones (2007), Ericksson and Pesamaa (2007), Mason (2007), and Yeung et al (2008) have all carried out research on partnering using quantitative research, and thus buttressing the suitability of quantitative research strategy for this research. In particular, a questionnaire survey was used. As a precursor to a wider study, a pilot was undertaken in which a total of 30 questionnaires were sent out to contractors and clients. The questionnaire posed questions relating to the nature of client-contractor relationships, the awareness of partnering, and the applicability of partnering in the Ghanaian construction industry.

Out of the 30 administered questionnaires, 20 responses were received. Out of the 20 respondents, 7 were from public clients, 5 were from private client organisations, and 8 were from contractors. The data was analysed using descriptive statistics to gauge the extent of the nature of client-contractor relationship and more so the level of awareness of partnering and its perceived applicability.

FINDINGS AND DISCUSSION

Nature of client-contractor relationship in Ghana

According to Table 1, 6 out of 7 public clients indicated that, their relationships are paternalistic and only 1 describes it as an adversarial relationship. 2 private clients indicated that their relationship with contractors is mostly adversarial, whilst 3 stated cordial relationship. Also, 50% of the contractors indicated that paternalistic
relationship best describe their relationship with clients, whilst the remaining 50% consider it to be adversarial.

Overall, a majority of the respondents (i.e. 50%) described client-contractor relationship as being mostly paternalistic, although the study by Anvuur et al (2006) indicates that client-contractor relationship is mainly adversarial in the Ghanaian construction industry.

Table 1: Relationship that exist between clients and contractors

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Response Count</th>
<th>Response Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Clients</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paternalistic</td>
<td>6</td>
<td>86%</td>
</tr>
<tr>
<td>Adversarial</td>
<td>1</td>
<td>14%</td>
</tr>
<tr>
<td>Cordial</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Private Clients</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paternalistic</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Adversarial</td>
<td>2</td>
<td>40%</td>
</tr>
<tr>
<td>Cordial</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td><strong>Contractors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paternalistic</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td>Adversarial</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td>Cordial</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Awareness of partnering**

Regarding the awareness of partnering (as shown in Table 2), apart from the contractors, all the public and private clients indicated the awareness of partnering. 75% of the contractors (i.e. 6 out of 8) also indicated the awareness of partnering. Overall, 90% of the respondents showed the awareness of partnering. This means that although there is no report of partnering being applied as a procurement route in Ghana, the concept of partnering is not new at least to some Ghanaian construction clients and contractor organisations. This is further reinforced by the findings regarding the respondents’ perceived benefits of partnering which are shown in the next section.

Table 2: Awareness of partnering

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Yes (% of respondents)</th>
<th>No (% of respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Clients</td>
<td>7 (35%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Private Clients</td>
<td>5 (25%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Contractors</td>
<td>6 (30%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18 (90%)</td>
<td>2 (10%)</td>
</tr>
</tbody>
</table>

**Benefits of partnering**

To further explore the awareness of partnering, the respondents who indicated awareness of partnering were asked to indicate what they consider to be the benefits of partnering. The results are shown in Table 3.
Whereas a majority (i.e. 88%) of the public clients consider better working relationships to be a benefit of partnering, a majority (i.e. 66%) of the private clients rather consider reduced disputes and construction time to be a benefit of partnering. For the contractors, a majority (i.e. 66%) consider guaranteed work to be a benefit of partnering. This suggests that the various parties place different emphasis on what they perceive to be benefits of partnering. This is further accentuated by the fact that none of the private clients consider guaranteed work to be a benefit of partnering which sharply contrasts with the results from the contractors majority of whom consider guaranteed work to be a benefit of partnering. This is consistent with findings from other studies (see Barlow et al, 1997; Wood and Ellis, 2005) in which contractors indicated future work opportunities as their main reason for engaging in partnering arrangements. Overall, better working relationships and reduced disputes is considered by most of the respondents (i.e. 88%) as a benefit of partnering. Again, this finding further highlights the desire for improved working relationships in the global construction sector that is dominated by a culture of finger-pointing, mistrust (Ankrah et al, 2009) and disputes (Akintola et al., 2011). These findings suggest that strategic partnering on a series of projects as opposed to one-off partnering (Bresnen, 2007) is likely to be the most attractive partnering approach for public clients and contractors in Ghana. Given the contractors’ expectation of partnering (i.e. guaranteed work), public sector clients are better positioned to drive partnering implementation in the Ghanaian context due to their potential to provide constant workflow as against private clients who often engage in one-off type projects.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>% of PC indicating as a benefit</th>
<th>% of PvC indicating as a benefit</th>
<th>% of C indicating as a benefit</th>
<th>% of respondents indicating as a benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better working relationships</td>
<td>88%</td>
<td>50%</td>
<td>50%</td>
<td>83%</td>
</tr>
<tr>
<td>Reduced disputes</td>
<td>75%</td>
<td>63%</td>
<td>50%</td>
<td>83%</td>
</tr>
<tr>
<td>Reduced cost of construction</td>
<td>50%</td>
<td>38%</td>
<td>38%</td>
<td>56%</td>
</tr>
<tr>
<td>Organisational learning</td>
<td>25%</td>
<td>38%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Technical and process innovation</td>
<td>63%</td>
<td>25%</td>
<td>38%</td>
<td>56%</td>
</tr>
<tr>
<td>Guaranteed work</td>
<td>63%</td>
<td>0%</td>
<td>63%</td>
<td>56%</td>
</tr>
<tr>
<td>Reduced construction time</td>
<td>63%</td>
<td>63%</td>
<td>13%</td>
<td>61%</td>
</tr>
</tbody>
</table>

Note: PC = Public client, PvC = Private Client, C = Contractor
Applicability of partnering to the Ghanaian construction industry

As shown in Table 4, a majority of the respondents (i.e. 70%) are of the view that partnering would work in the Ghanaian construction industry. However, this is intriguing as the previous results indicate that paternalistic and adversarial relationships which are hindrances to partnering are the dominant forms of client-contractor relationships. This is supported by Bresnen and Marshall (2000) who accentuated that the adversarial attitudes and behaviour apparent in the construction industry are deeply entrenched thereby making it difficult to apply reforms like partnering. This finding supports the need for changes in attitude amongst client and contractor organisations if partnering approaches are to be a success in the Ghanaian construction industry.

Table 4: Applicability of partnering in Ghana

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Yes (% of respondents)</th>
<th>No (% of respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clients</td>
<td>8 (40%)</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>Contractors</td>
<td>6 (30%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>14 (70%)</td>
<td>6 (30%)</td>
</tr>
</tbody>
</table>

Although the findings suggest that partnering is applicable and desirable in the Ghanaian construction context, especially amongst public sector clients who can engage in strategic-type partnering, there are wider implications given that public sector projects have to meet the requirements of Ghana’s Public Procurement Act 663. Given that such national procurement laws and regulations can present barriers to partnering implementation (Eriksson et al, 2008), the influence of the Public Procurement Act 663 on the implementation of partnering approaches in the Ghanaian public work sector will have to be interrogated in further studies. Further research will also have to consider the applicability of partnering-type collaborative forms of contract (Eriksson, 2010) such as the NEC3 in the Ghanaian construction context where traditional-type forms of contract remain dominant.

CONCLUSION

A majority of construction projects in Ghana are principally organised with the traditional method of procurement. In addition to the adversarial client-contractor relationships which characterise the traditional method practised in Ghana, client-contractor relationships are also paternalistic in nature. Despite the prevailing adversarial and paternalistic client-contractor relationships it appears that there may be some scope for partnering to work in the Ghanaian context to help improve client-contractor relationships in project delivery. Moreover, the study suggests that the public sector is better placed to drive partnering implementation given their ability to generate constant workflow to meet contractor expectations of partnering. Given the pilot nature of this study, the results are not conclusive and therefore additional studies are required to research firmer conclusions. Building on this pilot, it is hoped that the further work by the authors will provide greater clarity.

REFERENCES


Institute of Civil Engineers (ICE) (2001) *The AEC Partnering Option-Option X12*. London: ICE.


A STUDY OF LIQUIDITY IN RESIDENTIAL PROPERTY SALES TRANSACTION IN LAGOS STATE NIGERIA

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The research aims at reducing the sales transaction time with a view to enhancing the liquidity of residential properties. The researcher adopted a five (5) stages transaction process adapted from McNamara (1998) and Crosby and McAllister, (2005) three (3) and six (6) stages of property transaction processes. With a target on the Nigerian property market, this paper examined the average transaction time on each stage in the sales transaction process to know the liquidity in residential properties sales transaction. The researcher used self administered questionnaire to elicit information on the average transaction time on each stage in the process and frequency of sales on different property types from; 40% of the registered estate surveyors and valuers in the 2009 NIESV Directory and vendors. Out of the sample frame of 270 registered estate surveying and valuation firms, 108 sample size of estate firms, representing 40 per cent of firms in the study area was selected randomly. A total of 432 questionnaires were administered on the two categories of stakeholders in the Nigerian real estate markets. The sample was selected randomly from the respective sample frame of the stakeholders i.e. estate firms and vendors. Two hundred and sixteen (216) each were administered on estate surveying firms and vendors. Data were analyzed with the use of frequency distribution, and mean. The result showed that, marketing period is the most significant stage of residential property transaction with an average transaction time of 72.14 days hence, the major determinant of transaction time, followed by exchange to completion, and pre-marketing period each with an average transaction time of 43.42 days and 31.07 days respectively. The other two processes, due diligence and decision to sell with average transaction of 24 days and 23.72 days which is less than a month are not significant. The supply of fund is averagely accessible and the marketing strategies used did not maximize the marketing opportunities in information technology which could have assisted in having shorter transaction time. Also, the market liquidity for block of flats is 47 days, detached house 85 days, duplex 104 days and bungalow 228 days. The study concluded that marketing period contributed more to the transaction delay, while exchange to completion and pre-marketing stages in property sales transaction process also had negative impact on the residential property sales transaction.

Keywords: Liquidity, Residential Property, and Sales Transaction.

INTRODUCTION

Research on the real estate investment market has been limited when compared to other main investment classes such as shares and bonds (Hoesli and Macgregor, 2000). Nevertheless, the importance attached to real estate can not be over emphasized. As a specialised investment, real estate market enhances easy exchange of bundles of right in real estate. Where it is possible for participant to exchange their right for money, an efficient market is said to exist.

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A lot of writers such as; Liao and Mei (1999), and Mabogunje (2002), opined that for an efficient/market to exist there must be establishment of records and information system, improved land registration and transfer process, effective utilization of land, a functional frame work for infrastructure provisioning and access of the poor to property. Similarly Antwi and Omirin (2004) posited that markets work best when there are many suppliers and consumers, free flow of information and easy entry and exit. Thus the level of maturity of the property market determines to a large extent the liquidity of properties in that market.

Regardless of individual perceptions, liquidity is evidenced by shorter marketing times relative to the norm for a specific asset Forgey et al (1996).

Transaction frequency represents a key indicator of the liquidity in the market. According to Fisher et al (2003) transaction frequency refers to the number of transactions that occur in a particular market during a particular period of time (e.g., 120 properties per year). The number of transactions is generally affected by market conditions (including the size of the market), property conditions, and other factors influencing buyer and seller decisions.

Market liquidity according to Fisher et al (2003) is define as the ease, or speed, at which properties transact, or are expected to transact. For instance, a market with an average transaction frequency of 120 properties per year constitutes a transaction “speed” of about 3.0 days per transaction (365 / 120). It requires an adjustment for the relative size of each market. Thus, market liquidity depends on the relative number of buyers and sellers “in” the market at a particular time and it reflected the conditions of the market, property, and other factors affecting their purchase/sale decision.

Residential property sales transaction being an investment activity in real estate operate within the activities of participants such as; individual persons, or the individual companies and government organisations like Ministry of Lands, in Lagos state, Nigeria. According to land use act 1978, every transaction such as residential property sales needs consent of the state governor concerned.

Residential property sales transaction was examined based on the conceptual transaction process that has five stages comprising; decision to sell, pre-marketing period, marketing period, due diligence and exchange to completion. The activities of government such as; Lagos state metro project, lands registration system, governor’s response rate to consent on land transactions etc has tendency to have impact on the last three stages of the transaction.

This condition, from the views of several writers such as; Olayiwola and Adeleye (2006), in the literature had not only increased transaction cost but, also delayed perfection of title due to bureaucracy. Against the backdrop of these challenges in the study area, this paper presents the state of residential property sales transactions in Nigeria.

LITERATURE REVIEW

The essence of literature review is to create gap between the existing works and the current study. Genesove and Mayer (1997) are able to uncover the financial position of each seller when they build a data set for the Boston condominium market. They find that sellers with high loan-to-value ratio tend to set a higher initial listing price, have a lower probability of sale but, if and when they sell, obtain a higher price. Also
Lamont and Stein (1999) opined that seller reservation prices are affected by the loan-to-value ratio, and that variations in price dynamics across metropolitan housing markets are related to differences in overall loan-to-value ratios across cities. The gap is that all these studies were done in developed countries with a more developed economy and are also focused on one factor.

Sometimes, according to Crosby and McAllister, (2005) re-assessment of offer price and difficulty of funding such as increasing use of debt result in an additional due diligence process which could cause delay. Widespread home ownership cannot be achieved without robust housing finance built on mortgage finance institution and this has made focus on finance to be prominent in the Nigeria government programmes for enhancing housing delivery (Sanusi, 2003). In addition, Olaleye and Adegoke (2007) opined that finance is fundamental to housing delivery and there is need for efficient integration of interconnected parts such as; fund mobilisation, disbursement and recoupment for it to function. But, despite the importance of housing, it is beguiled with absence of formal financial arrangement and prohibitive nature of medium term loan of commercial banks for long term finance (Nubi, 2002) and (Olaleye and Adegoke, 2007). All these writers, Nubi (2002), Sanusi (2003) and Olaleye and Adegoke (2007) focused on the importance of finance to provision of adequate housing and none look at the issue of liquidity of residential property sales transactions in Nigeria.

Merlo and Ortalo-Magne (2004) analyzed a new data set of housing transactions in England. by obtaining record of all listing price changes and all offers ever made on a property and found out that the size of the reduction in the listing price is larger the longer a property has been on the market. Second, the level of a first offer relative to the listing price at the time the offer is made is lower the longer the property has been on the market, the more the property is currently overpriced. And if there has been no revision of the listing price, the probability of success of a negotiation decreases with the number of previous unsuccessful negotiations. Third, the higher the number of negotiations between initial listing and sale agreement, the higher the sale price.

There exist two gaps, first the study was restricted to impact of overpricing on probability of sale and second it was carried out in the more developed country.

Study carried out by Crosby and McAllister (2005) using data from three organisations in the UK revealed that the preliminary analysis of the 187 transactions for transaction time over the last three stages of the process suggested that very few generalisations can be made concerning the causes of longer and shorter transactions times. The continuing reduction in the time from exchange to completion does not significantly reduce the overall transaction time because is the least variable and the least lengthy. The research though carried out an analysis of real estate property transaction stages, there exist some gaps. The data was based on a more developed economy of the UK and few generalisations can be made.

Wu and Zheng (2008) in their study on determinants of housing liquidity showed that in four Chinese cities, market maturity dominates the variation of housing liquidity, with the effects of housing characteristics, seller’s search cost, search strategy, and market conditions being less significant to the time-on-market equation. They however observed that these empirical results indicate that the slow turn-over of housing stock may constrain the overall level of housing liquidity in major Chinese cities. The gap is that the study focused on the determinants factors of housing
liquidity and did not look at issues such as the timing of transaction process and it was also done in a more developed Chinese economy.

**CONCEPTUAL FRAMEWORK**

A typical transaction process identified by McNamara (1998) and Crosby and McAllister, (2005) breaks the sales process down into three parts; marketing, due diligence and settlement and six parts; decision to sell a particular sector or sub-sector, decision to sell a particular asset, pre-marketing period, marketing period, due diligence period and exchange to completion. However, the conceptual transaction process has five stages comprising; decision to sell, pre-marketing period, marketing period, due diligence and exchange to completion. The conceptual key stages of transaction are illustrated diagrammatically in Figure: 1

![Conceptual Key Stages of Transaction](image)

Figure 1: Conceptual Key Stages of Transaction

Author’s Conceptual Framework of Key Stages of the Residential Property Transaction.

The first stage is the decision to sell property as an asset and it set in motion the sale process. It commenced by issuance of instruction letter by the vendor to the agent (estate surveyor) and there could be delay in reaching this decision by the client.

The second stage is the pre-marketing period. At this stage the estate surveyor is called to determine the capital value of the real estate property to be disposed. He will also determine and ascertain the marketability potential of the property vis-a-vis location, property characteristics, title etc. This can take time depending on the response rate of valuer to inspect the property and turn out value. Sometimes, solicitors are simultaneously instructed to identify any potential legal obstacles to sale.
After receiving positive marketing report from the agents, formal marketing commences via; production and distribution of a brochure, advertising, contacting target clients etc. Best bids are then invited from interested purchasers for assessment and Heads of Terms agreed with the selected bidder. If there is itches in effective marketing, the process revert to pre-marketing period.

After successful completion of marketing, solicitors are instructed to proceed towards exchange of contract and go through the due diligence process. Authenticity and level of encumbrance of the title were confirmed at this stage. If there is a problem, the process of pre-marketing commences again. Because, sometimes re-assessment of offer price and difficulty of funding such as increasing use of debt according to Cosby and McAllister, (2005) was said to sometimes result in an additional due diligence process which could cause delay.

Therefore, from the following analysis, typical real estate transaction in Nigeria has five separate stages.

Stage 1 – Decision to sell
Stage 2 – Pre-marketing period
Stage 3 – Marketing period
Stage 4 – Due diligence period
Stage 5 – Exchange to completion

The researcher designed a simple algorithm in Pascal programming language that could be used for calculation of average transaction time on each stage of the transaction process and on each transaction. With this algorithm, mean transaction time on each transaction and each stage of the transaction process can be determined. Other statistical methods such as excel, SPSS etc can also be used to calculate the mean.

**Research Methodology/Analysis**

To know the liquidity in residential properties sales transaction, the researcher used self administered questionnaire to elicit information on the average transaction time on each stage in the process from; 40% of the registered estate surveyors and valuers in the 2009 Nigerian Institution of Estate Surveyors and Valuers’ Directory, vendors and estate officers of the ministry of lands of the Lagos state government in the study area.

**Flow Chart on Average Transaction Time in Each Stage of the Transaction Process**

**STAGE 1....5. (Pascal Programming Algorithm)**

Let T = Counter, and X = Property
Read X (1<sup>st</sup> Property)
Sum = 0, T = 0
10 Read X (1<sup>st</sup> Property)
Sum = Sum + X
T = T + 1
If $T < 94$ Go to 10

$$AVG = \frac{Sum}{T}$$

PRINT AVG.

---

**Figure 2:**

Author’s Conceptual Framework of calculation of Average Transaction Time on Each Stage of the Transaction Process

**Flow Chart on Average Transaction Time on Each Property (Transaction)**

**PROPERTY 1...94. (Pascal Programming Algorithm)**

Let $T$ = Counter, and $Z$ = Stage

Read $Z$ (1$^{st}$ Stage)

$Sum = 0$, $T = 0$

10 Read $Z$ (1$^{st}$ Stage)

$Sum = Sum + Z$

$T = T + 1$

If $T < 5$ Go to 10

$AVG = \frac{Sum}{T}$

PRINT AVG.
Figure 3:

Author’s Conceptual Framework of calculation of Average Transaction Time on Each Property (Transaction)

**Average Transaction Time in each Stage in the Process**

Source: Field Survey, (2011)

Figure 4. Average Transaction Time in each Stage of the Transaction Process

The researcher proceeded to determine the average transaction time at each stage of the transaction process to determine the stage with the longest average transaction time in line with the objective of the study. On this, the researcher sought to know the determinant stage among the conceptual five stages in figure 1. Mean and the bar
chart in figure 4 revealed that marketing period is the most significant stage of residential property transaction with an average transaction time of 72.14 days hence, the major determinant of transaction time, followed by exchange to completion, and pre-marketing period each with an average transaction time of 43.42 days and 31.07 days respectively. The other two processes, due diligence and decision to sell with average transaction of 24 days and 23.72 days which is less than a month are not significant.

Table 1. Response Rate on Impact of Information Technology on Reduction of Transaction Time

<table>
<thead>
<tr>
<th>Impact</th>
<th>Frequency</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agreed</td>
<td>13</td>
<td>22.8</td>
</tr>
<tr>
<td>Agreed</td>
<td>27</td>
<td>47.4</td>
</tr>
<tr>
<td>Partly Agreed</td>
<td>5</td>
<td>8.8</td>
</tr>
<tr>
<td>Disagreed</td>
<td>10</td>
<td>17.5</td>
</tr>
<tr>
<td>Indifferent</td>
<td>2</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Source: Field Survey, (2011)

Information obtained from Table 1 showed that 70.2% agreed that the use of information technology in marketing will reduce transaction time, while only 8.8% partly agreed and 17.5% disagreed.

Table 2. Response Rate for Marketing Strategies employed by Estate Surveyors

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Frequency</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>15</td>
<td>26.3</td>
</tr>
<tr>
<td>Advert on Newspapers/Property magazines</td>
<td>57</td>
<td>100</td>
</tr>
<tr>
<td>Exchange of property sales bulleting with other estate firms and property firms.</td>
<td>26</td>
<td>45.6</td>
</tr>
<tr>
<td>Placing of For Sale board</td>
<td>45</td>
<td>79</td>
</tr>
<tr>
<td>Direct Marketing to targeted buyers</td>
<td>23</td>
<td>40.4</td>
</tr>
</tbody>
</table>

Source: Field Survey, (2011)

But, evidence from Table 2 revealed that majority of the respondents firms are still using conventional marketing strategies such as; advert on newspapers 100%, For Sale board placement 79%, exchange of sales bulleting 45.6%, and direct marketing to targeted buyers 40.4%, while only 26.3%, used information technology in their marketing strategies. Thus the outcome in figure 4 where marketing period has the longest average transaction time is due to poor marketing strategies as evidenced by the lack of significant use of information technology revealed by the respondents’ perceptual analysis is a contributory factor to longest average transaction time recorded by marketing period. Also previously unknown or ignored inherent problems at pre-marketing period such as multiple ownership characteristics which may delay transfer of title at exchange to contract stage and thereby add to the marketing period.
Table 3. Response Rate on Fund Availability for Mortgage in Lagos State as perceived by Estate Surveyors

<table>
<thead>
<tr>
<th>Fund Availability</th>
<th>Frequency</th>
<th>Relative (%)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>----------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>High</td>
<td>----------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Averagely High</td>
<td>51</td>
<td>89.5</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>6</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Not Accessible</td>
<td>----------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>

Prolonged marketing period and delay in exchange to completion may also be as a result of down payment constraint emanated from average fund availability as revealed in Table 3. 89.5% of the respondents agreed that mortgage fund are averagely accessible and 10.5% opined that the availability of the fund is low. The implication from this finding is that, for the practice of real estate property sales transaction to be enhance in Nigeria, there is need to understudy the causes of delay in marketing period and exchange to completion.

Table 4. Frequency of Sales Portfolio/ Sale Transactions of Estate Firms for Specified Residential Properties in Five Years (2006 to 2010) and Market Liquidity.

<table>
<thead>
<tr>
<th>Property Type</th>
<th>Frequency of Sales Portfolio</th>
<th>Frequency of duly completed sales</th>
<th>Market Liquidity per Property Type (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block of Flats</td>
<td>338</td>
<td>181</td>
<td>47</td>
</tr>
<tr>
<td>Duplex</td>
<td>185</td>
<td>84</td>
<td>104</td>
</tr>
<tr>
<td>Detached House</td>
<td>161</td>
<td>101</td>
<td>85</td>
</tr>
<tr>
<td>Bungalow</td>
<td>91</td>
<td>38</td>
<td>228</td>
</tr>
</tbody>
</table>

From Table 4, the market liquidity for block of flats is 47 days, detached house 85 days, duplex 104 days and bungalow 228 days. This implied that block of flats is the most liquid of all the property types under the study in Lagos metropolis followed by detached house, duplex and bungalow respectively. Furthermore, data from estate officers at Ministry of Lands Alausa, Lagos from Table 5 and 6 displayed the following information.

Table 5. Response Rate for Exchange to Contract by Estate Officers at Alausa, Ikeja

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Frequency</th>
<th>Relative (%)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>2</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>3</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>8</td>
<td>30.8</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>10</td>
<td>38.5</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>3</td>
<td>11.5</td>
<td></td>
</tr>
</tbody>
</table>
From Table 5, 50% of the respondents were of the opinion that exchange to contract time can be as long as 90 – 120 days, while 30.8% and 11.5% went for 60 days and 45 days respectively and only 7.7% said it is 30 days.

Table 6. Response Rate for Due Diligence by Estate Officers at Alausa, Ikeja

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Frequency</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Authors Field Survey, (2011)

Therefore, the researcher is of the opinion that the 30 days rule of obtaining governor’s consent to formal sales transaction in Lagos has not been achieved. This is in consonance with the views in some literatures such as Butler (2009) and Odebode (2010) that the average days for getting governor’s consent is far above 30 days. But all the respondents as revealed in Table 6 agreed that due diligence is done immediately.

**CONCLUDING REMARKS**

Residential property sales transaction in Lagos state is characterized with; long marketing period with an average transaction time of 72.14 days followed by exchange to completion, and pre-marketing period each with an average transaction time of 43.42 days and 31.07 days respectively. The other two processes, due diligence and decision to sell have average transaction of 24 days and 23.72 days. The supply of fund which is a major factor in the property market is averagely accessible in the state. The market liquidity of 47 days for block of flats, detached house 85 days, duplex 104 days and bungalow 228 days implied that block of flats is the most liquid of all the property types under the study followed by detached house, duplex and bungalow respectively.

The study concluded that marketing period contributed more to the transaction delay, while exchange to completion and pre-marketing stages in property sales transaction process also had negative impact on the residential property sales transaction.

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This paper investigates the relationship between the Lagos Megacity and Ota Township, a small township on its periphery. The study examines linkages between and Lagos in terms of growth, urban development as well as mobility. 553 questionnaires were administered to household heads across the 12 residential districts of Ota Township. Survey was carried out by systematic random sampling. Classified traffic counts were also taken at strategic locations along the four main axial roads in Ota. The data collected were analysed with descriptive and inferential statistical methods including cross-tabulation and correlation analysis. Findings of the research have shown that the proportion of inter-city traffic from Ota directed towards Lagos is about 48% of total inter-city traffic generated. More than 40% of Ota residents migrated from Lagos and still commute daily to the megacity. The paper concludes by recommending strategies for better synergies between Ota Township and the Lagos megacity. These include the implementation of integrated master planning, effective environmental management and traffic policies for the township as well.

Keywords: Peri-urban, settlements; linkages; Lagos Megacity; Ota Township.

INTRODUCTION

Central to understanding the system of cities is how they evolve and interact in the process of urban growth (Rossi-Hansberg et al (2004). An interesting case is that of Lagos which has grown from a set of farming and fishing villages to arguably the third largest city in the world. The growth of the Lagos metropolis has been phenomenal, both demographically and spatially. From an estimated population of 28,518 in 1871 (Mabogunje,1968; Ayeni, 1981), Lagos metropolis is estimated to have a population of 13million persons (World urbanization Prospects, 2011). Spatially, Lagos has grown from a traditional core settlement of about 3.8km$^2$ in 1881 to 271km$^2$ by 1981 and on to a huge metropolis of over 1,183km$^2$ by 2004 (Uthman 2005).

This continual growth has had effects on settlement structure, land use, population concentration, physical and social infrastructure, housing development, traffic and transportation in such a manner that development has extended to suburban areas as well as on the frontier settlements of Ogun State (Kadiri, 2001; Akinyode, 2010). One of such frontier settlements is Ota Township in Ogun State whose population has grown from 14,248 in 1963 to an estimated 142,793 by 2003 (CPMS 2005). Ota is situated near the boundary of Lagos State and has steadily grown as a result of its proximity to Lagos (Kadiri, 1992). Ogun State Regional Plan (2005) also identified
Ota as one of the neighbouring settlements to the Lagos Metropolis bearing the brunt of the expansion pressure of the Lagos Metropolis. This paper therefore examines the relationship between the Lagos Metropolis and Ota Township and attempts to investigate the effects of this relationship on the urban character of Ota Township.

**METROPOLITAN IMPACT ON NEIGHBOURING COMMUNITIES**

Urban growth according to Cheng, (2003) is defined as physical and functional changes due to the transition of non-urban to urban land. According to Martine and McGranaham (2010), rapid urban growth is the single most influential process affecting socio-economic, political and demographic trends in low and middle-income countries in the 21st century. Consequently, population concentration in towns and cities directly affect development, poverty and environmental conditions. With an increasing percentage of the world’s population living in urban areas, employment is concentrated in the city centre and population growth is mainly occurring in the outlying regions (Darin-Drabkin (1977)). This has resulted in the manifestation of peri-urbanization and dormitory communities, especially in developing countries including India (Thangavel and Robinson, 2000) and China (Cheng, 2003).

Dekel and Ostriker (1997) from a study of four townships adjacent to major urban centres in Ontario Canada surmised that the growth of major metropolitan centres has significant fiscal impact on adjoining localities. Konadu-Agyemang (2001) study of Accra and Kumasi metropolitan areas also revealed that urban growth in these metropolises induced both intensification of densities and sprawling on their fringes or peripheral areas. These peripheral communities, often lacking effective development control mechanisms are responsive to development pressure; hence they begin to experience the effects and challenges of urban development without the machinery to manage such. (Hall, 1982)

The urban growth of Lagos has been largely amoebic in nature, spreading sporadically in many directions. Amoebic Urbanization has been described by Nas and Heuling (2001) and Hern (2008) as urban growth which spreads in a sprawl formation, with satellite lesions which are ragged, invasive and constantly expanding. The Lagos Megacity region includes the continuously expanding area comprising the 20 local government areas of Lagos State and the emerging settlements that have developed in close linkage to the metropolitan area. According to Lawanson, Yadua and Salako (2012), the spatial expansion of Lagos had extended outwards annexing nearby settlements with potential for expansion; strong interconnection with the Lagos Megacity and strong potential for informal economic activities.

Peri-urban growth has been intense along the southwest end of Ojo-Badagry Expressway, the south east along the Lekki-Epe corridor, the north east along Ikorodu corridor, Alimosho-Igando-Iba-Lasu corridor in the North West and the Lagos-Ibadan axis towards the north of the Metropolis. The corridors along the Lagos-Ogun State borders have experienced the highest pressure. Ota, Ibafo-Mowe, Ojodu-Akute, and Ogijo areas are under intense pressure of physical growth with very few indicators of real development. (Lagos Megacity Report 2004).

Existing research on peri-urbanization in Lagos has focused largely on the spatial expansion of the Megacity and the effects of these on the Lagos Metropolis. These include the work of Mabogunje (1968, 1980), Onakomaiya (1978), Ayeni (1984), Farunkanmi (2003); Agbola (2006); Olujimi, (2009) and Dekolo and Oduwaye
Scant research exists on the effects of the expansion of the Lagos Megacity on annexed settlements. As such, this paper will focus on the growth and development of Ota Township in the context of the primacy of the Lagos Megacity.

**STUDY AREA**

The study is set in Ota Township, Ogun State, Nigeria. Ota is a peripheral settlement adjoinging the Lagos metropolis, located on latitude $6^\circ 42'\ N$ and longitude $6^\circ 13'\ E$. In areal distance, Ota is about 53km to Abeokuta - the Ogun State capital, and 22km to Ikeja-the Lagos State capital. See Fig I

![Fig 1: Map of Ogun State showing Ota Township](http://goo.gl/maps/rn4ym)

Ota is a fast growing medium size town whose physical growth is mainly driven by proximity to two major highways: the Lagos - Abeokuta Expressway and Idiroko Road. These two roads intersect at Sango, the commercial node.

The morphology of the town responds to the postulations of the Concentric Zone Theory as modified by Harris and Ullman (1945) in the Multi-Nuclei Theory. The core area is surrounded by a transitional zone of better housing and intensive commercial and informal industrial uses and a peripheral emergent suburb where the best housing estates and industries are located. The built up area of Ota can be distinctly categorised into three sections, made up of:

- The traditional core areas, made up of four quarters, Ijana, Otun, Osi and Oruba, and bounded by Idiroko Road;
- The transition area comprising newly developing land uses to the north of the Byepass including the Housing Corporation Estate, Industrial Estates and Sango, mainly inhabited by the non-Yoruba community; and
- The emerging suburban areas covering formerly distinct settlements as Ijoko, Ijako, Iloye, Iyesi,

Commercial activities in Ota take place in a linear form along the major arteries of Lagos – Abeokuta Expressway, Ota – Ijoko Road and Ota – Idiroko Road. The transport system in Ota consists essentially of road network, thus making the town accessible only to road traffic. Ota is highly accessible in terms of regional linkage.
and connectivity to other parts of the country and beyond. The internal road system consists of some trunk roads, township roads and local streets. The road and drainage system of Ota is poor given the fact that the town has grown amorphously over the years. Over 70% of the total road network in Ota is earth in nature and most of the traditional core area is accessible through a dense network of footpaths.

**RESEARCH METHODS**

Data collection was by systematic random sampling. Information was collected on the socio-economic characteristics of residents and their travel behaviour in order to determine the interactions between Ota and Lagos. Furthermore, housing and neighbourhood infrastructure survey was done to determine the urban character of the study area. The environmental condition was determined by observation. A sample size of 5% of all buildings (11,051) in Ota Township was selected. A total of 553 questionnaires were administered on household heads in the 12 residential neighbourhoods that make up Ota Township. The survey was conducted using systematic random sampling in which every twentieth house was sampled. Classified traffic counts were also taken at selected points along the four main axial roads in Ota for a period of twelve hours (6am - 6pm) for three days. This was done to determine the traffic flow, volume and pattern between Ota and Lagos. Survey points were established along Ota - Ijoko Road, Ota - Abeokuta Road, Ota - Idiroko Road and Ota - Lagos Road.

There was 96.38% response rate as out of the 554 questionnaire recovered from the survey exercise, 532 were fully completed and therefore acceptable for further analysis. Data analysis was done using simple descriptive statistics and Pearson’s Correlation analysis. The results of the traffic count were converted to Passenger Car Units (PCU).

**RESULTS**

**Socio Economic Profile of Respondents**

Socio economic variables considered are gender, age, marital status, employment and household income as shown in Table 1.

The study area is dominated by males (59.3%). However the male female ratio is negligible in the emerging communities and markedly different in the transitory communities where it is roughly 2:1. This is because the transitory zone is the main commuting zone and most of the respondents are resident there temporarily. The study revealed that that 68% of the respondents are married, 23.9% are single, 3.4% are separated, 3.3% are widowed and 1.4% are divorced. There are more single respondents in the emerging area (29%) compared to the transitional zone (21%) and the traditional core area (18.1%). This further corroborates extant literature which asserts that younger unmarried people tend to reside in peripheral settlements. The study revealed that 6.3% of the respondents are younger than 20 years old. Respondents between the 20 and 40 years old are 49.7% while those aged between 41 to 60 years old are 39.1% of the entire population. Those older than 60 years old make up only 4.9% of the population. The transitory zone and emerging communities had a higher concentration of young people as well as working age population.

The study area is quite literate by UNESCO standards as 71.7% of respondents have completed at least secondary school education. Those with tertiary education constitute 22.8%, 30.4% and 30.9% of the respondents in the traditional, transition
and emerging communities respectively. The high proportion of highly literate population may be attributed to the concentration of factories in Ota requiring skilled manpower.

Ota Township has a relatively high employment rate as only the traditional core area recorded a significant proportion of unemployed persons and this was in most cases by reason of retirement. There was also insignificant proportion of respondents who were students in the transitory zone, even though the values were also relatively low in the other areas. This can be adduced to the one man nature of most small scale businesses in the area as well as the fact that most factories in the area employ mainly skilled labour.

Table 1: Socio Economic Profile of Respondents

<table>
<thead>
<tr>
<th>Category</th>
<th>Traditional Core % (n=127)</th>
<th>Transitory Area % (n=186)</th>
<th>Emerging Communities % (n=220)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59.1</td>
<td>68.4</td>
<td>51.7</td>
</tr>
<tr>
<td>Female</td>
<td>40.9</td>
<td>31.6</td>
<td>48.3</td>
</tr>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20</td>
<td>0</td>
<td>4.1</td>
<td>11.7</td>
</tr>
<tr>
<td>20 – 40</td>
<td>44.1</td>
<td>54.1</td>
<td>49.1</td>
</tr>
<tr>
<td>41 – 60</td>
<td>48.8</td>
<td>39.8</td>
<td>33.0</td>
</tr>
<tr>
<td>≥ 60</td>
<td>7.1</td>
<td>2.0</td>
<td>6.1</td>
</tr>
<tr>
<td>Highest Educational Attainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non formal</td>
<td>25.2</td>
<td>6.2</td>
<td>13.5</td>
</tr>
<tr>
<td>Primary</td>
<td>11.0</td>
<td>12.4</td>
<td>23.9</td>
</tr>
<tr>
<td>Secondary</td>
<td>40.9</td>
<td>51.0</td>
<td>37.0</td>
</tr>
<tr>
<td>Tertiary</td>
<td>22.8</td>
<td>30.4</td>
<td>30.9</td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>12.6</td>
<td>3.0</td>
<td>18.2</td>
</tr>
<tr>
<td>Student/ apprentice</td>
<td>14.2</td>
<td>3.1</td>
<td>18.6</td>
</tr>
<tr>
<td>Informal sector employed</td>
<td>11.8</td>
<td>15.3</td>
<td>14.3</td>
</tr>
<tr>
<td>Formal sector employed</td>
<td>31.5</td>
<td>38.3</td>
<td>20.0</td>
</tr>
<tr>
<td>Self employed</td>
<td>29.9</td>
<td>40.3</td>
<td>44.7</td>
</tr>
<tr>
<td>Average monthly income in Naira</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤18,000</td>
<td>76.3</td>
<td>56.8</td>
<td>75.4</td>
</tr>
<tr>
<td>18,001 – 40,000</td>
<td>21.9</td>
<td>21.9</td>
<td>7.1</td>
</tr>
<tr>
<td>40,001 – 60,000</td>
<td></td>
<td>13.5</td>
<td>6.7</td>
</tr>
<tr>
<td>60,001 – 80,000</td>
<td>14.0</td>
<td>1.0</td>
<td>3.8</td>
</tr>
<tr>
<td>≥ 80,000</td>
<td>3.5</td>
<td>6.7</td>
<td>6.2</td>
</tr>
<tr>
<td>Length of Stay in Ota</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1 year</td>
<td>9.0</td>
<td>10.2</td>
<td>10.4</td>
</tr>
<tr>
<td>1-5 years</td>
<td>21.0</td>
<td>7.1</td>
<td>31.3</td>
</tr>
<tr>
<td>6-10 years</td>
<td>23.1</td>
<td>43.9</td>
<td>29.1</td>
</tr>
<tr>
<td>11-15 years</td>
<td>5.9</td>
<td>7.4</td>
<td>15.2</td>
</tr>
<tr>
<td>≥15 years</td>
<td>32.3</td>
<td>13.3</td>
<td>13.9</td>
</tr>
</tbody>
</table>

Further breakdown of the employment status showed that informal sector employees were mainly artisans and shopkeepers, while those employed in the formal sector were civil servants, teachers and factory workers. The self employed respondents were mainly engaged in farming and trading. There were no farmers in the transitional and emerging communities, while there were no factory workers in the traditional core areas. Average household size is quite large as 58.1% of respondents belong to
households of between 5 and 9 persons. 3.5% of households in the traditional core area are more than 20. Most of the respondents fall below the poverty line as average monthly income was ₦8,000 in the core area, ₦12,500 in the transition zone and ₦10,000 in the emerging zone. The standard of living in the study area is quite low with close to 70% if respondents households earning less than the national minimum wage of ₦18,000 monthly, and only about 6% in each zone with monthly household incomes of more than ₦80,000.

Over 65% of the respondents had lived in Ota for more than five years and reasons adduced for choosing Ota as a place of live include cheaper cost of living (21.5%), nearness to Lagos (19.3%), nearness to work (16.7%), cheaper rent (15.2%), and nearness to kin (8.8%).

**HOUSING AND ENVIRONMENTAL CONDITIONS IN THE STUDY AREA**

The housing typology in the study area is predominantly the rooming house. The study revealed that the age of buildings in the study area was a reflection of the spatial growth. A large proportion of buildings in Ota were built between 1986 and 2005. In fact, 82.4% of buildings in the transition zone came up in this period. This translates that the spatial growth of Ota accelerated after 1985. Predictably, majority of the new buildings are in the emerging areas. The nature of housing tenure ship in the study area is such that family owned communal properties, occupied rent free is strong in the traditional core area, while majority of respondents in the transitory areas were tenants and those in the emerging areas were majorly owner occupied as shown in Table 2.

<table>
<thead>
<tr>
<th>Age of building</th>
<th>Traditional Core % (n=127)</th>
<th>Transitory Area % (n=186)</th>
<th>Emerging Communities % (n=220)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since 2006</td>
<td>-</td>
<td>5.2</td>
<td>22.2</td>
</tr>
<tr>
<td>1996 - 2005</td>
<td>12.6</td>
<td>24.7</td>
<td>27.4</td>
</tr>
<tr>
<td>1986 - 1995</td>
<td>23.6</td>
<td>42.4</td>
<td>19.1</td>
</tr>
<tr>
<td>1976 - 1985</td>
<td>11.0</td>
<td>14.3</td>
<td>13.9</td>
</tr>
<tr>
<td>Before 1976</td>
<td>52.8</td>
<td>13.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Housing Tenureship</td>
<td>Owner Occupied</td>
<td>31.5</td>
<td>34.0</td>
</tr>
<tr>
<td>Tenant</td>
<td>23.6</td>
<td>60.8</td>
<td>39.6</td>
</tr>
<tr>
<td>Family Owned</td>
<td>41.7</td>
<td>5.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Squatting</td>
<td>3.2</td>
<td>-</td>
<td>0.9</td>
</tr>
<tr>
<td>Patronage of Public Services</td>
<td>Primary School</td>
<td>84.7</td>
<td>27.4</td>
</tr>
<tr>
<td>Secondary School</td>
<td>91.7</td>
<td>74.5</td>
<td>64.1</td>
</tr>
<tr>
<td>Health Centre</td>
<td>59.0</td>
<td>35.8</td>
<td>33.3</td>
</tr>
<tr>
<td>General</td>
<td>Good</td>
<td>23.6</td>
<td>44.4</td>
</tr>
<tr>
<td>Environmental Condition</td>
<td>Fair</td>
<td>75.6</td>
<td>38.3</td>
</tr>
<tr>
<td>Poor</td>
<td>16.8</td>
<td>15.31</td>
<td>16.6</td>
</tr>
</tbody>
</table>

Patronage of all public facilities was high in the traditional core area while in the emerging area and transition zone, only patronage of public secondary schools was high. Respondents in these areas prefer to patronise private primary schools and health centres. This choice however may have been because of location as spatial analysis of the study area shows that public primary schools and public health facilities (Ota General Hospital) are located in the traditional core area.
General environmental condition was classified as good (concrete block building with indoor household facilities, free flowing drainage, motorable access and clean surroundings), fair (concrete block building with outdoor household facilities, open drainage, clean surroundings and no motorable access) and poor (mud building with no household facilities, drainage or motorable access and dirty surroundings). While the modal condition was fair in the traditional core area, it was good for both the transition zone and the emerging settlements.

**DISCUSSION**

**Ota- Lagos Linkages**

This section discusses the relationshs between Lagos and Ota and the effects of these on the Ota Township with respect to spatial growth, urban character and traffic and transportation patterns.

**Spatial Growth**

Ota as a strategically located nodal town has witnessed rapid growth, largely because of its proximity to the Lagos Metropolis. The settlement of Ota has grown from its 1963 size of about less than 1km$^2$ to 11km$^2$ by 1983 and to 53km$^2$ by the year 2006. In fact, the spatial growth of Ota has been directly proportional to that of Lagos as shown in Figure 2.

Fig 2: Spatial Growth of Lagos and Ota (1963-2006)


Demographic comparisons also attest to this as shown in Table 3 below. Proximity to Lagos can be adduced as the major reason for the phenomenal increase in Ota’s population, especially if one compares it to that of Ayetoro, a similarly sized town. Ayetoro, situated 115 kilometres from Lagos, had a population of 15,040 in 1963. This figure rose to 44,576 in 2005, compared to that of Ota which rose from 14,346 in 1963 to 157,977 in 2006.

To further determine if there was any significant relationship between the growth of Ota and Lagos, the following hypothesis was tested using 30 settlements with relative proximity to the Lagos Metropolis, Ota being the closest in distance (22km). Other settlements were Ifo (35km), Owode- Yewa (49km), Owode-Egba (52km), Ado Odo (55km), Ogere (57km), Sagamu (59km), Ode Remo (60km), Iperu (61km), Igbessa (61km), Ilaro (62km), Agbara (65km), Isara (65km), Ipokia (67km), Ikenne (68km), Ilisan (71km), Odogbolu (73km), Aiyepe(74km), Idi iroko (77km), Ososa (79km), Abeokuta (80km), Igbogila (85km), Ijebu Ode (85km), Ijebu Ife(90), Omu (95km), Ijebu Igbo (110km), Ayetoro (115km), Ago Iwoye (120km), Oru (125km) and Imeko (147km).

Ho: Proximity to Lagos Metropolis does not have significant impact on the growth of neighbouring settlements

H$_1$: Proximity to Lagos Metropolis has significant impact on the growth of neighbouring settlements

The population growth factor and distance from Lagos were subjected to the Pearson’s Moment Correlation Coefficient ($r$) test. A value of $r = -0.658$ was gotten and it can be inferred from this that the relationship between the distance of a settlement to Lagos and its growth factor is both moderately negative, i.e. the greater the distance between a settlement and Lagos the less its intensity of urban growth.
To determine the percentage of contribution of the proximity to variation on settlement growth, the coefficient of determination was calculated and a result of $r^2 = 0.433$ was obtained. This means that 43% of the variation in a settlement’s growth is determined by its distance from a neighbouring large metropolitan centre.

Table 3: Demographic Trends of Lagos and Ota (1850 - 2006)

<table>
<thead>
<tr>
<th>Year</th>
<th>Lagos Metropolis (Population)</th>
<th>Ota (Population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1850-1860</td>
<td>20,000</td>
<td>3,000</td>
</tr>
<tr>
<td>1879-1881</td>
<td>37,452</td>
<td>5,000</td>
</tr>
<tr>
<td>1952</td>
<td>267,407</td>
<td>8,914</td>
</tr>
<tr>
<td>1963</td>
<td>951,677</td>
<td>14,348</td>
</tr>
<tr>
<td>1988</td>
<td>7,580,000</td>
<td>35,523</td>
</tr>
<tr>
<td>1991</td>
<td>8,787,000</td>
<td>103,322</td>
</tr>
<tr>
<td>2001</td>
<td>12,949,000</td>
<td>132,836</td>
</tr>
<tr>
<td>2005-2006</td>
<td>16,860,000</td>
<td>157,977</td>
</tr>
</tbody>
</table>


**Urban Character**

The survey revealed that 92.3% of the respondents consider the proximity of Ota to Lagos to have overwhelming effect on the urban character of the township. Their perception of the current status of their environment given the intense Lagos- Ota interactions is shown in Table 4.

Table 4: Respondents Perception of Urban Character of Ota Township

<table>
<thead>
<tr>
<th>Indices</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Supply</td>
<td>27.9</td>
<td>-</td>
<td>72.1</td>
</tr>
<tr>
<td>Water Supply</td>
<td>32.8</td>
<td>6.8</td>
<td>60.4</td>
</tr>
<tr>
<td>Security</td>
<td>66.1</td>
<td>6.9</td>
<td>27.0</td>
</tr>
<tr>
<td>Cost of Travel</td>
<td>27.7</td>
<td>3.3</td>
<td>69.0</td>
</tr>
<tr>
<td>Traffic Flow</td>
<td>23.7</td>
<td>2.6</td>
<td>73.7</td>
</tr>
<tr>
<td>Cost of Food</td>
<td>24.7</td>
<td>0.2</td>
<td>75.1</td>
</tr>
<tr>
<td>Environmental Sanitation</td>
<td>25.2</td>
<td>54.4</td>
<td>20.3</td>
</tr>
</tbody>
</table>

The respondents were of the opinion that all indices of urbanization had increased significantly within the last ten years as a result of the proximity of Ota to Lagos as shown in Table 5. The most significant increases were the population growth rates as well as housing density and urban growth rates. About half of the respondents consider the crime rate to have increased in the past ten years, while 21.2% think it has reduced.
Table 5: Respondents Perception of Effects of Lagos Proximity on Ota Township

<table>
<thead>
<tr>
<th>Indices</th>
<th>Increased (%)</th>
<th>No change (%)</th>
<th>Reduced (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Value</td>
<td>86.8</td>
<td>2.0</td>
<td>11.2</td>
</tr>
<tr>
<td>House Rent</td>
<td>86.1</td>
<td>8.8</td>
<td>5.1</td>
</tr>
<tr>
<td>Traffic Intensity</td>
<td>89.2</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Population Growth</td>
<td>97.4</td>
<td>1.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Housing Density</td>
<td>94.1</td>
<td>5.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Urban Growth Rate</td>
<td>93.1</td>
<td>5.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Urban Crime Rate</td>
<td>55.0</td>
<td>23.8</td>
<td>21.2</td>
</tr>
<tr>
<td>Urban Sprawl</td>
<td>66.5</td>
<td>26.7</td>
<td>6.8</td>
</tr>
</tbody>
</table>

**Traffic and Transportation**

The study discovered that 65.4% of respondents work within Ota Township, 4.1% in surrounding communities while 30.5% commute to Lagos for work. In fact, 38% of respondents were formerly resident in Lagos and no fewer than 75% visit Lagos at least once a month, usually for shopping and/or social engagements as shown in Table 6. For 78.5% of respondents, the most popular mode of travel to Lagos is by public transport (78.5%), private car (19.9%) and other means such as the commercial motorcycles and tricycles.

Table 6: Purpose of Respondents visits to Lagos

<table>
<thead>
<tr>
<th>Purpose of Visit to Lagos</th>
<th>Daily (%)</th>
<th>Weekly (%)</th>
<th>Fortnightly (%)</th>
<th>Monthly (%)</th>
<th>Infrequently (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>15.7</td>
<td>7.1</td>
<td>3.1</td>
<td>1.5</td>
<td>3.0</td>
<td>30.5</td>
</tr>
<tr>
<td>Schooling</td>
<td>9.6</td>
<td>3.1</td>
<td>1.8</td>
<td>2.5</td>
<td>-</td>
<td>16.0</td>
</tr>
<tr>
<td>Shopping</td>
<td>4.8</td>
<td>15.7</td>
<td>14.1</td>
<td>10.2</td>
<td>4.6</td>
<td>79.6</td>
</tr>
<tr>
<td>Social/Religious Engagements</td>
<td>7.1</td>
<td>35.3</td>
<td>21.7</td>
<td>17.6</td>
<td>5.2</td>
<td>84.3</td>
</tr>
</tbody>
</table>

A traffic survey was also conducted along the four main roads in Ota to determine the rate of travel between Ota and its neighbouring towns. Table 7 reveals that the Ota Lagos route was the busiest, accounting for 47.8% of all vehicular movement over the three day traffic count.

**CONCLUSION**

This study has revealed the effects of a rapidly expanding metropolitan centre on neighbouring settlements using the specific case study of Ota. This study has shown that the growth potential of a particular settlement is directly proportional to its distance from a large metropolitan centre. The intense interaction between Ota and Lagos has resulted in a high rate of population influx into Ota, usually from Lagos. This has resulted in a situation of near annexation of Ota Township by the Lagos
Megacity. This situation has far reaching implications for urban planning and development both in Lagos and Ogun States.

Table 7: Average Daily Traffic Volume (PCU) of Major Roads in Ota

<table>
<thead>
<tr>
<th>Route</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Saturday</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ota – Lagos Road</td>
<td>41931</td>
<td>53211</td>
<td>62817</td>
<td>157959</td>
<td>47.8</td>
</tr>
<tr>
<td>Ota – Ijoko Road</td>
<td>4285</td>
<td>4239</td>
<td>5711</td>
<td>14234</td>
<td>4.3</td>
</tr>
<tr>
<td>Ota – Idi Iroko Road</td>
<td>19630</td>
<td>19340</td>
<td>19706</td>
<td>58675</td>
<td>17.8</td>
</tr>
<tr>
<td>Ota – Abeokuta Road</td>
<td>36071</td>
<td>33521</td>
<td>29904</td>
<td>99496</td>
<td>30.1</td>
</tr>
</tbody>
</table>

A study of housing development pattern in Ota reveals the slipshod manner of urban development as well as often incompatible land uses situated side by side. Coupled with inadequate and ineffective development control, there are emerging environmental problems in the study area. Challenges in the areas of infrastructural deployment, environmental pollution by the industries, and social service provision among others are such that Ota, while being a small town is being burdened with big city challenges. Development control must be invigorated, especially in the transition zone and emerging areas. Failure to do this will inevitably lead to the urban sprawl. Furthermore, within the framework of the Ogun State Regional Master plan, the full implementation of the Ota Sector as an activity centre must be operationalized. A combined effort of the Lagos and Ogun State governments is necessary for addressing the urban development challenges of Ota Township. The reality is that as many as the 47% of workers who commute between Lagos and Ota pay taxes in Lagos state and enjoy public amenities and other social services in Ogun State. When metropolitan areas spill-over into more than one administrative boundary, urban management issues require a unified and comprehensive approach covering the total extent of the metropolitan area. The fusion of Ota and Lagos is still at its infancy and the development may become uncontrollable soon resulting in physical dysfunction with its attendant high economic and social costs to both sides. The Megacity Commission must be inaugurated to oversee this process.

The effects of the Lagos –Ota linkage also has high significance for the urban transport sector. Close to 50% of all inter urban travel in Ota is either to or from Lagos. The situation presently, especially at peak periods is that the Ota Lagos road is blocked, resulting in loss of man hours, environmental pollution and environmental health hazards including stress and carbon monoxide poisoning. The traffic situation is also a high security risk as criminals consistently take advantage of the situation to extort and/or rob travellers on the route. It is imperative that an effective mass transport solution be provided. The initial step to achieve this would be the development of a regional transportation plan for Metropolitan Lagos which will include travel to and from adjoining dormitory settlements such as Ota. The railway line between Ota and Lagos should also be rehabilitated.

Metropolitan suburb settlements have been noted to suffer a number of externalities imposed upon them as a result of their proximity to the rapidly expanding metropolitan city. Often times, development planning tends to focus on the metropolis
to the detriment of the adjoining settlements. The case of Ota vis-a-vis the Lagos Megacity is poignant and decisive action must be taken before Ota becomes another urban hazard.

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AN APPRAISAL OF BUILDABILITY PRACTICE IN THE NIGERIAN CONSTRUCTION INDUSTRY

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Department of Building, Ahmadu Bello University, Zaria, Nigeria

The traditional contract procurement system has long been the most widely accepted and used system in Nigeria; this separates the design phase from the construction phase of a project, thus leading to buildability problems and high rate of building defect because of lack of constructors’ input in design development. This is a study on the problems of buildability practice in Nigerian construction industry. A total of 40 structured questionnaires were administered to relevant professionals within the construction industry out of which 30 were received and analyzed. A structured oral interview was also undertaken. Results revealed that, a section of professionals especially designers do not have clear understanding of the philosophy behind buildability, 75% of designers do not understand the reason and relevance of constructors’ input in design development. It was concluded that one of the major problems that affect buildability practice in Nigeria is the issue of effective communication and relationship between professionals, which is discouraged by the nature of contract procurement system. Some of the suggestions made are: the inclusion of buildability as part of curriculum in every institution for both designers and constructors and also to include buildability programme in the national building code (NBC) 2006 which will encourage the creation of an enabling environment for the practice.

Keywords: buildability, design analysis, traditional contract procurement, experience, maintainability

INTRODUCTION

Buildability is the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives (CII 1986). Put simply, buildability is the extent to which a building design is production friendly. In any construction work, buildability is an issue of paramount relevance which help in detecting the feasibility and viability of the building construction, and also economy, quality and time of a production. George and John (2001) noted that previous research has demonstrated numerous benefits of constructability input. According to Matheson et al (1995) the inclusion of construction knowledge and experience into the planning and design of a project – Constructability/Buildability - can result in reduced installation cost Buildability analysis is undertaken before or at the inception stage of any construction process to detect how production friendly the design of the building could be and also to eliminate all problems associated with the production of the building. This analysis is a pre-construction activity, which takes into consideration all factors relating to building’s constructability. Some of the factors it considers are the issue of technical efficiency of the design, simplicity of work, standardization and the issue of simple

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integrated units. Technical efficiency considers the building geometry/layout, building detail and construction methodology. Standardization refers to the standard sizes of construction materials with respect to size and geometry of the building itself, simplicity deals with the issue of uncomplicated building system and construction or design of simple geometric buildings and simple integrated units deals with the ability to combine components in building.

Buildability problems cause difficulty in construction and therefore must be addressed. The problems of buildability can arise from faulty and defective working drawings and other contract documents, resistance of clients to budgetary limitation, non-standardization of design and defective communication skills among construction parties. The problems of buildability must be reviewed in order to establish equilibrium among the primary concerns of cost, time and quality of construction.

Gray (1983) notes that the definition of buildability has two major implications, these are buildability exist on a scale of good to bad i.e. a design with good buildability must take into account the way it is to be constructed and vise-versa, and secondly, each building has overall requirements which may necessitate less than good buildability. The construction industry in Nigeria is a developing one as it reflects the economy of the nation. The commonly used contract procurement system is the traditional system which separates the design and construction phase of a project. According to Ferguson (1989), in no other industry is it seen as sensible to divorce the design of a product from its fabrication and it is expected, therefore, that the designers working in those industries will be familiar generally with the relevant production processes as fabricators are with broad intention of the designer. This separation brings about buildability problems and high rate of building defect which may lead to collapse. In buildability analysis, issues which may lead to building defects are addressed in the design, some of these issues are, errors, wrong specifications, tolerance of specified materials and omission in design. In every construction work, there must be a balance in the primary concerns of time, cost and quality (Mbamali, 2008). This cannot be achieved without proper planning, which entails, among other things, close examination of the production information so as to determine waste, wasted effort and any constraint that would affect the successful execution of project – buildability. That is why, it was noted that buildability has started from modest research activity and now attained a reasonable glow of respectability (Bamisile 2004). Recently, Medugu et al (2012) carried out a study on stakeholders’ perception on the buildability practice in the Nigerian construction industry. This is a report on a study of the problems of buildability practice in Nigeria which was achieved through review of the concepts and identification of bottlenecks to their application.

**METHODOLOGY**

The methodology for this research comprises the following;

Research questionnaire was designed and administered to relevant professionals, Builders, Architects, Quantity Surveyors and Engineers within the construction industry in Nigeria. The field survey was carried out in Abuja and Kaduna metropolis. These locations were chosen due to the appreciable level of construction activities and high concentration of professionals in these areas (Dahiru et al 2012).

A purposive sampling technique was used in selecting the respondents. They were asked to rank the level at which construction professionals should be involved in design stage, awareness of buildability concept, the most suitable procurement method that enhances buildability. The questionnaire also requested respondents to rank level
at which some listed factors discourage buildability programme, the level at which some factors are given consideration in their design and to suggest possible solutions to buildability problems. The extent to which buildability programme is adhered to (ranging from poor to excellent) was investigated, also views of respondents on ways and means of promoting buildability such as: making buildability programme a regulation, involvement of builders in the design stage were investigated. Also, the effect of non-inclusion of construction professionals at the design stage, in achieving buildable design for construction project was studied. The most common problems encountered during buildability analysis, were part of the major issues covered in the questionnaire. The questions were based on Likert scale. These ranking ranges from 0 = not important to 4 = very important.

In view of the fact that the central limit theory states that a sample size of thirty (30) and above, is large enough for any research work (Dawdy and Wearden 1985) The total number of questionnaires administered was 40, out of which 30 were received and this represents 75% of the response expected, 37% were Architects, 40% Builders/Constructors and 23% Quantity surveyors and Engineers. It was discovered that 17% of the respondent have 0-5 years working experience, 33% have 6-10 years working experience and 50% have 10 and above years working experience.

A structured interview was also undertaken to cover some areas which were not covered in the questionnaire and to confirm the results of the field survey. Experienced professionals in the built environment were selected. Three professionals from: Architecture, Building, Civil engineering, and Quantity surveying

THE LEVEL OF PROFESSIONALS’ PERCEPTIONS OF BUILDABILITY CONCEPT

Respondents’ understanding of the concept of design analysis was first and foremost, established by presenting to them various definitions of the concept, some were correct while others are wrong they were requested to choose. Result of investigation shows that quite a number of the respondents who are professionals in the built environment, unfortunately have perception which is at variance with the buildability analysis. As can be seen in Table 1, there are those who view buildability as interference by the constructors (32%) while others, regard buildability and maintainability analysis as an effort by “non-professional” to assess professionals’ work (18%). Additionally, when the result was closely examined, it was observed that more than 75% of those that chose these answers were architects and design engineers. it was further confirmed by the oral interview; in which many designers oppose the issue of buildability and maintainability/ design analysis and the idea of bringing the builder/constructor at the design stage - for the fact that the builder is, what Ferguson (1989) described, ‘as a practical man” for the designer to benefit from his experience.

Investigation was also carried out to obtain the views of respondents on level of awareness of buildability in the construction industry in Nigerian construction industry. Result of their response shows that 36% maintain that there is no awareness of the concept at all, while 57% noted that there is no adequate awareness and only 7% observed that there is sufficient awareness of buildability concept in Nigerian construction industry. Result of Oral interview also shows that buildability is a “strange word” in the Nigerian construction industry. In other words, many professionals don’t know it and, are highly against it. There are many (especially
designers) who claimed that it is uncalled for; according to them, that is why there is no “buildability” in the dictionary

Table 1: Professional’s Perception of Buildability

<table>
<thead>
<tr>
<th>S/N</th>
<th>Definitions</th>
<th>Percentage of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>An attempt to interfere into issues that is purely not within the province of builders/constructors</td>
<td>32</td>
</tr>
<tr>
<td>2.</td>
<td>Extent to which the design of a building facilitates ease of construction, subject to the overall requirement - for the completed building.</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Optimum integration of construction knowledge &amp; experience in planning, engineering, procurement and field operations to achieve overall project objective</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Checking/assessment of what the designer has prepared</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>The degree to which the design is construction friendly</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Buildability in the curriculum of Universities and Polytechnics

An investigation of the training that students received with regards to buildability and maintainability was carried out. This was achieved by taking a survey of the universities and polytechnics in North West geo-political zone. In which the syllabus of building, architecture and civil engineering were examined. Result of the study showed that only one department in one university, out of seven universities, has buildability and maintainability analysis in their curriculum. However all of them have building construction as a subject in their programme. In case of the department of architecture in all universities and polytechnics, they have construction methodology as part of their programme. It was noted that the polytechnics, have uniform curriculum prepared by the National Board of Technical Education, NBTE (though there is provision for each polytechnic to add few courses to take care of local needs). However, there are no provisions for buildability in the curriculum.

Buildability Practice

Table 2: Extent to Which Professionals Undertake Buildability Analysis

<table>
<thead>
<tr>
<th>% of professionals</th>
<th>Always</th>
<th>Sometimes</th>
<th>Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>63</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

The respondents were also requested to state the frequency of carrying out buildability analysis before construction. Result shows that 63% of the respondents do not always carry it out, 17% always undertake buildability analysis and 20% do not carry it out at all, this is represented in table 2. This means not all professionals undertake
buildability analysis. This will not only affect the smooth running of construction work but also construction efficiency and the rate of maintenance work.

Result of the oral interviews shows that many of the major technical problems faced during building production can be traced to design. This could be attributed to, among others, lack of buildability analysis.

**The Extent of Adherence to the Best Practice in Buildability in the Nigerian construction industry**

The degree of adherence to the best practice in buildability analysis in Nigeria was studied, in which respondents were given options to rank from “poor” to “excellent”. From their answer, 73% of Architects noted that there is fair adherence while 27% were of the view that there is good adherence, 25% of builders said there is poor adherence, 25% said there is good adherence and the other 50% said there is a fair adherence to the best practice in buildability analysis, 14% of quantity surveyors/Engineers were of the view that there is a poor adherence, 26% said there is good adherence and the others 60% responded that there is a fair level of adherence of professionals to buildability programme in Nigeria. This can be seen in Table 5. The study also made further effort to confirm the assertion made by respondents on issue by requesting for and assessing the report that is supposed to be prepared after undertaking buildability and maintainability analysis.

In addition, check lists which summarized the major steps that are supposed to be followed when undertaking buildability analysis and a list containing standardized areas that are checked during the buildability analysis were prepared and used to assess the buildability and maintainability practice in the Nigerian construction industry.

These two tables were used to investigate the practice. Initially each step was to be assessed using a scale of 1-5, from poor – excellent, respectively. However, most of these steps in table A1 (in Appendix) were not followed, while construction professionals do not prepare the report. Thus the form used in preparing buildability analysis report, which contains issues as shown in table A2 was not used.

<table>
<thead>
<tr>
<th>Professionals</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architects</td>
<td>0%</td>
<td>73%</td>
<td>27%</td>
</tr>
<tr>
<td>Builder</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>Quantity surveyor/Engineer</td>
<td>14%</td>
<td>60%</td>
<td>26%</td>
</tr>
</tbody>
</table>

From the result of the survey on the extent of adherence, it can be seen that there is consensus of opinion that the level of adherence to the best practice is not excellent or even very good. However, majority of the respondents noted that the extent of adherence is fair. This means the professionals that carry out buildability analysis do not have the required skill and knowledge of it.

**Factors that Affect Buildable Design**

Respondent were asked to rank, the level at which some factors affect design. Result shows that three major factors were ranked highest. These factors are: clients’ commitment, construction experience of designer and contribution of professionals other than designers.
Table 4: Factors that Affect Buildable Design

<table>
<thead>
<tr>
<th>Professionals</th>
<th>Clients’ commitment</th>
<th>Construction experience</th>
<th>Contribution of other professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architects</td>
<td>36%</td>
<td>64%</td>
<td>0%</td>
</tr>
<tr>
<td>Builder</td>
<td>16%</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td>Quantity surveyor/Engineer</td>
<td>0%</td>
<td>86%</td>
<td>14%</td>
</tr>
</tbody>
</table>

From Table 4, it can be observed that the highest percentage of factors that affect buildable design is lack of construction experience by designers. However, the architects were of the view that other professionals have nothing to contribute to buildable design, while 42% of builders were of the view that other professionals have a role to play in producing buildable design. On the other hand, quantity surveyors were of the view that clients’ commitment has no influence on the buildable design. This is an indication of the fact that many professionals do not have clear understanding of the concept and its relevance. Also, it is a good indicator of the reason why there are problems associated with it in view of the fact that an important prerequisite to undertaking buildability analysis is cooperation.

**Extent to Which Professionals Should Be Involved in Design Stage**

Respondents were requested to rank the degree to which construction professionals should be involved in design stage, their response in Table 5 shows that 50% of builders ranked equal involvement of builders and designers, 42% ranked the designers involvement as the highest rank followed by builders and 8% ranked builders first before designers. 9% of Architects ranked equal involvement of designers and builders, 82% of ranked Architects’ involvement higher than builders and others and 9% ranked no involvement of builders in design stage. 50% of Quantity surveyors/Engineers ranked equal involvement of designers and builders and 50% ranked designers higher than builders and other professionals in design stage.

Table 5: The Degree at which Professionals Should Be Involved in Design Stage

<table>
<thead>
<tr>
<th>Professionals</th>
<th>Equal involvement</th>
<th>Designers higher</th>
<th>Builders higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architects</td>
<td>9%</td>
<td>82%</td>
<td>9%</td>
</tr>
<tr>
<td>Builder</td>
<td>50%</td>
<td>42%</td>
<td>8%</td>
</tr>
<tr>
<td>Quantity surveyor/Engineer</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Respondents were also demanded to give their opinion if builders should be allowed in design stage as part of the design team, so as to benefit from their experience, from their response, 100% of builders gave a “yes” answer while 91% of the architects disagree.

Oral interview revealed that designers regard constructors or builders as professionals with no adequate level of design knowledge to participate in design development. This is a clear indication of the fact that there is lack of cooperation among professionals in the built environment in Nigeria. This is a stumbling block to buildability analysis.
Procurement Method that Enhances Buildability

For the fact that there is consensus of opinion among the respondents (90%) that the traditional contract procurement system is the most widely used procurement system, they were asked to suggest the best procurement method that enhance buildability programme. Result showed that 63% of the respondent suggested “design and build”, 17% recommended construction management while 20% were of the view that management contracting is the best procurement method that best boosts buildability. Thus most of the respondents preferred Design and Build method of procurement, perhaps due to the fact that, design and build method of procurement allows design and construction to be handled by the same firm and the processes are not treated by different professionals order than the ones in the firm. This agrees with Medugu et al (2012) findings in which they noted that stakeholders’ overall ranking also showed that design and build is the most favored method in terms of support to buildability.

Factors that inhibit the Practice of Buildability in the Nigerian Construction Industry

Investigations on the major factors that impede the practice of buildability were carried out. Result of such a study is presented in Table 6.

1=Not important; 2= Less important; 3= Important; 4= Very Important

<table>
<thead>
<tr>
<th>S/N</th>
<th>Common Problems Associated with Buildability Practice in Nigerian Construction Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Absence of cooperation and effective communication between designers and constructors.</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Lack of awareness of buildability concept</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>Deficiency of necessary skill to carry out design analysis by the constructors.</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Most Designs are not Complex</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>No enabling environment such as request by the client/Inclusion in National Building Code</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>Designers view it as a way of challenge to them</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>There is no much effort on the part of professional bodies especially, to educate their members on the importance, procedures and need for cooperation among professionals in the industry.</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

FINDINGS

Level of Perception of Respondents

Looking at the result of an investigation on the level of perception of professionals as regards to the concept of buildability, it can be observed that there is a divided opinion on their own understanding of the concept. For, 32% of respondents regard it as interference by the constructors/builders on issues that is purely not within their area of specialization. Another 18% view it as an assessment of what the designer has
prepared. Thus 50% of the respondents have wrong perception of buildability. Result of oral interview confirms this; because most of the respondents, especially architects were completely against their design to be subjected to buildability and maintainability analysis or constructor’s input at the design stage. According to them constructors do not have the required training to do that. On the whole, close study of the entire results showed that there is lack of understanding of the rationale behind buildability and what it entails. Large section of the respondents seems to misconstrue the concept to mean builder is to check what designers have prepared.

**Buildability Practice**

Results of a survey on the extent to which buildability is undertaken by professionals, shows that only 17% carry out such an important exercise. This is to be expected in view of the fact that large section of the respondents do not understand the concept as well as regard it as a challenge to them. Besides, an investigation on the extent of adherence to the best practice clearly shows there is still room for improvement. This is because among the few that undertakes buildability, none of the respondents rated the practice in Nigeria as excellent. Majority (75%, 53% and 60%) of the architects, builders and Quantity Surveyors/Engineers, respectively rated the practice as fair. In an effort to come up with good judgment of the quality of buildability carried out, a checklist (with a summary of the major steps) was used to confirm the observations made by respondents on buildability. Result shows that careful study of production information is usually carried out but not in a systematic and holistic way that buildability and maintainability analysis requires. This include, as a major part of the buildability analysis, writing a report on the problems identified and meeting with design professionals so as to raise these problems with a view to proffering solution. However result of the study shows that there is no any report prepared after the exercise and no formal meeting organized. Thus, professionals do not put their ‘heads together’ for solution to buildability problems, as they ought to. It means it may not necessarily achieve the desired objective.

**Constraining Factors Affecting Buildability Practice**

From Table 6 it can be noted that there is a consensus of opinion among respondents that three (3) factors, with a mean of over 3.0, are the major problems affecting buildability practice in the building industry in Nigeria. These are: Deficiency of necessary skill to carry out design analysis by the constructors, (with a mean of 3.5), negative view of the concept by designers, in which it is regarded as a challenge to them (3.5) and lack of general awareness of buildability concept (3.4). However lack of effort by professional bodies to educate their members is not regarded as an important problem that act as a constraint to the practice. This could be due to the fact that many of the respondents are aware of the effort made by professional bodies to organize workshops on important issues. Among these bodies is the Nigerian Institute of Building, NIOB, which has organized workshops on buildability. According to one of the respondents, attempt was made to put buildability in the National Building Code, NBC, 2006. However such a proposal was vehemently opposed by the architects. It was further observed that major problem associated with buildability has to do with very wrong perception of the philosophy behind the concept and the inability of professional bodies in the construction industry in Nigeria, to develop a very good culture of dialogue and communication among them. Another major impediment (based on the account of respondents in the oral interview, is continued use of the traditional contract procurement method even though it may not be suitable for all types of contracts.
**Involvement of Constructors in Design Stage**

As it can be seen from Table 5 majority of Architects stated that designers have the outmost relevance in a buildable design, other professionals have noted that both designers and builders are of equal relevance in the outcome of a buildable design so they should have equal involvement in design stage of any project. From this result it can be noted that a lot of designers see no relevance of having a builder’s input in the production of a buildable design, this is to say that no recognition of the relevance of builders’ idea or the knowledge of construction in design and this is a big impediment to a good and buildable design. This confirms the observation made by Mbamali (2008), that “until recent times the builder had the chance to join the professional team only after completion of the design and preparation of tender document”. It is a well-known fact worldwide that when design team and construction team are closely together from the beginning of a building project, the ensuring structure will have relatively little or no problems (Anthony, 2008).

Table 5 represents the respondents’ opinion on the factors that affect buildable design and shows that the highest factor that affects buildable is lack of construction experience of designers. From Table 5, builders are not seen as very relevant in design, and from Table 4 the major problems in buildable design production is the lack of construction experience which can major be seen in builders. In this research it can be noted since lack of construction experience by designers is a major factor that affects buildable design, builders’ input in design stage is of paramount importance since they have more construction knowledge and experience.

Majority of the respondents (63%) chose “design and build” as the best procurement method that enhances buildability programme in Nigeria. This procurement method allows design and construction to be handled by a single firm or contractor; this reduces segregation of design from construction and as such provides opportunity for builders’ or constructors’ input in design. Communication in this context deals not just with the mode of interaction between professionals but also with the way a design can adequately communicate the goals to be achieved in the construction project. This can be due to factors such as omission, errors, wrong dimension or detailing etc.

According to Bamisile, (2004), the procurement method chosen for a project will determine the relationship, obligation and the line of communication between the client, consultants and constructors or builders. This means that unsuitable procurement system may lead to poor communication between stake holders. This impedes buildabilty programme in Nigeria, according to the result gotten from this research.

**CONCLUSION AND RECOMMENDATIONS**

Based on the results, analysis and discussions, the following conclusions were drawn:

The level of perception of the concept of buildability is, generally low, especially among the designers. Likewise the constructors lacked constructability knowledge that link constructability issues to design decisions. Besides that, lack of awareness of buildability concept, deficiency of necessary skill to carry out design analysis by the constructors and non-inclusion of constructors input at the design stage are major constraints of buildability programme in the Nigerian construction Industry. The extent to which buildability is carried out is, generally very low and the practice does not conforms to the best practice. Additionally, lack of construction experience by designers is a factor that greatly affects the production of a buildable design. This
shows that most designers lack sufficient construction knowledge and experience and construction experience has a great relevance to the production of buildable design. It was noted that the procurement method that best enhances buildability programme is the “design and build” method. Finally it was noted that there is no enabling environment for the carrying out of buildability programme in Nigeria.

**Recommendation**

1. The construction industry in Nigeria should find ways and means of promoting effective communication between professionals in the construction industry.

2. Professional bodies should carry out mandatory training programme from time to time for their members in order to acquaint themselves with the latest knowledge in their field.

3. The industry should be flexible in selecting contract procurement method for construction project. The choice should be based on many factors such as nature and complexity of the project, cost, etc. to that extent all projects should explore ways and means of benefitting from the experience of constructors/builders.

4. In view of the fact that construction work is a team work, one of the important prerequisite for the successful execution of such an undertaking is cooperation; this can only be possible if there is mutual respect and recognition of each of the professional’s role and value. As such, professional bodies and higher institutions should find ways of ensuring good understanding among professionals in the construction industry in Nigeria – possibly using curriculum.

5. The National Building Code, NBC 2006, should be enforced. Buildability and maintainability analysis should be Included in the NBC 2006 so as to create an enabling environment for the practice of buildability and maintainability analysis.

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### APPENDIX A

**Table A1: Summary of the Major Steps in Buildability Analysis**

<table>
<thead>
<tr>
<th>S/No</th>
<th>Major Steps</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparatory Work</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Request &amp; collection of production information and regulations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open register &amp; record the collected information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preliminary study.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site visit (Reconnaissance survey)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Detailed Examination of Production Information and Regulations</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Identification of Areas worthy of Builders/Constructors Attention</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Preparation of Report</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Discussion with Designers and Project Coordinator.</td>
<td></td>
</tr>
</tbody>
</table>

**Table A2: Summary of the Areas worthy of attention in Buildability Analysis**

<table>
<thead>
<tr>
<th>S/No</th>
<th>Areas worthy of Attention</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dimensional Coordination</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2</td>
<td>Tolerance</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Discrepancies</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Omissions</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Errors</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Variety</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Conversion</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Handling</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Personnel Skill</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Details</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Spare Parts</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Access of Maintenance</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Guidelines for Maintenance</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Buildability Factor</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>General Comments</td>
<td></td>
</tr>
</tbody>
</table>
AN APPRAISAL OF CHALLENGES FACING COMPETITIVE TENDERING IMPLEMENTATION IN PUBLIC WORKS PROCUREMENT IN CHAD REPUBLIC

Sazoulang Douh1, E. Badu, T. Adjei-Kumi and E. Adiniyira

Department of Building Technology, KNUST, Kumasi, Ghana

Competitive Tendering is widely recognized as an attractive procurement mechanism and is commonly advocated by international organizations due to its widespread benefits. In Chad, despite the reforms undertaken since 2003, the implementation of Competitive Tendering is still characterized by low rate (25%) of projects execution due to excessive delays in the treatment of projects, abusive use of derogations (60%) in the award of contracts, concentration of many contracts (28%) into the hands of few contractors, and projects’ overprices reaching 40%. As result, the performance of the works procurement process is very poor. The objective of the study is to appraise the challenges facing the implementation of competitive tendering in works procurement. A series of structured exploratory interviews were held with policy and decision makers among senior public officers to complement and/or corroborate initial observations and findings from literature review. Besides, a questionnaire using a 5-points Likert scale is employed to rank the 15 potential challenges and related issues identified. The study reveals the following major challenges: delay, ignorance and complexity of procedures, rigidity and incompleteness of regulations, lack of qualified personnel, lack of adequate equipment, poor funding of activities and entities, institutional weaknesses, corruption, political interferences. The study recommends that these challenges must be addressed through development of well-articulated long-term strategies among which a thorough review of the processes and procedures to mitigate delays and corruption.

Key words: Competitive Tendering, Challenges, Works Procurement, Delay, Chad

INTRODUCTION

In construction industry, Competitive Tendering (CT) is a procurement method whereby contractors are invited to make a firm and unequivocal offer of the price and terms which on acceptance shall be the basis of subsequent contract (Oladapo, 2000). So, competitive bids are submitted on the same basis, under the same conditions and using the same criteria for evaluation (Adetola, 2000). Consequently, CT is widely recognized as an attractive procurement mechanism and is commonly advocated by international organizations like World Bank, European Union, African Development Bank, OECD-ACD. As a result, the majority of developing countries prescribed CT as the prime method of public procurement due to its widespread benefits. These include promoting competition and hampering corruption (Steven and Patrick, 2006), reducing cost by broadly 20% (Simon et al, 2005) and providing the enabling environment for effective utilization of scarce resources in the economy (Dikko,

1 sazoumata@gmail.com

2000). Besides, when performed effectively, CT is capable of achieving project delivery in a timely and cost effective manner (Oladope, 2000).

Although Competitive Tendering appears to be the most acceptable method of selecting contractors in the world (Akubueze, 2000) and the most beneficial to local construction industries (Oladope, 2000), yet its implementation has been the most difficult in developing countries. Despite the reforms of Policies, Acts, Regulations and Procedures, effected at the beginning of 2000s, public procurement practices remain still questionable. In fact, CT does not benefit fully to developing countries as expected due to many challenges related to laws and regulations, institutions and structures, personnel, fraud and corruption, and above all the lack of good performance management (Ofori, 2009; Collins et al., 2011; Patrice, 2008). Inevitably, the persistence of questionable public procurement practices has led to Paris Declaration on the Aid Effectiveness for partner countries, which declaration stressed the urgent need for improvement of public procurement practices (OECD-ACD, 2005).

In Chad for instance, these challenges have generated excessive delays (75%) in project delivery, abusive use of derogations (60%), award of up to 8 contracts to a single contractor or incapable contractors, projects’ overprices (40%), preventing hence CT for yielding the expected widespread benefits. These poor results of CT implementation in Chad are constantly reported by OCMP (2008 to 2010), Patrice (2008), and CSCR (2006 to 2010). The worst is that many contracts fail to meet Government expectations due to poor performance of tendering procedures. For example, more than 70% of loose of time and cost in construction projects were attributed to ‘biased award of contracts’ which could throw site work into disarray even abandonment (CSCR, 2009).

Owing to the various advantages offered by CT method, any improvement in its effective implementation is urgently needed in developing countries. Therefore, the objective of the study is to appraise challenges facing the implementation of CT; that could be a starting point of the improvement of public procurement performance in Chad as well as in any developing country.

Following this introduction, the rest of the paper is structured into four sections. The first section gives a brief profile of the study area and the identification of challenges through literature review. The second section is consecrated to the method adopted whilst section three presents the results and discussion. Finally, the last section deals with conclusions and recommendations.

CHALLENGES FACING THE COMPETITIVE TENDERING IN CHAD

Before exploring through literature the potential challenges confronting competitive tendering, a brief profile of Chad Republic is given to fix the country specific context in which the study is conducted.

2.1. Chad Republic Profile

Chad Republic is a big land of 1,284,000 sq.km situated in Central Africa with little population of 10.5 Million (Institut National des Statistiques du Tchad (INST), 2009). The country accessed to its Independence since 11 August 1960 but its economy has long been handicapped by its landlocked position which is both a disadvantage and barrier for developing Chad (Liam and James, 2009). With a per capita income of
$1,600 and the rate of GDP growth of 0.6% (OECD, 2010), Chad is ranked 170 out of 177 in the Human Development Index (UNDP, 2011) and classified as the 12th poorest country in the world by the World Bank (WB, 2011). According to US Bureau of Economic, Energy and Business (2011), Chad’s commercial climate suffers from limited infrastructure, chronic energy shortages, high energy costs, scarce skilled labor, high tax burden and corruption. Fortunately enough, the Chadian construction industry started growing; boosted by financial resources drawn from oil exploitation since 2004. As illustration, table 1 below presents amounts spent in construction projects from 2007 to 2010 (OCMP, 2010). Consequently, the contribution of the Construction Industry to the GDP has risen from 4 in 2006 to 7% in 2011 (OECD et al. 2012).

Table 1: Evolution of expenditures in construction projects

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Contracts</th>
<th>Total Amount of Works’ Contracts in CFA</th>
<th>% of negotiated Contracts</th>
<th>% of awarded Contracts</th>
<th>No of Contractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>162</td>
<td>251,073,017.000.00</td>
<td>30.00 %</td>
<td>70.00 %</td>
<td>85</td>
</tr>
<tr>
<td>2008</td>
<td>184</td>
<td>119,460,000.000.00</td>
<td>51.40 %</td>
<td>48.60 %</td>
<td>88</td>
</tr>
<tr>
<td>2009</td>
<td>202</td>
<td>385,313,000.000.00</td>
<td>55.00 %</td>
<td>45.00 %</td>
<td>85</td>
</tr>
<tr>
<td>2010</td>
<td>140</td>
<td>446,949,887,781.00</td>
<td>60.00 %</td>
<td>40.00 %</td>
<td>72</td>
</tr>
</tbody>
</table>

Source: Author survey (2013) compiled from OCMP annual reports

Although the tendency is at the rapid growth, the local construction industry is still confronted to excessive bureaucracy that delays every process, weak materials supply base that maintains very high prices, financial uncertainties and uncontrolled inflation, unregulated labor market and poor management practices (Patrice, 2008). He added that in spite of the passage of the Public Procurement Act 2003, (Act 503) and the establishment of a procurement cadre in government ministries, State Great Institutions and Public Agencies, the procurement system is not functioning as it ought to and is rather riddled with corruption, fraud and irregularities. Again, political interferences, weak technological capacity, economic and structural conditions prevailing, have also been reported as in many other developing countries (Ofori, 1999, CCSRP, 2008).

Further, as shown above in Table 1, an average of 50% of contracts is awarded through negotiation procedure (OCMP, 2008) which is perceived as one of incentives to corruption and fraud (UNDP, 2004; OECD, 2009). Again, using massively negotiation method is considered as a breakage of laws and regulations (PPA, 2003). That is why, in Chad as well as in most of developing countries, the reform of public procurement may still be considered as work-in-progress. Certain improvements have been made but much remains to be done to achieve competitive, transparent, uncorrupt and competently managed procurement systems opined Alfonso et al. (2009). Obviously, notwithstanding this progress, challenges as the poor performance of procurement system and the lack of procurement managerial and technical capacity are depriving Chad of CT benefits. Such situation is imputable to the lack of appropriate responses given to persistent and recurrent issues. Therefore, appraise these challenges becomes necessary and urgent in Chad.
Potential Challenges facing the implementation of CT

Public procurement is a multi-faceted challenging field; and public procurement practitioners have faced numerous challenges caused by internal and external factors (Thai, 2006). For instance, in Southern Asia, David (2007) identified six (6) following challenges and obstacles facing public procurement: legal framework, institutional and human resource capacity, competition and access, corruption, transparency and decentralization. In Bangladesh, Shakel (2010), asserted that the implementation of procurement process is far from satisfactory, due to poor advertisement, short bidding periods, poor specifications, nondisclosure of selection criteria, contract awards by lottery, one-sided contract documents, negotiations with all bidders and rebidding without adequate grounds, occurrence of corruption involving donor agency are not uncommon at nationally or globally and or other levels. In Kenya, challenges are similar to those in Bangladesh and Southern Asia with a serious concern about procurement capacity (Mette et al., 2007). None the less, most developing countries are facing rapid changes in public procurement requirements that are impacting pressure on how the procurement function performs its internal and external processes and procedures in order to achieve its objectives (Kakwezi and Nyeko, 2008). According to Thai (2011), interactions between various elements, professionalism, staffing levels and budget resources, procurement organizational structure whether centralized or decentralized, procurement regulations, rules, and guidance, and internal control policies, all need attention and influence the performance of the procurement function. In Chad specially, the accelerated development of public infrastructures and equipment projects since 2007, has boosted the local construction industry but has also revealed some following challenges namely delay, weak and incomplete legal frame, poor institutions and procurement capacity, so on son forth.

Delay is the first challenge acknowledged by the majority of stakeholders interviewed like asserted John et al. 2011 : “It is a rare construction project which begins on time or which is completed within the time allocated in the contract”. In Chad, delays have led to a very low rate (25%) of projects execution (CCSRP, 2006). Incontestably, lateness is registered at all levels of the process and consequently, every project has to experience delay without any tangible reason. For instance, a contract can last more than six (6) months before being approved (OCMP, 2007).

Secondly, rigid and incomplete laws, vague and flexible regulations and complex or ambiguous procedures, have given room to massive violations, abusive use of derogations in the award of contracts that has reached 60%, inconsistency, confusion and lack of transparency and public accountability (OCMP and CCSRP, 2009). Other issues as obsolescence of laws and regulations and absence of some key implementing decrees and manuals are also mentioned. The ignorance of how the public procurement operates (Thai, 2011) and lack of laws and regulations enforcement (Collings, 2011) have been the principal causes of these challenges.

Another major challenge is the poor performance of procurement Institutions. The lack of personnel in quantity and quality, lack of working equipment, lack of adequate offices and premises, lack of funds, and deficiency of institutional, administrative, legal and regular frameworks are identified as constraints to smooth functioning of procurement entities. David (2007) asserted that one of the factors contributing to the failings in public procurement in Southeast Asia has been the absence of central procurement authorities to oversee procurement policy and practices, to review procurement rules, draft bidding documents, advertise intended procurements, and
monitor compliance with the rules. In Chad also, regulatory and audit bodies are absent in the scene rendering difficult some procurement operations. Corollary, the capacity deficiency affects in many cases the ability of the procuring authority to properly follow the procurement rules and thus obtain the required outcome from a procurement procedure. The OCMP’s 2010 annual report revealed that the poor capacity of personnel is the root cause of the very low performance of the institution. Other causes as poor qualification, lack of experience, overload of work, lack of motivation, deficiency in ethics and deontology, shortage of high qualified people, and so on and so forth are also reported by independent auditors when assessing human resource performance.

Besides, Overpricing is mentioned as a product of lack of competition which may arise from a bidding system subject to preferential margins, and quota restrictions, to discriminate against foreign suppliers. According to procurement officers interviewed, abnormally high prices are also attributed to the absence of the yearly updated official prices list, massive utilization of negotiation procedure, cartel problem, inflation of construction materials’ costs, monopoly of some contractors in certain domains, and corruption. Furthermore, CCSRP (2009) identified the lack of procurement plan and its publication, poor advertisement of invitations to tender, no publication of tender results, fraud, corruption, political interferences, and abuse of power as indicators of the lack of transparency in the system. Obviously, public procurement practitioners have always faced other challenges imposed upon by a variety of environment factors including market, legal, political, organizational, and socio-economic (Thai, 2006). Another external factor that came to light during the interviews is the problems caused by the mismatch between budgetary appropriations and the actual release of funds, which often prevents procuring authorities from meeting financial obligations to contractors.

In short, at least fifteen (15) potential challenges are found to be relevant in Chad and listed as follows: Delay, No respect to regulations, Complexity of laws and regulations, Length of procedures, Poor capacity, Poor performance of institutions, Overprice, Lack of transparency and public accountability, Poor openness, Absence of Equity and Fairness, Corruption, Political interferences, Abuse of power, Fraud, Absence of Regulatory and Control bodies. All these variables, not exhaustive, are to be assessed using the method adopted below.

**RESEARCH METHODOLOGY**

The adopted method uses both qualitative and quantitative strategies with interview and questionnaire as primary data collection instruments. Such mixed approach was adopted by many researchers in the field of Construction Management (Kumar, 2005; Mohamed, 2007; Pana et al, 2010). Indeed interview is used to investigate into major challenges facing the implementation of CTP, while the questionnaire is used in the establishment and ranking of identified variables. Hence, a set of 21 questions extracted from literature review has formed the interview schedule. A series of exploratory interviews were held with seven (7) key informants to complement and/or corroborate initial observations from literature review. Based on literature review and in-deep interviews results, a questionnaire draft was designed where respondents are asked to identify, assess and/or rank various items using a 5 points Likert scale (i.e. 1 = not important, 2 = of little importance, 3 = moderately important, 4 = important and 5 = very important).
The targeted population comprises public procurement bodies, contracting authorities, procurement entities and units, tender committees, control and inspection units plus few consulting firms, contractor firms, sponsors and independent experts that are daily involved in procurement transactions. In total, the population size is 56 that was considered as sample.

Out of 56 questionnaires issued, 31 valid questionnaires representing 57.5 % were returned. Weighted mean rating and severity indices are computed and used to rank major challenges and related issues. A variable scoring a severity index of 70% or more is considered as relevant and adjudged important (Elhag and Boussabaine, 2002). Lastly, the coefficient of variation is computed using standard deviation and weighted mean of variable to compare relative variability of different responses.

### RESULTS AND DISCUSSION

<table>
<thead>
<tr>
<th>Code</th>
<th>Major Challenges</th>
<th>Weighted Mean</th>
<th>Severity Indices</th>
<th>Standard deviation</th>
<th>COV in %</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delay in the processing of CT document</td>
<td>4.03</td>
<td>80.67</td>
<td>0.096</td>
<td>2.390</td>
<td>1st</td>
</tr>
<tr>
<td>2</td>
<td>No respect to regulations and legal time-limits</td>
<td>3.90</td>
<td>78.00</td>
<td>0.062</td>
<td>1.589</td>
<td>2nd</td>
</tr>
<tr>
<td>3</td>
<td>Complexity of laws and regulations of CT</td>
<td>3.10</td>
<td>62.00</td>
<td>0.145</td>
<td>4.664</td>
<td>14th</td>
</tr>
<tr>
<td>4</td>
<td>Length or duration of CT procedures</td>
<td>3.80</td>
<td>76.00</td>
<td>0.036</td>
<td>0.951</td>
<td>4th</td>
</tr>
<tr>
<td>5</td>
<td>Poor capacity of personnel in charge of the implementation of CT</td>
<td>3.80</td>
<td>76.00</td>
<td>0.036</td>
<td>0.951</td>
<td>4th</td>
</tr>
<tr>
<td>6</td>
<td>Poor performance of structures in charge of the implementation of CT</td>
<td>3.80</td>
<td>76.00</td>
<td>0.036</td>
<td>0.951</td>
<td>13th</td>
</tr>
<tr>
<td>7</td>
<td>Generalized and systematic overprice of bids</td>
<td>3.60</td>
<td>72.00</td>
<td>0.015</td>
<td>0.430</td>
<td>10th</td>
</tr>
<tr>
<td>8</td>
<td>Lack of transparency and public accountability</td>
<td>3.80</td>
<td>76.00</td>
<td>0.036</td>
<td>0.951</td>
<td>4th</td>
</tr>
<tr>
<td>9</td>
<td>Poor openness of the competition in CT</td>
<td>3.63</td>
<td>72.67</td>
<td>0.007</td>
<td>0.190</td>
<td>12th</td>
</tr>
<tr>
<td>10</td>
<td>Absence of Equity and Fairness in the award of contracts</td>
<td>3.73</td>
<td>74.67</td>
<td>0.019</td>
<td>0.507</td>
<td>7th</td>
</tr>
<tr>
<td>11</td>
<td>Corruption in the acquisition of contracts</td>
<td>3.83</td>
<td>76.67</td>
<td>0.045</td>
<td>1.168</td>
<td>3rd</td>
</tr>
<tr>
<td>12</td>
<td>Political interferences in the award of contracts</td>
<td>3.73</td>
<td>74.67</td>
<td>0.019</td>
<td>0.507</td>
<td>7th</td>
</tr>
<tr>
<td>13</td>
<td>Abuse of power in the award of contracts</td>
<td>3.67</td>
<td>73.33</td>
<td>0.002</td>
<td>0.047</td>
<td>10th</td>
</tr>
<tr>
<td>14</td>
<td>Fraudulent practices (swindling)</td>
<td>3.73</td>
<td>74.67</td>
<td>0.019</td>
<td>0.507</td>
<td>7th</td>
</tr>
<tr>
<td>15</td>
<td>Absence of Regulation body</td>
<td>2.90</td>
<td>58.00</td>
<td>0.196</td>
<td>6.767</td>
<td>15th</td>
</tr>
<tr>
<td></td>
<td>Average =</td>
<td>3.66</td>
<td>73.24</td>
<td>0.05</td>
<td>1.44</td>
<td></td>
</tr>
</tbody>
</table>
In this section, research results are presented and discussed accordingly. First, responses rate of 57.50% seems satisfactory in Chad because similar studies undertaken by the author in 2008 and 2010 recorded respectively 45% and 51%. The majority of respondents (56.4%) had more than 5 years of experience in the Public Procurement practices. This indicates that the results may represent the point of view of experienced people. Then, out of the fifteen (15) potential challenges identified, thirteen (13) items have scored Severity Indices (SI) more than 70%. Delay is the first major challenge with SI equals to 80.67% followed by the No respect to laws and regulations (78.00%), and Corruption in the acquisition of procurement (76.67%). Other variables like the lack of transparency and public accountability, poor capacity and length of the process, have identical score of 76% and ranked as important. Finally, Table 2 below presents the whole results and the six firsts will be briefly discussed.

Delay is ranked first confirming that delays on construction projects are a universal phenomenon (Syed et al. 2004; Theodore et al. 2009). In connection with delay, the study reveals that delay is very severe at the Contract Approval Process level (93%) and the Tender Evaluation Process level (77%). Otherwise, these figures confirm interview result. Meanwhile, Patrice (2008) estimated that tendering process could be successfully performed in Chad within 120 days. In addition, 80% of respondents agree on a period of four (4) weeks as optimum duration of both tender evaluation and contract approval processes; and twelve (12) weeks for the whole tendering process. In Europe for instance, an average duration for tendering process is found to be 108 days (Strand et al. 2011). Rwanda’s Government also has limited to 120 days the reasonable duration of tendering process for works project (RPPA, 2009).

Laws and regulations’ violations constitute the second challenge with a SI equals to 78%. The study also reveals that ignorance (SI = 78.00%), obsolescence (SI = 65.33%), and complexity (SI = 65%) are the main causes as displayed in Table 3 below.

According to David (2007), a major impediment in achieving effective public procurement in most developing countries has been the fragmentation, ambiguities and limited scope of laws, implementing regulations, and procedures. Furthermore, the lack of laws and regulations enforcement have generated poor performance of institutions and capacity, lack of transparency and public accountability, corruption and fraud, etc. Not surprisingly, corruption is ranked as the third major challenge in Chad.

<table>
<thead>
<tr>
<th>Code</th>
<th>Issues related to laws and regulations</th>
<th>Weighted Mean</th>
<th>Severity Indices</th>
<th>Standard deviation</th>
<th>COV in %</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>146</td>
<td>Ignorance of the texts</td>
<td>3.90</td>
<td>78.00</td>
<td>0.257</td>
<td>6.59</td>
<td>1st</td>
</tr>
<tr>
<td>144</td>
<td>Maladjustment of the texts to the current context of the country (obsolescence)</td>
<td>3.27</td>
<td>65.33</td>
<td>0.001</td>
<td>0.25</td>
<td>2nd</td>
</tr>
<tr>
<td>141</td>
<td>Complexity (difficult to understand) of the texts</td>
<td>3.25</td>
<td>65.00</td>
<td>0.008</td>
<td>0.25</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>Average =</td>
<td>3.27</td>
<td>65.47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In fact, the high score (76.67%) of Corruption confirms the International Transparency Report (2011). Corruption is a global issue given the importance and
diversity of the legal and regulatory arsenals put in place in the world for so many years (UNDP, 2011; OECD, 2009). Further, despite the international massive mobilization and joint effort in the battle against corruption, failure to eliminate significantly corruption in developing countries shows the complexity of the phenomena. To respond to that, Chad has initiated and even implemented many measures but once again, results remain unsatisfactory (Transparency International, 2011; FMI, 2011) due to the weak enforcement of laws and regulations. This leads to the next challenge which is the lack of transparency and public accountability that is supported by following indicators revealed by the study: excessive utilization of negotiation method than competitive tendering, absence of official publication of tendering results, no publication of annual procurement plans.

The poor performance of procurement institutions is characterized by the fact that out of the eleven (11) institutions, only one (i.e. OCMP) has a SI of 72.27%; all the rest is below the minimum of 70% (see Table 4 below). It was also found that constraints reducing the performance of institutions are the lack of qualified personnel and working means, and the lack of funds.

Table 4. Performance of different entities / structures

<table>
<thead>
<tr>
<th>Code</th>
<th>Performance of different entities / structures</th>
<th>Weighted Mean</th>
<th>Severity Indices</th>
<th>Standard deviation</th>
<th>COV in %</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>161</td>
<td>Public Procurement Board (OCMP)</td>
<td>3.63</td>
<td>72.67</td>
<td>0.210</td>
<td>5.773</td>
<td>1st</td>
</tr>
<tr>
<td>162</td>
<td>Contracting Authority (some ministries and institutions)</td>
<td>3.43</td>
<td>68.67</td>
<td>0.147</td>
<td>4.268</td>
<td>2nd</td>
</tr>
<tr>
<td>163</td>
<td>Technical units in charge of tender documents</td>
<td>3.27</td>
<td>65.33</td>
<td>0.094</td>
<td>2.872</td>
<td></td>
</tr>
<tr>
<td>164</td>
<td>Procurement Unit of Ministries</td>
<td>3.13</td>
<td>62.67</td>
<td>0.052</td>
<td>1.648</td>
<td></td>
</tr>
<tr>
<td>165</td>
<td>Tender Committee (COJO) of Ministries</td>
<td>3.27</td>
<td>65.33</td>
<td>0.094</td>
<td>2.872</td>
<td></td>
</tr>
<tr>
<td>166</td>
<td>Tender Evaluation Panel (SCTE)</td>
<td>3.40</td>
<td>68.00</td>
<td>0.136</td>
<td>3.999</td>
<td>3rd</td>
</tr>
<tr>
<td>167</td>
<td>Commission of Qualification/Selection of contractors</td>
<td>2.73</td>
<td>54.67</td>
<td>0.075</td>
<td>2.738</td>
<td></td>
</tr>
<tr>
<td>168</td>
<td>Commission of Pre-qualification of bidders</td>
<td>2.70</td>
<td>54.00</td>
<td>0.085</td>
<td>3.162</td>
<td></td>
</tr>
<tr>
<td>169</td>
<td>Procurement Appeal Board (CRRA)</td>
<td>2.27</td>
<td>45.33</td>
<td>0.222</td>
<td>9.812</td>
<td></td>
</tr>
<tr>
<td>1610</td>
<td>State General Inspectors body</td>
<td>2.57</td>
<td>51.33</td>
<td>0.128</td>
<td>4.969</td>
<td></td>
</tr>
<tr>
<td>1611</td>
<td>Chamber of counts of the Supreme Court</td>
<td>2.30</td>
<td>46.00</td>
<td>0.212</td>
<td>9.212</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average =</td>
<td>2.97</td>
<td>59.45</td>
<td>0.132</td>
<td>4.666</td>
<td></td>
</tr>
</tbody>
</table>

Another major challenge revealed by the study points the personnel issues. From Table 5 below, poor qualification (SI = 80%), deficiency in ethics and deontology (SI = 78.67%), complaisance in the recruitment (SI = 74.67%) are ranked as the important issues that undermining personnel performance. Though human resource capacity building has been recurrent concern, it is still not properly addressed in developing countries. As a result, there are vast differences in the staffing from one ministry to another. Not only that, there is a clear difference in levels of understanding of the procurement function between procurement officials and other stakeholders in the system.
The last but not the least is the Length of the process itself that can be considered as an internal challenge. Indeed, Patrice (2008) has identified 49 steps in Competitive Tendering Process from planning up to contract execution. As remedy, he recommended the cancellation of unnecessary approvals steps. But the idea of shortening the process alone stands as another challenge because it implies amendments of laws and regulations. Hence, how long would the lack of adequate processes and procedures continue to severely damaging the procurement system in Chad?

Table 5: Issues of Personnel in charge of Competitive Tendering

<table>
<thead>
<tr>
<th>Code</th>
<th>Issues of Personnel in charge of Competitive Tendering</th>
<th>Weighted Mean</th>
<th>Severity Indices</th>
<th>Standard deviation</th>
<th>COV in %</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td>Poor qualification of personnel</td>
<td>4,00</td>
<td>80,00</td>
<td>0,151</td>
<td>3,780</td>
<td>1st</td>
</tr>
<tr>
<td>152</td>
<td>Lack of experience in works procurement of the personnel</td>
<td>3,60</td>
<td>72,00</td>
<td>0,000</td>
<td>0,000</td>
<td>4th</td>
</tr>
<tr>
<td>153</td>
<td>Overload of work on the personnel</td>
<td>3,23</td>
<td>64,67</td>
<td>0,139</td>
<td>4,286</td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Lack of motivation of the personnel</td>
<td>3,60</td>
<td>72,00</td>
<td>0,000</td>
<td>0,000</td>
<td>4th</td>
</tr>
<tr>
<td>155</td>
<td>Complaisance in the recruitment of the personnel</td>
<td>3,73</td>
<td>74,67</td>
<td>0,050</td>
<td>1,350</td>
<td>3rd</td>
</tr>
<tr>
<td>156</td>
<td>Deficiency in ethics and deontology of the personnel</td>
<td>3,93</td>
<td>78,67</td>
<td>0,126</td>
<td>3,203</td>
<td>2nd</td>
</tr>
<tr>
<td>157</td>
<td>Shortage of personnel</td>
<td>3,10</td>
<td>62,00</td>
<td>0,189</td>
<td>6,096</td>
<td></td>
</tr>
<tr>
<td>Average =</td>
<td></td>
<td>3,60</td>
<td>70,67</td>
<td>0,135</td>
<td>3,742</td>
<td></td>
</tr>
</tbody>
</table>

To conclude this section, for procurement practices to change will require a change of mind-set amongst leaders and officials alike in which procurement rules are taken seriously at all levels and violations of these rules are not tolerated. In all probability, changes in the public administrations will only be achieved gradually, especially in Chad where malpractices are rather legitimized or have been taken for granted over a long period.

CONCLUSIONS AND RECOMMENDATIONS

As in many developing countries, despite the reforms undertaking for years, even when accompanied by the necessary institutional mechanisms, there is no sufficient improvement in the day to day transactions of works procurement through competitive tendering. Therefore the study reveals that the implementation of Competitive Tendering Process in Chad is facing many challenges that are more or less very acute. Out of the thirteen major challenges found, the six firsts high ranked are delay, no respect to laws and regulations, corruption, lack of transparency and public accountability, poor capacity and length of the process. The challenge of delay is observed at all levels added to a very long process difficult to be reduced. Laws and regulations are not respected and corruption is everywhere and high. In addition, procedures laid down in the reformed Public Procurement Act are either ignored or put aside or deliberately violated. Besides, the performance of procurement institutions and personnel in charge are poor.
From all what precedes, it is clear that all issues risen above have to be addressed properly and urgently. For this end, the study recommends a reassessment of the procurement system and the development of well-articulated long term strategies among which a thorough review of the processes and procedures to mitigate delays and corruption.

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AN ASSESSMENT OF CONTRACTOR’S RISKS EXPOSURE WITHIN SOME STANDARD FORMS OF BUILDING CONTRACT IN NIGERIA

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Department of Quantity Surveying, Ahmadu Bello University, P.M.B 1069, Zaria, Nigeria.

Construction projects are subjected to several risks due to different activities involved. The activities are performed by several parties under different circumstances. Among the various stakeholders the Contractor has been identified as the party that carries the highest number of risks. Contractors are always exposed to contractual risks which occur as a function of contract provisions and clauses. This research work identified and assessed the risks which Contractors are exposed to within some Standard Forms of Contract in Nigeria. It went further to determine the likelihood of occurrence of the identified risks as well as the impact of these risks on Contractors. Data were collected through questionnaires distributed to selected Contractors around Abuja and analysed using qualitative risk analysis technique. The research identified 35 potential risk factors with 54% of the risks emanating from the Clients, 31% from the Architect, 6% from the Quantity Surveyor, 6% from the Project Managers and 3% from the government agents. The study revealed that failures to write instructions regarding variations and documents which are not issued on time are the major potential risk factors with high likelihood of occurrence while the other risk factors have moderate likelihood of occurrence. Thirteen (13) potential risk factors were identified to have high impact on Contractors project delivery. Fifteen (15) risk factors represent high degree of risk. The study concluded that Contractors must understand the nature of risks, their source and the extent of exposure so as to pay attention to dealing with them appropriately. The study therefore recommended that Contractors should minimize the adverse consequence of these risks and maximize the opportunities that comes with it using appropriate risk management tools.

Keywords: contractual risk, standard forms of building contracts, contractors.

INTRODUCTION

The construction industry is a unique and dynamic industry of the economy; in Nigeria it accounts for over 1.4% of its Gross Domestic Product in addition to being a large employer of labour (Oluwakiyesi, 2011). But over the years it has been criticized for its expensive and wasteful nature, low productivity, quality problem and project delay. It is a generally recognized fact that those within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors. These uncertain situations according to Turner (1990) have made many projects to fall short of the desired objectives of cost, time, quality and satisfaction.

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Project Management Institute (2000) defines risk as an uncertain event or condition that if it occurs could have a positive or negative effect on the project objective. There are many risks involved in construction projects, which could be attributed to a number of reasons; amongst them are the nature of the construction process, the complexity and time-consuming design and construction activities, the involvement of a multitude of people, from different organisations, with different skills and interests, all resulting in accumulative associated risks for the project. Hence, a great deal of effort is required to co-ordinate the wide range of activities that are undertaken (Chapman and Ward, 1997; Shen, 1999).

Different project risks have to be allocated to the party to the project on the basis of who has best qualifications for dealing with any specific risk (Sou, 2000). However, in many projects there are attempts by parties trying to avoid risks as far as possible and let somebody else in the value chain deal with them. Majority of project risks are usually borne by contractors (Andi, 2006); this is because contractors are usually visible for almost the entire project life-cycle, hence contractors are exposed to risks and are constantly saddled with the responsibility of managing risks and uncertainties inherent in the project life-cycle.

Akintoye and Macleod (1997) in their study identified contractual risks as a fundamental risk in project management, recognized as having most adverse consequences on the successful completion of construction project. Contractual risks were also revealed to be the risks mostly encountered by contractors in Nigeria (Olatunji, 2007) and bearing the consequences of claims, disputes, disruption of work, stoppage of work, lack of co-ordination, delays and inflated costs. Since construction projects are often executed under contractual agreement and impose numerous obligations and duties on parties to the contract; this study intends to identify common contract provisions that form as risks to contractors within some standard forms of building contract in Nigeria.

This was informed by a study carried out in South Africa by Harinarain (2008) to identify and quantify contractors’ risk sources as imposed by Joint Building Contract Committee (JBCC) Principal Building Agreement Series 2000, their study found that the risk sources to the contractors (ranked from highest to the least) included the client, subcontractor, quantity surveyor, principal agent, architect, engineer, government authorities and suppliers. But as Chapman and Ward (1997) and Project Management Book of Knowledge (2008) observed that it was not enough to just identify risks and their sources without prioritizing them by assessing and combining their probability of occurrence and consequences, or impact. Williams (1996) too argued that proper consideration of project risk requires the consideration of both likelihood and impact of risk. This informed the decision to carry this study beyond the level achieved in the South African case with particular reference to Nigeria. The study would assist contractors to be aware of contract provisions that tend to increase their risk and also expose weak links in the construction process.

**LITERATURE REVIEW**

Risk is a challenging concept to define and understand, it often means different things to different people. Correia *et al* (1989) and Remenyi *et al* (1993) describes risk as a possibility that the actual input variable and the outcomes may vary from those originally estimated. Risk in relation to construction is seen as a variation in the process of a construction project whose variation results in uncertainty as to the final cost, duration and quality of the project (Buained, 1987).
Contractors and Project Managers in the study by Akintoye and McLeod (1997) perceive risks as a factor which can adversely affect the successful completion of a project in terms of budget and schedule, they also perceived risk as an opportunity to make profit and not something that will always have adverse effect. Zuofa et al., (2012) discovered that Contractors perceive risk as those factors that jeopardise their abilities to meet predefined project scope, cost and time and risks are depicted as any event that has a negative effect on their operations.

The general consensus in literature in the field of risk management has identified performance risk or technical risk, political risk, contractual risk, financial risk or economic risk and physical or geographical risk as risks that construction projects are exposed to. (Smith et al, 1998; Wang et al, 1999; Zaghloul et al, 2002; Khalafallah, 2002; Usta, 2005; Panthi, 2007).

It is believed that risks in construction are to be allocated or transferred to the person or party who is in the best position and qualified to deal with it (Sou, 2000), this is done through contract provision. Flanagan and Norman (1997) reveal that building contract is a trade-off between the contractors’ price for undertaking the work and his willingness to accept controllable and uncontrollable risks. A variety of factors make a construction contract different from most other types of contracts; these include the length of the project, its complexity, its size and the fact that the price agreed and the amount of work done may change as it proceeds (Adriaanse, 2007).

Over the years construction contracts have evolved into standard contract forms, not only because of their advantages of familiarity and the prohibitive cost of customisation but also to provide certainty on the nature of the transaction between parties on a project specific basis (Masterman, 1997); in effect, to minimise transaction costs. Fellows (1989) has been very critical of this development arguing that the practice is outmoded and that its practice has contributed significantly to many of the construction industry’s recent and current difficulties highlighted subsequently by Latham (1993, 1994).

The complexity of the relationship required between stakeholders in the construction industry in the construction process is such that the industry has come to rely on the standard forms of contract to simplify the definition of these relations. A number of organisations have prepared recommended standard general conditions and associated forms such as Fédération Internationale des Ingénieurs-Conseils (FIDIC), New Engineering Contract (NEC), Institute of Civil Engineers (ICE), Joint Contract Tribunal (JCT) etc. In Nigeria the JCT and the Standard Form of Building Contract (SFBC) 1990 is commonly used for administering building contract. The standard form of building contract (SFBC 1990) in Nigeria is provided and reviewed by the Nigeria Institute of Architects (NIA) to act as a guideline to different issues and complexities of building contracts and construction in Nigeria. It spells out the extent of power and jurisdiction of each stakeholder involved in construction.

In as much as contract is good in managing risk, contractual agreements in the contract only define the ground rules but the execution of the contract rests on goodwill, intention and the relationship between parties. It is therefore important to note that the construction contract, whatever form it may take should purposely be a “meeting of the minds” document, stating clearly the roles and responsibilities of the parties without overlaps or voids and aims squarely at achieving a quality project.
RESEARCH METHOD

The research approach adopted in this study comprised a comprehensive literature review, structured questionnaire distributed to randomly selected contractors handling 55 government building projects in Abuja and its environ and analysed using qualitative risk analysis method. A total of 55 questionnaires were distributed, of these 36 were returned and duly completed and then used for the basis of analysis of the study.

The questionnaire consist of 2 sections, section A solicited general information about the respondent and the project, section B carried a total of 35 potential risk factors drawn from literature and the Standard Form of Building Contract of Nigeria 1990 (SFBC 1990) and Joint Contract Tribunal (JCT 2005). The respondents were asked to indicate the party or parties responsible for these risks, indicate the likelihood of occurrence of these risk as “most likely, likely, possible, unlikely and rare”, also the impact of the risks on the project as “very high, high, moderate, low and very low on a 1-5 point Likert scale.

The relative important index (RII) for each risk was calculated using Eqn. (1) to calculate for the likelihood of occurrence and impact and then ranked.

Relative Importance Index, \( RII = \frac{\sum_{i=1}^{5} w_i x_i}{\sum_{i=1}^{5} x_i} \) \hspace{1cm} (Eqn.1)

Where:

\( w_i = \) weight assigned to \( i \)th response; \( w_i =1, 2, 3, 4 \) and \( 5 \) for \( i =1, 2, 3, 4 \) and \( 5 \) respectively

\( x_i = \) frequency of the response

\( i = \) response category index = 1, 2, 3, 4 and 5 for Rare / very low, Unlikely / low, Possible / Moderate, Likely / high and Most likely / very high respectively

The results of the likelihood of occurrence and impact were used to assign scores into the Risk Matrix Analysis table shown in Table 2. Risk Analysis Matrix is a semi-quantitative method using a subjective assessment table of very low, low, moderate, high and very high indicator to show the degree/ level of risk (Alkali, 2010). The score are graded so as to assign them on the risk matrix analysis table, this is presented below;

Table 1: Grading for the Risk Analysis Table

<table>
<thead>
<tr>
<th>Grading</th>
<th>Likelihood of Occurrence</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 – &lt;1.5</td>
<td>Rare</td>
<td>very low</td>
</tr>
<tr>
<td>1.5 – &lt;2.5</td>
<td>Unlikely</td>
<td>Low</td>
</tr>
<tr>
<td>2.5 – &lt;3.5</td>
<td>Possible</td>
<td>Moderate</td>
</tr>
<tr>
<td>3.5 – &lt;4.5</td>
<td>Likely</td>
<td>High</td>
</tr>
<tr>
<td>4.5 – 5.0</td>
<td>Most likely</td>
<td>Very high</td>
</tr>
</tbody>
</table>
Table 2: Risk Analysis Matrix Table

<table>
<thead>
<tr>
<th>LIKELIHOOD OF OCCURRENCE</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Most likely</td>
<td>M</td>
</tr>
<tr>
<td>Likely</td>
<td>M</td>
</tr>
<tr>
<td>Possible</td>
<td>L</td>
</tr>
<tr>
<td>Unlikely</td>
<td>L</td>
</tr>
<tr>
<td>Rare</td>
<td>L</td>
</tr>
</tbody>
</table>

Key: (E) - Extreme Risk, (H) - High Risk, (M) - Moderate Risk, (L) - Low Risk

RESULTS AND DISCUSSION

Respondents Profile and Standard Form of Building Contracts.

Table 3 shows the summary of the respondents’ profile, the standard form of building contract used in the project. The findings revealed that the SFBC 1990 is mostly used because of its localised nature with most clauses are copied from the JCT 1963.

Table 3: Respondent Profile.

<table>
<thead>
<tr>
<th>Category</th>
<th>Respondents No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profession</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architect</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Builder</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Engineer</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Quantity Surveyor</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Project Manager</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Educational Attainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.Sc</td>
<td>11</td>
<td>31</td>
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<td>P.G.D</td>
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<td>B.Sc</td>
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<td>HND</td>
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<td>14</td>
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<tr>
<td>Working Experience</td>
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Potential Risk Factors

In assessing risks contractors are exposed to within some standard forms of contract, 35 potential risk factors were drawn out from the JCT 2005 and the SFBC 1990 as
These potential risk factors were drawn from the clauses that relate to the parties to the contract other than the contractor in respect of their obligations and duties that could act as potential risk to the contractors.

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<th>1990 Clause</th>
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<td>Delay in making interim valuations</td>
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<td>Delay in issuing final certificate</td>
<td>4.15, 1.10</td>
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<td>Delay in making final payment</td>
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<td>32</td>
<td>Failure to write instruction regarding variation</td>
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<td>Failure to reimburse for direct loss and expenses</td>
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<td>11.8, 24</td>
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<td>34</td>
<td>Determination of contract</td>
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<td>35</td>
<td>Retention money not returned</td>
<td>4.10, 4.18, 4.20</td>
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## Sources of Risk

Table 5: Sources of Risk

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<th>Source</th>
<th>Potential Risk Factor</th>
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<tr>
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<td>3. Misinterpretation of contract conditions.</td>
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<tr>
<td></td>
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<td>4. Drawings and documents are not issued in time.</td>
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<td>5. Inaccessibility to necessary contract documents.</td>
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<td>6. Changes in the design.</td>
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<td>12. Failure to honour claims.</td>
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<td>17. Determination of contract.</td>
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<td>Architect</td>
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<td>5</td>
<td>Govt. agent</td>
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</table>
The study sought to identify the parties that are likely to be responsible for the identified potential risk factors. The result as shown in Table 5 revealed that the Client serves as an immense risk the contractor is exposed to, this is because the Client makes the decision to build, owns the financial resources and specifies the design requirement, they tend to be in a rush to commence the project without all the necessary planning and design input.

The study also revealed that the Architect represents another risk source because they act as an agent of the client. They are obliged under the contract to act for the client by undertaking certain actions within prescribed time, when all these obligations are not met it may affect the smooth running of the project. Other sources are Quantity surveyors, project managers and government agencies.

**Likelihood of Occurrence of Risk**

Table 6 shows the likelihood of occurrence of risk and ranked according to their Relative Important Index (RII). Failure to write instructions regarding variations was ranked 1st with the highest likelihood of occurrence. JCT 2005 Clause 5.21 and SFBC 1990 Clause 11.3 requires the Architect to put in writing any variation i.e. addition, omission or substitution of any work to the Contractor, inappropriate delay in issuing this instructions raises the level of risk in any project. Another risk with high likelihood of occurrence ranked 2nd is drawings/documents not issued on time. Clause 2.9, 2.12 and Clause 3.2 of the JCT 2005 and SFBC 1990 respectively requires the Architect to provide the contractor with 2 copies of documents necessary for use in carrying out the work, without these the contractor will not be able to function properly.

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<th>Level Of Occurrence</th>
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<th>Impact RII</th>
<th>Impact level</th>
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</table>

**Impact of Risk on Contractors**

Risk by its nature has strong influence on the project depending on the level of impact on the risk. 13 risk factors were found to have high impact on contractors as shown in Table 6. Ranked 1st is delay in making interim payments; it was discovered that most contractors experience this delay which result in project delay, reduction of profitability and in some cases the contractors may go into liquidation because these
payments are meant to augment the contractor financially to enable him carry out the work diligently.

Another factor with high impact (2\textsuperscript{nd}) is unfair and unrealizable programme of work; most clients set tight schedules for contractors to achieve for obvious time and money reasons, in trying to achieve this, the contractor tend to compromise quality, spend more on labour and machineries to meet the client’s target. Delay in issuing and responding to instructions (3\textsuperscript{rd}) is another risk with high impact because instructions communicate the intentions of the parties in the course of the project, prompt receipt

<table>
<thead>
<tr>
<th>S/No</th>
<th>Potential Risk Factor</th>
<th>Likelihood of occurrence</th>
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<th>Degree of Risk</th>
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<td>Moderate</td>
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<td>Scope of work not properly defined</td>
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<td>Moderate</td>
<td>Moderate</td>
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<tr>
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<td>Inadequate or insufficient site information</td>
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<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Unfair or unrealizable program of work</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Misinterpretation of contract conditions</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>6</td>
<td>Delay in setting out of the works</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>7</td>
<td>Defective/incorrect design</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>8</td>
<td>Changes in the design</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>9</td>
<td>Discrepancies in drawings and specifications</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>10</td>
<td>Drawings and documents are not issued in time</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>11</td>
<td>Increase in the scope of work</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>12</td>
<td>Scope of work differ from contract</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>13</td>
<td>Adjustment to the completion time of project</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>14</td>
<td>Inaccessibility to necessary contract documents</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Discrepancies in the Bill of Quantities</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>16</td>
<td>Contract documents used other than the purpose of the contract</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>17</td>
<td>Interference in the progress of work</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>18</td>
<td>Imposing of subcontractors</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>19</td>
<td>Imposing of suppliers</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>20</td>
<td>Assigning part of the work without consent</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>21</td>
<td>Third party nomination without consent</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>22</td>
<td>Delay in resolving disputes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>23</td>
<td>Delay in issuing and responding to instruction</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>24</td>
<td>Verbal instructions not backed by writing</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>25</td>
<td>Delay in interim payment</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>26</td>
<td>Delay in issuing interim certificate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>27</td>
<td>Failure to reimburse for direct loss and expenses</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>28</td>
<td>Delay in making interim valuations</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>29</td>
<td>Delay in issuing final certificate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>30</td>
<td>Delay in final payment</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>31</td>
<td>Addition of unreasonable taxes and charges to contract sum</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>32</td>
<td>Failure to write instruction regarding variation</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>33</td>
<td>Failure to honour claims</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>34</td>
<td>Determination of contract</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>35</td>
<td>Retention money not returned</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
and response to these notifications are crucial to the contractor to carry out one activity or the other or to resolve some ambiguities, but when it is not gotten on time it slows down the project and could lead to dispute.

Also with high impact on contractor is defective/incorrect designs (4th); it was discovered that errors and omissions in designs contributes to project delays as some part of the work might be demolished and done again which can lead to loss of productivity, waste of materials and additional cost being incurred by contractors. Other risk with high impact on project include inaccessibility to necessary contract documents, Misinterpretation of contract conditions, Inadequate or insufficient site information, Failure to reimburse for direct loss and expenses, Failure to reimburse for direct loss and expenses, Adjustment to the completion time of project, Verbal instructions not backed by writing, Discrepancies in drawings and specifications, Delay in issuing interim certificate and Changes in the design.

Degree of Risk

To provide an indicative level of risks to reflect the degree of risks in each category, the likelihood of occurrence and impact of each risk factors were combined using the Risk analysis matrix table (Table 2). 15 potential risk factors were discovered to represent high degree of risk to contractors and 20 risk factors represents moderate degree of risk as shown in Table 7.

These high degree risks are as a result of improper planning, payment not made when it ought to have been made and instructions are not received at the appropriate time, resulting to delays, claims, disputes and in many cases abandoned projects. It is therefore necessary for clients and their agents to put in place essential tools that will enable contractors succeed and they should also carry out their obligations under the contract promptly.

CONCLUSION

Risks by definition are uncertain events that could have positive or negative effect on the project objective, it is therefore important for contractors to minimize their adverse consequences and maximize the opportunities that comes with these risks. The findings have revealed that the Standard forms of contract exposes the Contractor to 35 risk factors emanating from principally 5 sources (Client, Architect, Quantity surveyor, project manager and government agents). Only 2 of these risk factors have high likelihood of occurrence while the other 33 are moderate. Thirteen of these risks are high impact risks and fifteen are high degree risks. It is therefore important for contractors to pay great attention to these risks for the success of present and future projects.

The following recommendations are hereby made based on the findings of the study;

i. Contractors should protect themselves against all unpredictable events by making sure contingency are added to accommodate all types of risk envisaged.

ii. To mitigate the impact of delays, the contractor must give early warning to the party that is likely to cause any delay and its implications.

iii. On the issue of tight schedule, contractors should negotiate the construction schedule with the client, if possible or at least allow time contingency and buffer in their schedule.
iv. Contractor should ensure they work with sets of carefully prepared and coordinated front end documents and drawings to avoid discrepancies and ambiguities.

v. Establishment of clear lines of communications that will ensure prompt receipt and response to instructions.

vi. Above all excellent collaboration of project participants and adequate technical skill of project managers would ensure good contractor performance on any construction project.

REFERENCES


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AN ASSESSMENT OF THE KEY DETERMINANTS OF BUILDING SCIENCE STUDENTS’ SATISFACTION WHEN UNDERTAKING GROUP WORK: A CASE STUDY OF THE UNIVERSITY OF JOHANNESBURG, SOUTH AFRICA

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This study assesses university’s students’ views on team work. The specific research aim is to investigate the factors that affect students’ satisfaction when undertaking group work. The data used in this paper were derived from both primary and secondary sources. The secondary data was collected via a detailed review of related literature. The primary data was collected through a structured questionnaire aimed at 55 BTech (undergraduate final year) students. Data received from the questionnaires was analysed using descriptive statistics procedures. Findings from the study revealed that the most important factors which affect students’ satisfaction when undertaking group works are: students having the same attitude towards work; ground rules for the operation of the group; some students do not come to group meetings and not all students contribute to the group assignments. This study reveals the key determinants of students’ satisfaction when undertaking group work, hence preparing the students to be team players before they enter the world of work.

Keywords: team work, group work, University of Johannesburg, student

INTRODUCTION

Working on a team is unavoidable in this present world, no matter your position—student, organizational communicator, movie actor, professor, amongst others (Johnson, 2011). This is because enterprises today are expecting employees to be able to work well both independently and collaboratively in order to maximise their potentials and foster creativity and development of one-another (Pang, 2011). Working in groups has become a fundamental part of education as a mechanism to help students learn through interaction with others as well as to become familiar to working in a group environment that imitates the work place (Freeman, 1996). Experiences from organisations using the team approach for improving performance have pointed to teamwork as an important tool in the work place. This perspective has pressed organizations to start looking for teamwork skills in their new employees (Ulloa and Adams, 2004). Although most employers provide on-the-job training, yet, they expect that their new employees at least possess the basic understanding of why teamwork skills are important to their career.

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Looking for ways of shortening the new employees learning experience on acquiring teamwork skills in the workplace, Ulloa and Adams (2004), Alexander and Stone (1997) stated that cooperations are suggesting institutions of higher education to prepare future employees (students) to be effective team players. Also, Thomas (2001) suggested that one way to prepare future employees for the work environment is by having them work in groups in academic settings. Based on this tenet, accreditation organizations at the academic level such as the South Africa Council for the Quantity Surveying Profession (SACQSP), The South African Council for Project and Construction Management Professions (SACPCMP) among others, are requiring higher education institutions in South Africa to introduce teamwork activities into their courses. In response to this demand, institutions of higher education are developing approaches for introducing teamwork in their classrooms. Higher institution are thus enhancing the process of learning through the use of teams knowing that in corporate environments teamwork is a key element to improving employee performance and learning (Cohen and Bailey, 1997; Devine et al., 1999).

The general acceptance of team structures in the construction industry environment together with the common practice of including group projects/assignments in university curricula means that undergraduate building science students who are being prepared for the construction industry are rightly directed towards maximizing their potentials by working in groups. Although group work is sometimes hailed as an educational panacea, however, the realities are considerably more complex. Therefore, identifying the appropriate team factors and their relationship with the students’ satisfaction is essential for higher education to know the areas to concentrate on when teaching students to work in groups.

Undergraduate (Final year) building science students majoring in Construction Management or Quantity Surveying at the Department of Construction Management and Quantity Surveying at the University of Johannesburg, are required to work in groups throughout their study time. The main educational reasoning behind requiring the students to work in groups as an integral part of their study time is that the experience of group work is a good preparation for working in teams and managing work teams in the future as construction professionals. Little research has been conducted which directly examine the determinant factors of satisfaction when students undertake group work during the course of their study. Hence, this research will assesses university’s (building science) students’ views on team work. The specific research aim is to investigate the factors that affect students’ satisfaction when undertaking group work. The research begins by looking at the concept of student group work in educational setting in some aspects; this will be followed by the explanation of the methodology adopted for the study. Thereafter, the findings for the study will be presented, followed by the conclusion, before drawings some recommendations for the study.

Student group work in educational settings

Research in educational settings shows that most students recognize the necessity of working in groups such as improving interpersonal skills, but they still prefer individual work when the goal is achieving good performance (McCorkle et al., 1999).

In our modern society, groups are an integral part of daily life. Hence, a vital aspect of study at any higher education is the opportunity to work as part of a group or team. Students’ working in groups are usually encouraged because it is viewed as a highly
effective way for students’ education, which is seen as extremely relevant to the workplace. The use of teams to address changing environment, increase competitiveness and cope with demands for ever-improving performance, have become common in the construction industry, Information Technology, engineering amongst others (Ammeter & Dukerich, 2002; Doolen, Hacker & Van Aken, 2006). For instance, Devine, Clayton, Philips, Dunford and Melner (1999) in their research assessment of 128 US organizations establish that 48% of organizations use teams (work in groups). Whilst, the US Industrial Report (1995) stated that 82% of organizations in the US with 100 or more employees use a team structure (Group work pattern) to carryout their job responsibilities.

Undergraduate (Final year) building science degree course of the University of Johannesburg, have adopted the practice of using teams as a part of the educational structure. Hence, about 50% of the work done by students at this level of study is via group work. It adoption is to improve team skills by shifting from lecturing and individual learning to self-directed work teams and cooperative learning (Freeman, 1996). For example, Bolton (1999) in a university faculty study, found that 72% of a university faculty used group work as part of their courses. Also, Amato and Amato (2005) informed that group work is widely applied in academic teaching and has become part of the course contents of most mainstream education courses as adopted at the University of Johannesburg Department of Construction Management and Quantity Surveying. Hence, Pang (2011) argued that group learning method facilitate the development of knowledge and skills used in the real world of work.

With the increasing acceptance of teams in workplace and educational settings, there is obviously a need to pursue research into working in groups, especially the impact of team effectiveness on the students and the key determinants of satisfaction when working in groups. For instance, White and Bassford (1978) researched on the factors that predict and control group success in student work, and argued that proper identification of these factors in team experience enables educators and students to direct and manage group project work more efficiently. Whilst, Salas, Stagl, Burke & Goodwin, (2007) measured the effectiveness at both the team and individual levels. The major focus on team work research has been on evaluating task performance of the group. Far less attention has been paid to individual member satisfaction with the team (Olivera & Straus, 2004; Pang, 2011)

Working with peers enables students to pool ideas, perceive problems from different viewpoints and benefit from analysing, discussing and exploring their own ideas and questions and to gain feedback from their peers. Without denying the significance of traditional lectures and instructor-led discussions in undergraduate education, an increasing number of higher education teachers are recognizing the value of also assigning collaborative work to their students (Davis, 1999). Davis (1999) further informs that group work, when used both in and out of class, can be an important supplement to lectures which helps students’ to master concepts and apply them to situations calling for complex applications of critical thinking skills. For instance, in the Award-Winning Teachers on Teaching Series entitled “Let Them Do It Themselves—In Groups”, Professor Donald Kennedy stated that students do a great deal for one another when working in groups, thus promoting learning (Kennedy, 1999). Hence, it is important that higher education teachers tap into this by practicing a kind of catalysed learning by creating opportunities whereby collaborative learning can help to crystallize concepts to take shape (Davis, 1999; Pang, 2011).
While many higher education teachers occasionally break their classes into small informal groups to accomplish brief tasks, the kind of collaborative group work discussed here as undertaken by building science students, refers to projects/assignments that last an entire class period, several class sessions, or even an entire academic year. The groups are created by the lectures, or at times, decided upon by the students themselves. Although, there are advantages and disadvantages to each approach, but the key is that the tasks to be accomplished require interdependence so that no individual student can complete the assignment alone. This kind of system requires careful planning on the part of the teachers and it is not without difficulties for students. But the benefits can be substantial, including increased participation by students in all components of the course, better understanding amongst others. Hence, researchers have reported that regardless of the subject matter, students working in groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats. This means that peers working groups provide an effective low cost substitute to individualized instruction by the teacher. Nevertheless, achieving these and other benefits, such as learning teamwork skills, do not come automatically. There are clear potential downsides to group work, including the time for organizing groups and dealing with intra-group problems, potential student resentment, more complex grading policies, and difficulties in scheduling amongst others. To achieve the purpose of group working, an instructor must carefully consider the desired educational goals and the benefits, trade-offs, and pitfalls during the course of the work.

Teaching Students to Work in Groups

Previous studies has shown that there are many elements involved in the process of introducing teaming into the classroom (Kunkel & Shafer, 1997). When these elements are not very well managed they can provide negative teamwork experiences discouraging students from continued participation in teams (Pfaff & Huddleston, 2003). Hence Krug (1997) states that negative team experiences create negative attitude toward teamwork that are transferred to the workplace.

According to Davis (1999), in a competitive academic setting, where students have most often been rewarded for individual effort, teamwork may not come naturally or easily for everyone. Despite most students have worked together informally in study groups or social organizations, they may never have considered the kinds of skills that best promote group achievement. Hence, an academic department and programmes who recommend that students should work in groups but fail to provide specific guidelines or models for successful work may find students struggling to get group projects off the ground. Even though some students will at the outset express skepticism about the value of group work, or feel that class time is best spent hearing from the instructor (who’s the authority) rather than working with students who, they consider to know as little as themselves. Whereas, others may feel that they have thrived thus far on individual effort, and hence, do not want to be encumbered by other students with different histories of success or different working methods. In another stance, some other students are nervous and unfamiliar to sharing their work with their peers.

Therefore, being clear, at the outset of the class and in the course outline, about how much of the course work will involve group effort, and about why such group work will help achieve the goals of the course, will go a long way toward overcoming the negativism of some students towards working in a group (Michaelsen, Fink & Knight,
It is important that course advisers inform the student on the importance of group work and the goals of group work, as students will be far more motivated to participate if they see the significance of the group assignments to the larger course objectives. Lecturers should be aware that most students have little training in guiding their peers through such activities. Hence, Bosworth (1994) states that the interactive and managerial abilities required for working in a group need to be properly stressed, so that students will be familiar with the importance of aspects such as: listening, clarifying statements, and providing good feedback; keeping discussions on task; probing assumptions and evidence; eliciting viewpoints and perspectives; mediating conflicts; and summarizing and presenting findings (Smith, 1996). Also, the roles each group member will play should be stressed, such as the facilitator (to lead discussions), note-taker (to record and summarize progress), planner (to outline where and how the group is proceeding through the assignment), evaluator (to elicit critiques)—and provide descriptions and examples of these roles. Except group management skills are identified, and unless students are asked to reflect on their successes and difficulties with exercising these skills, few participants will see the relationship between completing the project and achieving some of the larger goals of the assignment or course (Davis, 1999; Tiberius, 1990). The time taken to examine these skills is fundamental to the success of group work (Miller, Trimbur, & Wilkes, 1994). Working in groups can prove to be very rewarding but it takes a bit of work to ensure that a group becomes an effective team.

The importance of group work When to use the

“Groups . . . hold the key to solving such societal problems as racism, sexism, and international conflict. Because groups are the building blocks of society, and any attempt to change society will succeed only if the groups within that society change” (Forsyth, 1999: 9). Different students come to University with varying amounts of experience of working in groups. Some will have done this in their previous school or college or maybe have relevant work experience. While some others may have very little experience of working in groups, especially in an education setting. People may come from different cultures and all are likely to bring unique skills and qualities to the group. Learning to use these to the best effect and ensure that everyone is contributing effectively to a joint project can be challenging. The benefits, however, can be great at the long run. Students can achieve far more by working with other students as they often learn a great deal and develop certain skills as they progress.

Group work is believed to be beneficial not only in a work environment, but also to have many positive results in academic settings (Davis, 1993). Gatfield (1999) stated that group work allows students to explore a diversity of opinions, better retain learned information, and efficiently tackle projects too large to effectively handle on an individual basis. While Thomas (2001) suggests that in certain situations, group work is linked to an increase in students’ confidence levels. In a review of the educational literature on group learning, McCorkle et al. (1999) identified six benefits of group work and learning which include: comprehensiveness (allows for multifaceted projects); realism (emulates the workplace); communication skills gained by students; group skills (both interpersonal and group management); technical skills; motivation and interest (helps provide conditions for active learning. Regardless of these facts about group work, McCorkle et al. (1999), stated that there can be challenges when students work in groups. Some of the known problems when students work in groups include: social loafing by some members of groups; inadequate rewards (grading does not take into account individual as well as group efforts), which
is a major point of discourage for some students; transaction cost (greater effort to
work in groups); integrative learning problems (unequal participation can occur,
students may work separately and not understand what colleagues have done) and
other problems, such as group work not allowing for individual innovation. Also,
some students are not able to pace and structure outputs and others do not receive
feedback till later in the unit of study as compared to individual work.

Despite these points of departure, group working helps students to develop generic
skills such as organisation, delegation, effective communication, co-operation and
leadership; all valuable qualities that will be sought after and highly valued in their
careers. This is because employees look for teamwork qualities in new graduates.
However, it is not sufficient to put students in groups and ask them to work together:
students need to be taught the skills they will need to function successfully in this kind
of situation as already discussed above.

RESEARCH METHOD

The research method can be deemed to be quantitative in nature as a self-administered
questionnaire survey was conducted. The questionnaire survey led to the compilation
of the primary data. The purposive sample was extracted from 55 registered students
for the Bachelor of Technology in Construction Management and Quantity Surveying.
This was necessitated because the research was purposely targeted the experience of
the Construction Management and Quantity Surveying students with regards to their
experience while working in groups. The 55 students attend lectures together, albeit,
they do not attend the core discipline specific courses together. All 55 students were
engaged for the primary data collection, as it was found that they all belong to one
group or the other. The survey was conducted during one of the lecture sessions. The
survey took about 10 minutes to complete. Two principal structured questions were
asked: one aspect relating to the demography of the students and the other which
elicited responses pertaining to sixteen (16) factors, related to the subject of the key
determinants of satisfaction when undertaking group work. These factors were
identified during the course of the literature review and not part of an existing valid
survey instrument. Because the lead researcher is a staff at the department, all 55
students who were present on the day of survey responded accordingly. This equates
to a response rate of 100%. Descriptive statistics in the form of response percentages
and mean item scores (MIS) were therefore used for analysing the findings because of
the type of questions that were asked. RAI in the mean score table stand for relative
agreement index.

FINDINGS AND DISCUSSION

In line with what was stated in the previous section, the structured questions
investigated the students demography and the other elicited responses pertaining to
sixteen (16) factors, related to the subject of the key determinants of satisfaction when
undertaking group work. The response relating to the key determinant factors assessed
the extent to which the listed factors affect the student’s satisfaction when undertaking
group work. The impact of the factors was measured through a 5-point likert scale
ranging from 1 to 5. The numbers correspond to:

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
With regards to the students’ background information, findings form the questionnaire survey revealed that the gender distribution of the building science students was skewed towards a male dominated profession. It was found that 65% of the students were male, while 35% were female. The finding agrees with other numerous findings which perceive the construction industry as a male dominated industry. However, the findings all revealed the increased level of participation and flow of women into the construction industry. Findings relating to the ethnic background of the students revealed 90% were Black Africans, which included the Indian and Coloured group while only 10% were white. Further findings revealed that a majority (52.5%) of the students were within the age group of 20 to 25 years, while 47.5% were above 26 years. The reason while 47.5% of the students are above 26 years in an undergraduate degree programme can be attributed to the fact that students are given the option to either graduate with a national diploma degree after their first three years of study or to continue with their studies to acquire a BTech degree. Moreover, a majority (64%) of the students were studying part-time, while 36% were only studying full time.

Table 1: Factors that affect students’ satisfaction when undertaking group work

<table>
<thead>
<tr>
<th>Factors</th>
<th>RAI</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude (Students need to have the same attitude towards work)</td>
<td>4.59</td>
<td>1</td>
</tr>
<tr>
<td>Accountability (Mutual accountability towards the given task)</td>
<td>4.49</td>
<td>2</td>
</tr>
<tr>
<td>Rules (Ground rules to be set for the operation of the group)</td>
<td>4.47</td>
<td>3</td>
</tr>
<tr>
<td>Absenteeism (some students do not attend group meetings)</td>
<td>4.38</td>
<td>4</td>
</tr>
<tr>
<td>Communication</td>
<td>4.36</td>
<td>5</td>
</tr>
<tr>
<td>Contribution (not all students contribute to the assignment)</td>
<td>4.32</td>
<td>6</td>
</tr>
<tr>
<td>Contribution (my contribution is useful to the projects given)</td>
<td>4.25</td>
<td>6</td>
</tr>
<tr>
<td>Quality control (The team ensures that the work assigned to them meet the expected standards)</td>
<td>4.13</td>
<td>7</td>
</tr>
<tr>
<td>Conflict (Ease of conflict resolution within group members)</td>
<td>3.95</td>
<td>8</td>
</tr>
<tr>
<td>Group creation (I prefer we choose groups ourselves)</td>
<td>3.85</td>
<td>9</td>
</tr>
<tr>
<td>Some students do not respond to the group given task</td>
<td>3.60</td>
<td>10</td>
</tr>
<tr>
<td>Seclusion (some students keep to themselves when working in a group)</td>
<td>3.43</td>
<td>10</td>
</tr>
<tr>
<td>Expectation (not all students know what is expected from them in the group)</td>
<td>3.43</td>
<td>10</td>
</tr>
<tr>
<td>Support (Lecturers support us when working in groups)</td>
<td>3.25</td>
<td>11</td>
</tr>
<tr>
<td>Group creation (I prefer a lecturer to put us into groups)</td>
<td>3.10</td>
<td>12</td>
</tr>
<tr>
<td>Punctuality (all group members are punctual to group meetings)</td>
<td>2.45</td>
<td>14</td>
</tr>
</tbody>
</table>

The findings for the question pertaining to the evaluation of the key determinants factors that affects students’ satisfaction when undertaking group work is summaried in Table 1. From the 16 evaluated factors, it was found that the primary factor that determines students’ satisfaction toward group work is the attitude of other students. The responses recorded for this question shows an MIS of 4.59 (Table 1). This therefore suggests that the internal state that influences an individual’s choice of personal action or a response tendency is vital to the projection of the reasoning...
behind group work. Also, Table 1 revealed that accountability (mutual accountability towards the given task) was ranked second as a key factor that determines students’ satisfaction when working in groups, with an MIS score of 4.49. This was followed by the availability of rules (ground rules to be set for the operation of the group) with an MIS score of 4.47. This factor is perceived as a factor which will make the group work successful. A definition of what appropriate behaviour is for group members will go a long way to avoiding embarrassing or difficult situations and thereby encourage active participation in the group (Fisher & Ellis, 1990). Therefore, setting of ground rules is important in group work as revealed by the finding. The least factors that determines students satisfaction when undertaking group work as shown on the table are: group creation (I prefer a lecturer to put us into groups) with an MIS score of 3.05 and punctuality (all group members are punctual to group meetings) with MIS of 2.45.

The findings of this particular study reinforced the perceptions expressed by other researchers as conducted by previous research findings. For instance, Gardner and Korth (1998) described attitude towards teamwork as the individual willingness (internal state) to continue working together with the same team as well as in other teams (personal action). This is a vital factor toward the success of group work. There are few studies about students’ attitudes toward teamwork, and findings from these studies show contradictory results. For instance, Gardner and Korth (1998), and Scaraffioti and Klein (1994) in their study with graduate students and engineering employees respectively found that even though the results were not statistically significant, individuals’ attitude changed positively after their participation in teams. By contrast, Porter (1993), McCorkle et al. (1999) and Buckmaster (1994) found that students that participated in their studies were frustrated by the teamwork experiences. Although students recognized that the experience improved their interpersonal skills, they still preferred to work individually.

Also, the current findings concurs with the work of Adams et al. (2002), where seven constructs were identified as characteristics that needed to be present during the team process for it to be effective. The seven constructs are productive conflict resolution, mature communication, accountable interdependence, clearly defined goals, common purpose, role clarity and psychological safety. For instance, conflict resolution which was also considered as a key determinants by the students, is referred to by Capozzoli (1995) as the procedure and actions taken when a conflict occurs that lead to results such as facilitating the solution of the problem, increasing the cohesiveness among team members, exploring alternative positions, increasing the involvements of everyone affected by the conflict and enhancing the decision-making process (Capozzoli, 1995). According to Hoover (2002) constructive conflicts enhanced the quality of decision making and Fisher & Ellis (1990) adds on by saying conflicts should not be avoided in group work because when avoided they can create more problems. Conflicts are healthy in group work when well managed (Fisher & Ellis, 1990). Team work helps the individual develop a variety of strategies to deal with potential or actual conflict between team members (Burke & Barron, 2011).

Also, the findings agree with the work of McGregor (1960) with regards to the communication aspect, where it was stated that team members ensures their voices are heard in a team. Each team member is important in a team as the next member; which is what make teams to exist. A team is like a human body, each body part has its own function. If one body part does not function the whole body suffers. No matter how despised or small the function of that specific body part, its non-performance affects
Students' satisfaction

the whole body. Also, Mohrman et al. (1995) state that teams are self-managing individuals meaning they must commit themselves to producing a quality product which was reflected in the ranking accorded the factor of absenteeism. This is because group meetings are essential to share information and to make important decisions collaboratively and they must start at an agreed time as specified on the ground (Summer & Smith, 2010). Thus absenteeism will lead to frustration for other group members. Results from the research also show that students are not punctual to group meetings or they do not come at all, which was also a source of dissatisfaction for students. This suggests that some students do not take group work seriously, which is a sign of future performance when in the workplace. However, Hoover (2002) states that participation in a given team is personally rewarding because of the social support and the learning of new skills as evident in the findings.

CONCLUSION

The purpose of the current study is to outline the key determinant factors of satisfaction to students when undertaking group work. The findings from the questionnaire survey were ranked using a mean item score rating. All factors were considered relevant by the students as evident form the findings. It is however notable that six of the listed factors are highly rated more than the others based on the recorded mean item scores as shown on Table 1. The survey findings suggest that the students rated the attitudes of other students toward group works as the core determinant factor amongst others. However, there appear to be a need to place greater emphasis in certain areas that include expectation, because not all students know what is expected from them in the group, support form lecturers, group creation and punctuality. Given the limitations of the research with regards to the survey sample, wholesome generationalisation of the findings is not advised. However, the findings provide a platform to further understand the factors that gives students satisfaction when undertaking group work.

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ASSESSMENT OF THE PRICING OF PRELIMINARIES ITEMS IN THE BILL OF QUANTITIES

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The preliminaries section of a bill of quantities fulfils a number of functions consisting of information of project, describing requirements related to project, services and facilities that need to be provided prior to commencement of work on site. The preliminary items are usually priced but it is unusual to find more than a handful of items priced. The factors influencing the pricing of preliminaries items and the significance of these items in the bill of quantities based on the opinion of practitioners in the industry were assessed. A total of 80 questionnaires were distributed through purposive sampling to contractors and consultants. Forty two representing 53% response rates were used for the analyses. Data were analysed using frequency, mean and relative importance index. Complexity and size of project has the highest relative index (0.90) being very highly important factor followed by method of construction and site condition; site location and, plant and equipment required. In assessing the significance of preliminaries items scaffolding was considered very highly in pricing closely followed by temporary hoarding, water and site administration. Lighting and power, setting out, safety, health and welfare were also closely rated. The research reveals that all preliminary items were within the significant range in their mean and professionals would most likely price these items except the following six items; Small Plant and Tools, Temporary Telephone, Overtime, Cleaning, Drying the Works and Defects after Completion that were ranked low yet important.

Keywords: consultant, contractor, preliminaries, pricing.

INTRODUCTION

The items found in the preliminaries section of the bills of quantities are usually the most difficult and arbitrary of all to price. Pricing decisions are generally based on contractor’s experience, intuition and personal bias (Ahmet and Onder, 2004). This view corroborated by Holm, Schaufelberger, Griffin and Cole, (2005) who even went further to suggest that pricing decisions are subjective and rather unreliable. If all contractors’ priced bills for any project are examined, the preliminaries section would produce the greatest variation in prices with each contractor having his own idea as to the scale and extent of the costs involved. As a result of the subjective nature of preliminaries pricing, its pattern of pricing as discovered by Peurifoy and Oberlender, (2003) varies considerably between different contractors, and it varies according to job size and complexity, site location, accessibility, degree of mechanization practicable, position of contractor’s head office and relationships with local/domestic subcontractors. There are problems encountered during tender evaluation especially

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on cost comparison of preliminaries of each contractor. Some contractors do not even price the preliminaries bill; rather they just make a sufficient allowance of certain percentage of the cost of construction for the preliminaries, this however, makes valuation of preliminaries for interim payment and claims purposes a problem. It can readily be observed that there is no industry standard for pricing preliminaries. This situation makes the preliminaries element of a contractor’s tender a major area of variability between contractors, this according to Jagger, Ross, Smith and Love (2002) forms the basis of evaluation of claims for delay and disruption which according to Aibinu (2009) generates conflict and contract dispute and its mitigation would mean a substantial increase in financial savings on projects. Ashworth (2010) emphasised that it is important to discover the extent to which preliminary items are priced. The aim and objectives of the study is to assess the factors influencing the pricing of preliminaries items and the significance of these items in the bill of quantities. According to Gwang-Hee, Sung-Hoon, Hun-Hee and Kyung – In (2004) accuracy of estimation of construction costs in a construction project is a critical factor in the success of a project. The study would enhance the state of the contractors' familiarity concerning preliminaries in construction projects. It will also assist the contractors in properly identifying the significance of preliminary in their pricing consideration and strategy.

LITERATURE REVIEW

The bill of quantities rate cannot sufficiently cover all costs required for the execution of a construction project due to the general nature of some items which cannot be associated with a particular trade for pricing; these items are however covered under the concept of preliminaries (Odusami and Oni, 2007), from this assertion it can be deduced that preliminaries affects every part of a construction project. The Chartered Institute of Building’s (1982) description throws further light on the concept of preliminaries, the institute described it as the cost of administering a project and providing general plant, site staff, facilities, and site based services and other items not included in the rates. According to Odusami and Oni (2007) the preliminaries bill section comes first for pricing in the Bill of Quantities even though it is common practice for it to be priced last as it presents the contractor with the opportunity to influence the performance of his bid in competition. According to Ross, Fleming and Grant (1991), the preliminaries section needs utmost care in pricing as it is the section the contractor’s estimate must or should cover the cost of operating the site under specified conditions and in accordance with the contractor’s plan for the progress of the work and for storage and movement of materials, plants and site establishment. Milne (1990), Preliminaries bill pricing is complicated as there is no standard method of estimating cost of items and the section will give the greatest variation in prices especially during tender examination and evaluation and it varies according to job size and complexity, site location, accessibility, degree of mechanization practicable, position of contractor’s head office and relationships with local/domestic subcontractors (Peurifoy and Oberlender, 2003).

Factors Influencing Preliminaries Pricing Decisions

The preliminaries section of the bill of quantities fulfils a number of functions from an overview of the project; the project’s description, site and also details of the contract conditions to be used. Pricing decisions are generally affected by a number of factors, its accurate pricing is most times hampered by the unavailability of site plans and method statements during tender process, Trevor Sadd Associates (2005) stated some
key project factors to be considered when pricing preliminaries include: layout of the site together with access and the usable areas, an outline project program setting out the order of works and the critical items, key areas of work and the amount of labour and plant that each require, works by the main sub-contractors, an outline security and safety plan, a list of the key contractual requirements, and risks. Preliminaries can be higher in certain circumstances for instance if sites require special measures. Ghani (2006) listed the following factors that have to be considered when pricing preliminaries as also corroborated by Ashworth (2010);

**UNDERSTANDING CONTRACT PARTICULARS**

Ghani (2006) suggested that the contractor should be conversant with the standard forms of contract and should not do any amendments. Items which should be particularly noted by the contractor are Cost Variation Clause, Limit and period of retention, discounts on nominated suppliers and sub-contractors, insurances and special additional clauses.

**Site condition**

The contractor should visit the site and determine if an existing supply is available and if it is sufficient and can be used for building operations. Before commencing the pricing, the contractor must visit the Architect’s office and study the drawings, specification and contract documents. Also the site must be inspected and any special problems must be considered and appraised. Access, storage of materials, positioning of mechanical plants and multiple loading on the site would all be important matters to review. In good tendering practice, drawings are always sent to the tenderer.

**Location of the site**

The expected difficulties associated with location, such as travelling and subsistence payments, access to and egress from the site and buildings, distance from road networks and the necessity for temporary roads are to be identified (Ashworth, 2010). Ghani (2008) the contract being tendered for is in an existing factory which is enclosed by a boundary fence or in an area where damage or stealing is unlikely, the contractor will usually include a nominal amount to cover losses or damage. If, however, damage or stealing on a larger scale is expected a watchman would be employed for the whole of the construction period.

**Difficult contract and restricted site**

Many small contracts by the nature of the work involved, such as dangerous underpinning, deep foundations in bad ground and similar items, or contracts where working conditions and access are particularly bad, require foreman of great experience and of above average organizing ability. All the above items must be taken into account as they will influence the pricing of preliminaries and also the number of general foremen and assistant general foremen required for the particular contract.

**Magnitude of contract and Contract Period**

When pricing preliminaries the estimator must bear in mind the magnitude and type of contract. A simple, small and straightforward contract can be supervised by a modestly paid general foreman within a short contract period. On another contract of the same price bracket the complications and problems of the work may involve a highly paid site manager with relatively longer contract period. The financial scope of
contracts must also be considered. Ashworth (2010) explained that a short contract period may necessitate overtime and weekend working. Long contract periods often require a provision for increased costs, which would otherwise be included within the contract sum.

**Plant and equipment**

Plant-orientated construction or the use of innovative techniques often has special costs allocated within the preliminaries bill (Ashworth, 2010). The contractor has to decide the type of plant to be used on the contract being tendered for and the length of the time the plant will be required on the site. Sometimes using very rare plant and equipment also will influence contractor in pricing preliminaries. It is a practice for the majority of plant costs to be shown in the preliminaries section. This is because most of the plants and equipment may be used for several trades and it is difficult to apportion the cost between different items and section.

**Any obligation or restriction imposed by employer**

In respect of any matter not covered by any clause in the conditions of contract, any obligation or restriction imposed by employer is normally given as an item stating the relevant particulars in the preliminaries. The requirements are basically about details relating to tendering in addition to those on the invitation to tender, e.g. subletting, provision and content of documents, management of the works, quality control, security which according to Ashworth, (2010) include the necessity of temporary fencing, hoardings, gantries, public safety and protection from vandalism and pilfering.

**Lump sum pricing**

When contractors do not have enough time to price thoroughly then they price preliminaries as lump sum according to their past experience on similar projects.

**Availability of resources by the contractor**

Availability of resources has influence on contractors when pricing the Preliminaries items. Contractors who own plants have an advantage over contractors that hire plant and equipment. The contractor that owns plants and equipments will price low on this item compared to the contractors that have to hire plant and equipment and it shows that plant and equipment give a major factor to the pricing of the preliminaries items. According to Martin (2004), the Preliminaries bill gives the contractor the opportunity to price project overheads and as suggested by Ross et al (1991), it is where the contractor should cover the cost of operating the site. Holm, Schaufelberger, Griffin and Cole (2005) were of the opinion that project overheads delineates costs associated with administration of a project, indirect equipment usage, temporary construction, and certain miscellaneous items. The project overheads according to Holm et al, (2005) are often called ‘preliminaries’ preliminaries would be influenced by type, size and length of the contract period, and this section should be priced to reflect the varying costs on site associated with the particular project concerned. In addition the contractor will need to determine his method of working, such as the use of tower cranes and the amount of prefabrication off-site.

**Constituents of Preliminaries**

The constituents of preliminaries can be found in Section 1A of the Building and Engineering Standard Method of Measurement 3 (BESMM3) (2008), or section A of
Standard Method of Measurement, 7th Edition (SMM 7) which sets out the constituent items of preliminaries. As adapted from Langdon and Everest (1994), these include the following items but costs can only be assessed in the light of circumstances on a particular job, details should be given for each item and the opportunity for the tenderer to separately price items related to fixed charges and time related charges. Contractor’s general cost items are contained in section 1A40 – 1A44 of the BESMM3 as adapted from Langdon and Everest (1994), for items 1A41 – 1A44 it shall be clearly indicated whether such items are to be provided by the contractor or made available (in any part) by the Employer.

1A40 Management and staff (Provided by the contractor): The cost of site administrative staff has previously been included against clause no 10 of the JCT 80’ condition of contract, allowance for the provision of a watchman or inspection by a security organization, other general administrative staff costs such as Engineering, Programming and production and Quantity Surveying could be priced as either fixed or time related charges under this section.

1A41 Site accommodation (Provided by the Contractor or made available by the Employer): This includes all temporary offices laboratories, cabins, stores, compounds, canteens, sanitary facilities and the like for the contractor’s and his domestic sub-contractors’ use (temporary office for a clerk of works is covered under obligations and restrictions imposed by the employer).

1A42 Services and facilities (Provided by the contractor or made available by the employer): This generally includes the provision of all the contractor’s own services, power, lighting, fuels, water, telephone and administration, safety, health, and welfare, storage of materials, rubbish disposal, cleaning, drying out, protection of work in all sections, security, maintaining public and private roads, small plant and general attendance on nominated sub-contractors. However, this section does not cover fuel for testing and commissioning permanent installations which would be measured under sections Y51 and Y81 (BESMM3, 2008). According to Peurifoy and Oberlender, (2003) it varies according to job size and complexity, site location, accessibility, degree of mechanization practicable, position of contractor’s head office and relationships with local/domestic subcontractors.

**RESEARCH METHOD**

Purposive sampling was used to get the required respondents for the study. This is used in order to have an idea of the way construction professionals make consideration for the pricing of preliminaries. A total of 80 questionnaires were distributed to contractors, clients and consultants in the construction industry and only 42 responses were found appropriate for the analysis. Inferences drawn from the samples were used to draw conclusions on the study as responded to by consultants and contractors. Data analysis was carried out for the qualitative data obtained from the questionnaire survey. The frequency analysis was used to present result of personal and background data of the respondents. The result has been tabulated in the form of frequency tables. To determine the relative importance of factors influencing pricing pattern of preliminaries items; and significance level of preliminaries items as assessed by the respondents the data received in the questionnaire were analysed by Relative Importance Index (RII) in the formula;

$$RII = \frac{\text{Sum of weights } (X_1 + X_2 + X_3 + \ldots + X_n)}{A \times N}$$
where X = weights given to each factor by the respondents and will ranges from 1 to 5 where ‘1’ is for not important and ‘5’ is for very highly important. A = highest weight (i.e. 5 in this case), and N = total number of respondents. This is for easy and prompt observation of the results.

RESULTS

From the sample; twenty-two respondents representing 52% and twenty respondents representing 48% were professionals in construction contracting and consulting firms respectively. Twenty-seven or 65% of respondents are BSc degree holders followed by eight or 19% were MSc degree holders and seven or 17% were HND holders indicating that all respondents are educationally qualified. Construction cost experts were the major respondents considered in the survey; 81% were quantity surveyors, 14% Civil and or Structural Engineers, 2% builders and 2% project managers. All the respondents are professionally qualified. Table 1 shows 81% of respondents being NIQS members while 17% were members of the Nigerian Society of Engineers and only one indicating 2% of respondents were members of the NIOB.

<table>
<thead>
<tr>
<th>Professional Body</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIQS</td>
<td>34</td>
<td>81</td>
</tr>
<tr>
<td>NIOB</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>NSE</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>

Factors Influencing the Pricing Pattern of Preliminaries Items

Table 2 lists the various factors that affect pricing pattern in a descending order of their relative indices according to the degree of importance, it can be observed from Table 2 that complexity and size of project has the highest relative index (0.90), this is a very important factor in that small projects results in lower cost of preliminaries, a good example is management and staff, the next factor with higher relative indices are method of construction (0.86) and Site Condition (0.86); these two factors were ranked in the this order because of the difference in their mean yet they have the same relative index, this is closely followed in order by site location (0.85), plant and equipment required(0.82) and weather conditions (0.82), lump sum pricing and accessibility (0.79). It is important to note that all factors were within the importance mean with Extension of contract period (0.68) Lack of Understanding of Contract Conditions (0.67) and Relationship with local labour/domestic sub-contractors (0.66) in the lower ranking although ranked as important but their positioning shows that they are the remote factors to be considered by professionals in pricing for preliminaries.

Significance of Preliminaries Items

Table 3 lists the various preliminaries items in a descending order of their relative indices according to the degree of significance; it can be observed that scaffolding has the highest relative index (0.90), contractors tend to treat it with utmost importance, this is closely followed by temporary hoarding, water and site administration (0.89), these three have the same ranking as both their means and relative indices are the
same, and lighting and power (0.87), setting out (0.85), safety (0.82), Performance bond (0.80). It is important to note that all items were within the significant range in their mean.

Table 2: Frequency analysis on factors influencing pricing pattern of preliminaries items

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>R.I.I</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity and size of Project</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>24</td>
<td>4.5</td>
<td>0.90</td>
<td>1</td>
</tr>
<tr>
<td>Method of Construction adopted by contractor</td>
<td>-</td>
<td>7</td>
<td>15</td>
<td>20</td>
<td>4.31</td>
<td>0.86</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Site Condition</td>
<td>-</td>
<td>7</td>
<td>16</td>
<td>19</td>
<td>4.29</td>
<td>0.86</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Location of Site</td>
<td>-</td>
<td>4</td>
<td>23</td>
<td>15</td>
<td>4.26</td>
<td>0.85</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Weather Conditions</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>14</td>
<td>17</td>
<td>4.12</td>
<td>0.82</td>
<td>5</td>
</tr>
<tr>
<td>Plant and Equipment required for the Project</td>
<td>-</td>
<td>1</td>
<td>8</td>
<td>19</td>
<td>14</td>
<td>4.10</td>
<td>0.82</td>
<td>6</td>
</tr>
<tr>
<td>Lump Sum Pricing</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>13</td>
<td>17</td>
<td>3.95</td>
<td>0.79</td>
<td>7</td>
</tr>
<tr>
<td>Any obligation or restriction imposed by employer</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>21</td>
<td>10</td>
<td>3.95</td>
<td>0.79</td>
<td>7</td>
</tr>
<tr>
<td>Site accessibility</td>
<td>-</td>
<td>1</td>
<td>12</td>
<td>17</td>
<td>12</td>
<td>3.95</td>
<td>0.79</td>
<td>7</td>
</tr>
<tr>
<td>Construction method</td>
<td>-</td>
<td>2</td>
<td>10</td>
<td>19</td>
<td>11</td>
<td>3.93</td>
<td>0.79</td>
<td>10</td>
</tr>
<tr>
<td>Additional management and staff provided by</td>
<td>2</td>
<td>11</td>
<td>18</td>
<td>11</td>
<td>3.86</td>
<td>0.77</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>contractor</td>
<td>-</td>
<td>1</td>
<td>14</td>
<td>20</td>
<td>7</td>
<td>3.79</td>
<td>0.76</td>
<td>12</td>
</tr>
<tr>
<td>Construction period and programme of work</td>
<td>-</td>
<td>5</td>
<td>7</td>
<td>22</td>
<td>8</td>
<td>3.79</td>
<td>0.76</td>
<td>12</td>
</tr>
<tr>
<td>Position of the contractors head office</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>19</td>
<td>16</td>
<td>3.69</td>
<td>0.74</td>
<td>14</td>
</tr>
<tr>
<td>Availability of resources by contractors</td>
<td>1</td>
<td>3</td>
<td>13</td>
<td>19</td>
<td>6</td>
<td>3.62</td>
<td>0.72</td>
<td>15</td>
</tr>
<tr>
<td>Government policy</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>21</td>
<td>5</td>
<td>3.57</td>
<td>0.71</td>
<td>16</td>
</tr>
<tr>
<td>Mechanical Plants owned by Contractors</td>
<td>-</td>
<td>1</td>
<td>21</td>
<td>16</td>
<td>4</td>
<td>3.55</td>
<td>0.71</td>
<td>17</td>
</tr>
<tr>
<td>Extension of contract period (under force majeure)</td>
<td>-</td>
<td>9</td>
<td>12</td>
<td>17</td>
<td>4</td>
<td>3.38</td>
<td>0.68</td>
<td>18</td>
</tr>
<tr>
<td>Lack of Understanding of Contract Conditions</td>
<td>-</td>
<td>6</td>
<td>19</td>
<td>14</td>
<td>3</td>
<td>3.33</td>
<td>0.67</td>
<td>19</td>
</tr>
<tr>
<td>Relationship with local labour/domestic sub-contractors</td>
<td>1</td>
<td>4</td>
<td>20</td>
<td>15</td>
<td>2</td>
<td>3.31</td>
<td>0.66</td>
<td>20</td>
</tr>
</tbody>
</table>

**Note:** RII- Relative Importance Index; R- Ranking. 1- Not Important, 2- Less Important, 3- Averagely Important, 4- Highly Important, 5- Very Highly Important.

This shows that professionals would most likely price these items except the following six items; Small Plant and Tools (0.66), Temporary Telephone (0.65), Overtime (0.65), Cleaning (0.62), Drying the Works (0.60), Defects after Completion (0.56) that may be overlooked (or not priced) at some other times; say rarely.
### Table 3: Frequency Analysis of the Significance Level of Preliminaries Items

<table>
<thead>
<tr>
<th>Preliminaries Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>R.I</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaffolding</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>18</td>
<td>23</td>
<td>4.52</td>
<td>0.90</td>
<td>1</td>
</tr>
<tr>
<td>Temporary Hoarding</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>19</td>
<td>21</td>
<td>4.45</td>
<td>0.89</td>
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<td>Defects after Completion</td>
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<td>2</td>
<td>2.79</td>
<td>0.56</td>
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</tr>
</tbody>
</table>

**Note:** R.I- Relative Index, R-Rank, Scale: 1- Not significant, 2- Less Significant, 3- significant, 4- Highly Significant, 5- Very Highly Significant,

### CONCLUSIONS

The most common priced items were found to be the most significant as scaffolding was found to be the most significant of all the preliminaries items. The size and complexity of project is highly considered in pricing of preliminaries. This is a very important factor in that small projects result in lower cost of preliminaries, a good example is management and staff; the next factor with higher relative indices are method of construction and site condition; site location, plant and equipment requirement and weather conditions were also highly important in professionals’ consideration in pricing the preliminaries. All factors of consideration were rated important with extension of contract period, lack of understanding of contract conditions and relationship with local labour/domestic sub-contractors considerations in the lower stem although ranked as important but their position shows that they are
the remote factors to be considered by professionals in pricing the preliminaries. The very highly rated factors are plant and equipment related hence, the consideration given to preliminaries are plant and equipment driven whereas the remotely important factors are contract provisions documentations and relationships. Cost experts considered scaffolding very highly more than any other items; this is closely followed by temporary hoarding, water for the works and site administration. Lighting and power, setting out, safety, and performance bond were also assessed to be very important in the pricing of preliminaries. Professionals would most likely price these items except; small plant and tools, temporary telephone, overtime, cleaning, drying the works and defects after completion that may be overlooked or not priced at some other times. The research work is not exhaustive as further research is on-going to assess the pricing pattern from secondary data. It is recommended that construction professionals assess preliminaries items and distributes the costs appropriately among the various items, quoting accurate prices for the different items and also consider the factors that might affect the pricing pattern based on the level of significance and experience. Importantly, the consultant cost expert should ensure that they examine the preliminaries section of the bills of quantities during tender analysis in order to avoid burdensome additional payments in form of claims on extension of time which the contractor could strategically priced in the preliminaries section.

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AN EVALUATION OF PUBLIC PRIVATE PARTNERSHIP (PPP) FOR HOUSING DELIVERY IN LAGOS STATE, NIGERIA

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Housing is second to food in man hierarchy of needs and it is a fundamental need for every human being irrespective of their level of income or financial status. Basic as this need is, it (housing) and its associated facilities such as water, electricity, waste disposal and so on, are grossly inadequate and government alone cannot muster sufficient resources to meet with the demand. PPP provides an alternative avenue for funding major public sector capital projects. This study aims at evaluating public private partnership for housing delivery in Lagos State, Nigeria. A total of two hundred and twenty-eight (228) questionnaires were received and analysed for this study. The following professionals constitute the sample surveyed, architects, builders, estate surveyors and valuers, structural engineers, town planners and quantity surveyors. The simple random sampling technique was employed in the selection of respondents. Data collected were analyse using mean item score (MIS). The result obtained from the analysis of data indicates that BOT is the most familiar and most used of the PPP options. Unstable political situation/instability of government, lack of or poor legal/regulatory framework, corruption of public officials, lack of transparency in contract awards, lack of government commitment and support, inappropriate risk sharing and inability of the private partner to identify and manage risks are the greatest challenges to PPP projects, and usage of the mode for housing delivery. Recommendations were made based on the result of data analysed, that Government should encourage the use of PPP for housing provision in Nigeria, create an enabling and secure investment environment for both local and foreign investors, show adequate commitment and support throughout the partnership period; and establish a financial structure that can provide adequate security for lenders.

Keyword: housing, public private partnership, construction, professionals

INTRODUCTION

A house is a fundamental need for every human being irrespective of level of income or financial status (Otunola, 2005). A home or building occupies a unique position in the life of all human beings after food (Udegbe, 2005). Man requires security, privacy and certain elements of personal identification, which a home can offer. Building structure irrespective of size has a universal but singular purpose of providing shelter for man. In line with this view, Ukabam (2008) argues that shelter means more than a roof over one’s head. It means adequate: privacy, space, security, lightning and ventilation, basic infrastructure and location with regards to work and basic facilities.
Eleh (2010), upholding the views of Udegbe (2005) declares that housing is second only to food in man basic hierarchy of needs and that the quality and quantity of available housing stock in any country are also well accepted indices of a country’s level of development and quality of life. It is also one of the main contributors to any economy as it accounts for a sizeable portion of the production activity through its backward linkages to land markets, building materials, tools, furniture and labour markets and its forward linkages with financial sector. Housing market is an important indication of overall macro-economic activity and home ownership is a good measure of household wealth and GDP distribution.

However, despite the importance of housing for the physical and mental survival of man and productivity, its shortage is evident in the cry of the masses for good housing provision and slums across the states of the federation. According to Oyebanji (2008), housing environments are fast degenerating into slums areas like Makoko and Ajegunle in Lagos, Ayeye, Fako and Oke Oluokun in Ibadan and in many other Nigerian cities. Eleh (2010) asserts that nearly 85% of the population lives in a single room with occupancy rates estimated at between 5-8 persons per room. What this means is that most Nigerians are today living in very unsuitable accommodation (where they have any) without basic amenities. Suitable housing “encompasses all the ancillary and community facilities which are necessary for human well-being”. From available data, only a small percentage of houses in Nigeria will meet this criterion. It is noteworthy, that most houses are concentrated in Lagos prior to the movement of the Federal Capital to Abuja, implying that overcrowding and decadents has overcome houses in Lagos necessitating housing needs.

**TRENDS OF HOUSING NEEDS AND SUPPLY IN LAGOS**

Records of housing supply over the decades show that there was a plan to deliver 202,000 housing units to the public between 1975 and 1980, but only 28,500 units, representing only 14.1% was achieved, both in Lagos and in the then state capitals. Between 1981 and 1985, out of 200,000 housing units planned to be delivered; only 47,200 representing 23.6% was constructed, both in Lagos and in other areas (Ademiluyi and Raji, 2008). In the National Rolling Plan of 1990-92, government promised to increase housing supply from 4.8 million to 5.9 million by 2000. The 1991 housing policy estimated that 700,000 housing units are to be built annually if housing deficit is to be cancelled. In summary, it was stated that between 1973 and 2006, the Federal Housing Authority (FHA) built only 30,000 housing units nationwide (Akeju, 2007), and these were concentrated in Abuja alone.

Housing provision could be classified into, provision for the rich and provision for the poor. The old neighbourhoods residential of Mushin, Somolu, Bariga, Olodi-Apapa, Isolo, Oshodi, Sogunle, Mafoluku, Agege and the recent expansion into former urban fringe areas like Idimu, Egbe, Ikotun, in Alimosho LGA; and Ojo, Ajagbandi, Lembahausa, along the Badagry corridor provide housing for the poor. These houses are usually over crowded, lack basic services and amenities required for a healthy living. These parts accommodate over 70% of the 15 million Lagos population. Wilbur Smith (1979) reveals that 96% of such houses were structurally fair, while 4% were in poor and unsound conditions likely to require demolition by year 2000. Most of the houses lacked steady supply of pipe borne water and rely on water wells or tanker water. 75% relied on septic tank method of sewage disposal, 11 per cent on bucket or pail system of disposal and, 14% had latrines. The master plan for metropolitan
Lagos for the period (1980–2000) which was sponsored by the UNDP, accurately analysed the housing needs of Lagos and recommended that between 1980 and 2000, 1.4 million additional housing units should be constructed out of which, a million should be deliberately earmarked for the low-income households. By the year 2000 when the plan expired, not more than ten percent of the housing needs were satisfied.

REASONS FOR INADEQUATE HOUSING SUPPLY

Eleh (2010) identifies the following as impediments to housing delivery in Nigeria. They are, lack of long term funds, poor infrastructural development of the country, the land use decree (now Act 6) of 1978, high cost of building materials and high import dependence of the sector, construction methods, poor state of Public Private Partnership, lack of vital statistics, and the poor overall economy, low level of capital accumulation and stringent mortgage criteria which make it difficult to access.

HISTORY OF PPP

The origin of PPP in its different variants can be traced back to the privately financed French canals and bridges in the 17th century. The Private funded and operated trade related infrastructure for the transportation of people and raw materials following the industrial revolution and the French concession contract to supply drinking water to Paris in the 18th century, the Suez canal, the Trans-Siberian railway, and so on (Mabogunje, 2002; Olawore, 2004). However, as the influence of central and provincial government grew through the 20th century, public funding became the predominant and eventually monopolistic funding of nearly all public construction projects. Major changes in the political-economic climate of Europe during the 1980s have resulted in an increasing inability of government to fund large scale public projects. This has resulted in to government-led development concessions reappearing as a politically acceptable funding vehicle for major construction projects (Balogun, 2008).

THE VARIOUS PPP OPTIONS OR MODELS

Literature on the various options of PPP is replete with article papers and books (Obozuwa (2011), Balogun (2008), National Council for Public-Private Partnerships (2011), South Indian Bank (2010), Saidu (2009), and Rekhal (2012). They are:

Design-Build (DB) or Turnkey contract,
Build-Operate-Transfer (BOT),
Design-Build-Operate-Maintain (DBOM),
Rehabilitate-Operate-Transfer (ROT),
Build-Transfer-Operate (BTO),
Design-Build-Operate (DBO),
Build-Lease-Transfer (BLT)/ Lease-Purchase,
Build-Own-Operate (BOO),
Rehabilitate-Own-Operate (ROO),
Buy-Build-Operate (BBO),
Build-Own-Operate and Transfer (BOOT),
Build-Own-Operate-Subsidize-Transfer (BOOST),
Design-Build-Finance-Operate/Maintain (DBFO/M),
Service Contract / Operations and Maintenance (O&M),
Management Contract (MC)/Operations, Maintenance and Management (OMM), and Concession.

**CHALLENGES OF PPP REGARDING HOUSING DELIVERY**

Numerous problems persist regarding the successful delivery of housing through PPP options. Several authors (Ahmed, 2012; Li et al., 2005 and Xuenqing, 2005) have identified a number of these problems. From the list of problems identified by these authors, they can be categorized into six groups, namely: social, political, and legal problems; unfavourable economic and commercial conditions; inefficient public procurement framework; lack of mature financial engineering techniques; problems related to the public sector; and problems related to the private sector.

The problems of social, political, and legal issue relate to, unstable political situation; instability of governments; lack of or poor legal/regulatory framework and unenforceable contracts; public oppositions; change in law; politics that does not understand risk allocation; and too many government restrictions.

Unfavourable economic and commercial techniques deal on issues, such as, weak economic strength and poor prospects for economic growth of the local economy; economic risks and uncertain economic climate in developing countries; project fundamentals that cannot justify investments; lack of a strong capital market; and uncertainties in the demand and supply during the long contract period.

Inefficient public procurement techniques refer to lack of appropriate standard project procurement framework; public clients initiate PPP projects but do not in corporate them in their development plans; corruption resulted from unsolicited PPP schemes; poor project definition and articulation of client’s requirements at the tender stage; lack of basic and reliable data for tender preparation; inadequate means of controlling and allocating tender costs; lack of transparency in contract awards; lack of proper procedures for contract negotiations; long procurement processes and endless negotiations; and high transaction costs.

Lack of mature financial engineering techniques relate to factors, such as, complexities in project financing; long time and possibly long delay in reaching financial closure; lack of clarity on funding systems to allow public bodies to service tolls/tariffs; inappropriate accounting treatment of PPP projects; lack of appropriate toll/tariff adjustment mechanisms; financiers’ unwillingness to accept any high risks; public client’s lack of appreciation of returns expected by the private sector e.g., restriction on the cap of internal rate of return; and public client’s misleading cost comparison with projects procured in a traditional way.

Problems related to the public sector include, inexperienced government bodies and lack of proper understanding of PPPs; bureaucratic attitudes and resistance to change of civil servants in host government; lack of government commitment and support and full cooperation with the private sector; too many institutional players; host government’s unreasonable expectations of the private sector; general corruption and untrustworthiness of public officials; counter-party risks related to the poor credit quality of local administrative bodies; renegotiation of contract terms in mid-operation.
by public authorities; lack of appropriate financial risk guarantees from the public sector; inappropriate risk sharing—government may want to transfer all instead of appropriate risks to the private sector; and philosophical and ideological antipathy to working with the private sector.

Lastly, the problems related to the private sector are, lack of people prepared for working on PPP projects and most people (including investment banks) still prefer traditional projects; philosophical and ideological antipathy to working with the public sector; lack of understanding among stockholders; lack of managerial expertise of private sector participants; inexperienced project management team; poor coordination and team work within the concessionaire consortium; lack of innovation; construction delay; inability to deliver quality service for the price offered; and inability to identify and manage risks.

**RESEARCH METHODOLOGY**

The study was conducted within the Lagos Metropolitan City of Nigeria. This choice was taken because it is where major projects relative to number and magnitude is undertaken in Nigeria. The sample for this study consist of Architects (211), Builders (210), Estate Surveyor and Valuers (189), Quantity Surveyor (202), Structural Engineer (149) and Town Planner (254). Employing this formula to obtain sample size in each of the population (n=N/1+N(e)² where, n = sample size, N = population size, and e = levels of precision taken as ±10%. The following sample sizes were obtained: Architects (68), Builder (68), Estate Surveyor and Valuer (65), Quantity Surveyor (67), Structural Engineer (60) and Town Planner (72).

**DATA PRESENTATION AND DISCUSSIONS**

<table>
<thead>
<tr>
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<th>Reasons</th>
<th>MIS</th>
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<td>Lack of long term funds</td>
<td>4.33</td>
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<td>Poor infrastructural development of the country</td>
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<td>Poor state of Public Private Partnership</td>
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<td>5</td>
<td>High cost of building materials and high import dependence of the sector</td>
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Simple random sampling technique was used for the selection of sample in each of the population sample and a well structured closed end questionnaire were sent to respondents through post. In all, 400 questionnaires were administered and 228 questionnaires, representing 57% achievement was obtained. Respondents with the HND (35.4%) predominate, next is B.Sc/B.Tech. (33.9%) and Master’s degree (20.1%) and others (10.6%). Respondents with six (6) years of experience and above predominate (66.5%). Most of the respondents (71.89%) are members of their professional bodies, and are from the private sector. Most of the respondents’ organisations (85.2%) have been in existence for upward of six years. Inferential statistical tool was used for the analysis of the data obtained.
Cronbach’s alfa (α) test was conducted on the data obtained. The Cronbach α value for the data is 0.945, which is > 0.50, the value accepted for a good reliability of the internal consistency of data. Based on this value, the internal consistency of the data can be deemed reliable, and it is a measure of the reliability of the data measuring scale.

Table 2: Respondents Level of familiarity with various PPP options

<table>
<thead>
<tr>
<th>S/N</th>
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<th>MIS</th>
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<td>2</td>
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<td>3</td>
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<td>5</td>
<td>Design-Build-Operate-Maintain (DBOM)</td>
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</tr>
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<td>6</td>
<td>Build-Own-Operate and Transfer (BOOT)</td>
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<td>6</td>
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<td>Concession</td>
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<td>8</td>
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<td>Buy-Build-Operate (BBO)</td>
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<td>Management Contract (MC)/Operations, Maintenance and Management (OMM)</td>
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<td>Build-Transfer-Operate (BTO)</td>
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<td>16</td>
<td>Build-Own-Operate-Subsidize-Transfer (BOOST)</td>
<td>2.81</td>
<td>16</td>
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</table>

Table 1 reveals the reasons for housing deficit in Lagos. The factor with the highest rating is inconsistent government policies (MS=4.38). Government efforts in the implementation of policies towards housing provision have failed, this accounted for the reason for the serious housing problem, both in Lagos and in Nigeria today. Records of housing supply over the decades shows that there was a plan to deliver 202,000 housing units to the public between 1975 and 1980, but only 28,500 units was provided, representing only 14.1% achievement. Out of 200,000 housing units planned for delivery between 1981 and 1985, only 47,200 units representing 23.6% was delivered (Ademiluyi and Raji, 2008). In the National Rolling Plan of 1990-92, government promised to increase housing supply from 4.8 million to 5.9 million by 2000. The 1991 housing policy estimated that 700,000 housing units were to be built annually if housing deficit was to be cancelled. To cap it all, it was stated that between 1973 and 2006, the Federal Housing Authority (FHA) built only 30,000 housing units nationwide (Akeju, 2007).

Poor policy implementation remains a major problem of the government in housing delivery. Lack of long term funds (MS=4.33) was rated second. As at today, interest rate in the banking sector remains as high as 20%, lenders securing such loan do so, possibly to keep busy. As a result of the high interest rate, it may be impossible for lenders to make profit with such loan. The mortgage sector remains largely inactive and the National Housing Fund which was meant to be accessed at the rate of 9% is yet inaccessible to the generality of Nigerians due to its cumbersome requirements (Eleh, 2010). The two factors respondents rated low relative to reasons for housing
deficit are, land use decree (MS=3.19) and construction methods (MS=3.06). The process of obtaining a Certificate of Occupancy and the consent provision of the Decree makes transaction in land tedious, time consuming and expensive. Reliance on traditional method of construction has also not help in housing delivery. Industrialized building systems, which are cost and time efficient for mass housing projects is still not common.

Table 3: Response to influence of identified challenges on PPP project

<table>
<thead>
<tr>
<th>S/N</th>
<th>Challenge</th>
<th>MIS</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Social, political and legal risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Unstable political situation;</td>
<td>4.30</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Instability of governments</td>
<td>4.26</td>
<td>2</td>
</tr>
<tr>
<td>1.3</td>
<td>Lack of or poor legal/regulatory framework and unenforceable of contracts</td>
<td>4.10</td>
<td>3</td>
</tr>
<tr>
<td>1.4</td>
<td>Too many government restrictions.</td>
<td>3.52</td>
<td>4</td>
</tr>
<tr>
<td>1.5</td>
<td>Politics does not understand risk allocation</td>
<td>3.48</td>
<td>5</td>
</tr>
<tr>
<td>1.6</td>
<td>Change in law</td>
<td>3.40</td>
<td>6</td>
</tr>
<tr>
<td>1.7</td>
<td>Public oppositions</td>
<td>3.09</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Unfavorable economic and commercial conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Weak economic strength and poor prospects for economic growth of the local economy</td>
<td>3.99</td>
<td>1</td>
</tr>
<tr>
<td>2.2</td>
<td>Lack of a strong capital market</td>
<td>3.88</td>
<td>2</td>
</tr>
<tr>
<td>2.3</td>
<td>Economic risks and uncertain economic climate in developing countries</td>
<td>3.82</td>
<td>3</td>
</tr>
<tr>
<td>2.4</td>
<td>Project fundamentals cannot justify investments</td>
<td>3.75</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>Uncertainties in the demand and supply during the long contract period</td>
<td>3.57</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Inefficient public procurement framework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Corruption resulted from unsolicited PPP schemes</td>
<td>4.22</td>
<td>1</td>
</tr>
<tr>
<td>3.2</td>
<td>Lack of transparency in contract awards</td>
<td>4.20</td>
<td>2</td>
</tr>
<tr>
<td>3.3</td>
<td>Lack of appropriate standard project procurement framework</td>
<td>3.94</td>
<td>3</td>
</tr>
<tr>
<td>3.4</td>
<td>High transaction costs</td>
<td>3.90</td>
<td>4</td>
</tr>
<tr>
<td>3.5</td>
<td>Poor project definition and articulation of client’s requirements at the tender stage</td>
<td>3.86</td>
<td>5</td>
</tr>
<tr>
<td>3.6</td>
<td>Lack of proper procedures for contract negotiations</td>
<td>3.79</td>
<td>6</td>
</tr>
<tr>
<td>3.7</td>
<td>Long procurement processes and endless negotiations</td>
<td>3.72</td>
<td>7</td>
</tr>
<tr>
<td>3.8</td>
<td>Public clients initiate PPP projects but do not incorporate them in their development plans</td>
<td>3.72</td>
<td>7</td>
</tr>
<tr>
<td>3.9</td>
<td>Lack of basic and reliable data for tender preparation</td>
<td>3.56</td>
<td>9</td>
</tr>
<tr>
<td>3.10</td>
<td>Inadequate means of controlling and allocating tender costs</td>
<td>3.53</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Lack of mature financial engineering techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Complexities in project financing;</td>
<td>3.98</td>
<td>1</td>
</tr>
<tr>
<td>4.2</td>
<td>Financiers’ unwillingness to accept any high risks</td>
<td>3.97</td>
<td>2</td>
</tr>
<tr>
<td>4.3</td>
<td>Long time and possibly long delay in reaching financial closure</td>
<td>3.91</td>
<td>3</td>
</tr>
<tr>
<td>4.4</td>
<td>Lack of clarity on funding systems to allow public bodies to service tolls/tariffs</td>
<td>3.78</td>
<td>4</td>
</tr>
<tr>
<td>4.5</td>
<td>Inappropriate accounting treatment of PPP projects</td>
<td>3.78</td>
<td>4</td>
</tr>
<tr>
<td>4.6</td>
<td>Public client’s lack of appreciation of returns expected by the private sector</td>
<td>3.66</td>
<td>6</td>
</tr>
<tr>
<td>4.7</td>
<td>Public client’s misleading cost comparison with projects procured in a traditional way.</td>
<td>3.63</td>
<td>7</td>
</tr>
<tr>
<td>4.8</td>
<td>Lack of appropriate toll/tariff adjustment mechanisms</td>
<td>3.48</td>
<td>8</td>
</tr>
</tbody>
</table>
Table 3: Response to influence of identified challenges on PPP project continued

<table>
<thead>
<tr>
<th>SN</th>
<th>Challenge</th>
<th>MIS</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Problems related to the public sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>General corruption and untrustworthiness of public officials</td>
<td>4.22</td>
<td>1</td>
</tr>
<tr>
<td>5.2</td>
<td>Lack of government commitment and support and full cooperation with the private sector</td>
<td>4.16</td>
<td>2</td>
</tr>
<tr>
<td>5.3</td>
<td>Inappropriate risk sharing—government may want to transfer all instead of appropriate risks to the private sector;</td>
<td>4.11</td>
<td>3</td>
</tr>
<tr>
<td>5.4</td>
<td>Lack of appropriate financial risk guarantees from the public sector</td>
<td>3.96</td>
<td>4</td>
</tr>
<tr>
<td>5.5</td>
<td>Inexperienced government bodies and lack of proper understanding of PPPs</td>
<td>3.88</td>
<td>5</td>
</tr>
<tr>
<td>5.6</td>
<td>Bureaucratic attitudes and resistance to change of civil servants in host government</td>
<td>3.71</td>
<td>6</td>
</tr>
<tr>
<td>5.7</td>
<td>Too many institutional players</td>
<td>3.58</td>
<td>7</td>
</tr>
<tr>
<td>5.8</td>
<td>Host government’s unreasonable expectations of the private sector</td>
<td>3.58</td>
<td>7</td>
</tr>
<tr>
<td>5.9</td>
<td>Renegotiation of contract terms in mid-operation by public authorities</td>
<td>3.55</td>
<td>9</td>
</tr>
<tr>
<td>5.10</td>
<td>Philosophical and ideological antipathy to working with the private sector.</td>
<td>3.48</td>
<td>10</td>
</tr>
<tr>
<td>5.11</td>
<td>Counter-party risks related to the poor credit quality of local administrative bodies</td>
<td>3.47</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Problems related to the private sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Inability to identify and manage risks.</td>
<td>3.82</td>
<td>1</td>
</tr>
<tr>
<td>6.2</td>
<td>Lack of people prepared for working on PPP projects and most people (including investment banks) still prefer traditional projects</td>
<td>3.72</td>
<td>2</td>
</tr>
<tr>
<td>6.3</td>
<td>Inability to deliver quality service for the price offered</td>
<td>3.71</td>
<td>3</td>
</tr>
<tr>
<td>6.4</td>
<td>Lack of managerial expertise of private sector participants</td>
<td>3.71</td>
<td>3</td>
</tr>
<tr>
<td>6.5</td>
<td>Lack of understanding among stockholders;</td>
<td>3.65</td>
<td>5</td>
</tr>
<tr>
<td>6.6</td>
<td>Poor coordination and team work within the concessionaire consortium</td>
<td>3.61</td>
<td>6</td>
</tr>
<tr>
<td>6.7</td>
<td>Inexperienced project management team</td>
<td>3.58</td>
<td>7</td>
</tr>
<tr>
<td>6.8</td>
<td>Construction delay</td>
<td>3.58</td>
<td>7</td>
</tr>
<tr>
<td>6.9</td>
<td>Lack of innovation</td>
<td>3.57</td>
<td>9</td>
</tr>
<tr>
<td>6.10</td>
<td>Philosophical and ideological antipathy to working with the public sector.</td>
<td>3.45</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2 indicates the level of familiarity of respondents with various PPP options. BOT (MS=4.01) has the highest rating, implying the most familiar with and used. This could be as a result of the not complex condition of contract involve. DB/Turkey (MS=3.83) has the second most rating, and BOO (MS=3.60) was rated third place. The options of PPP, that respondents claim no familiarisation with and use are, Service Contract/and maintenance, Build Lease Transfer/Lease Purchase and BOOST with MS of 3.14, 3.10 and 2.81 respectively.

Table 3 presents influences of various identified challenges on PPP projects. These challenges are grouped into six categories which are:

Social, Political and Legal risks

Unfavorable economic and commercial conditions

Inefficient public procurement framework
Lack of mature financial engineering techniques

Problems related to the public sector

Problems related to the private sector

The various challenges have been grouped into six main headings, as indicated in Table 3. The first group, being the social, political and legal risk, has six challenges associated with it. The factor that has the most influence on PPP project in this group, is unstable political situation (MS=4.30). Parties to most PPP projects are the government and the private participants. The success of PPP projects is largely on the continual reign of such government. The change of government might mean the change of interest and the non-completion of such projects.

The second group is the unfavourable economic and commercial conditions. From this group, the factor with the most influential effect on PPP project delivery is weak economic strength and poor projects for economic growth of the local economy (MS = 3.99). Most PPP projects involve large sum of money to realise. A weak economy might not be able to finance projects of such. One solution is to look into the international market for funding, in which the problem of pay-back may not favour the release of funds.

The third main group is inefficient public procurement framework. The factor with the highest influence on PPP projects is corruption resulting from unsolicited PPP schemes (MS = 4.22). PPP projects are initiated to solve the needs or problems of people. In other words, to make life much easier to meet the challenges of life. For example, a good need, such as, energy plant – electricity and fuel, and provision of portable water for a good living. When these priorities are misplaced, the intent of such project may be to siphon money to private pockets, hence failure of such PPP projects.

The fourth main heading of PPP challenges is lack of mature financial engineering technologies. The factor that exact negative influence the most on PPP projects in this group is complexities in project financing (MS = 3.98). The setting of criteria too difficult to meet by borrowers/developers may limit the application of PPP in the delivery of projects.

The fifth main grouping of PPP challenges is problems related to the public sector. From this group, the factor with the greatest negative influence is general corruption and untrustworthiness of public officials. Personal interest relative to accumulation of wealth has take over public officials to the detriment of the growth of nation regarding facilities and public utilities.

The last grouping of PPP challenges is problems related to the private sector. Of this group, the most influencing challenges of PPP is inability to identify and manage risks (MS = 3.82). Risk are inherent in any project. The ability to identify them early and develop appropriate mechanism to deal with them, implies the success of the project. The inability to identify them will mean, the non placing of mitigating forces/plan to cushion the impact of such risk if they occur. This may lead to the failure of the project.

It is worthy of note, that of all the factors of the challenges of PPP, that which has the greatest negative impact on the delivery of PPP projects is unstable political situation, next is corruption resulting from unsolicited PPP schemes, while the third is weak economic strength and poor prospects for economic growth of the local economy.
Table 4: Responses to Criteria for successful application of PPP

<table>
<thead>
<tr>
<th>S/N</th>
<th>Criteria</th>
<th>MIS</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project must be financially sound, feasible and affordable.</td>
<td>4.66</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Contractors must have sufficient experience and resources</td>
<td>4.45</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Strong government support</td>
<td>4.39</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Sponsors must have sufficient financial strength; and be experienced and reliable.</td>
<td>4.38</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Stable legal framework</td>
<td>4.35</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Adequate security for lenders</td>
<td>4.33</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Fair and transparent bidding procedure</td>
<td>4.30</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Country risks must be manageable</td>
<td>4.27</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Efficient administrative framework</td>
<td>4.24</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Rational allocation of project risks among parties</td>
<td>4.22</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Reasonable conclusion time and cost for PPP transaction</td>
<td>4.07</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 4 reveals criteria for successful application of PPP procurement option in housing delivery. It is observed that respondents agree, that the factors listed relative to the successful application of PPP are important. All the factors have an MS greater than 4, implying a very strong agreement for the factors to be in place. The factor with the most rating is, project must be financially sound, feasible and affordable (MIS = 4.66). Before embarking on PPP projects, it is advised that the necessary finance for the completion should be available. All parties involved should be convinced that the project is feasible, that is able to generate the cost invested and make profit.

Next is contractors must have sufficient experience and resources (MS = 4.45). Failure looms when skills and competences are lacking on the party to the contract to put the resources of construction together. The third factor according to respondents rating is strong government support (MS = 4.39). Because PPP projects involve large sum of money and are embarked on by the government and the private sector, it requires government support in terms of policies, finance and operation of the facilities to be laid down prior to initiation of the project.

The least criterion for PPP success is the reasonable conclusion time and cost for the transaction. The project should not be for an indefinite time and cost. Actual time lines and project cost must be defined with clauses spelling the consequences of cost and time overruns.

CONCLUSION

Stated below are the conclusions emanating from the analysis of data for this study.

The lack of government financial resources, dissatisfaction from the populace with the level of existing infrastructure services and inefficient public sector administration are the major reasons for PPP projects. Build-Operate-Transfer (BOT); Design and Build (DB)/Turnkey contract, and Build-Own-Operate are the most familiar PPP options. While Build-Operate-Transfer (BOT); Design and Build(DB)/Turnkey contract;
Design-Build-Operate, and Maintain (DBOM) are the most frequently use PPP options for project delivery in Lagos. Inconsistent government policies and lack of long term funds are the major reasons for housing deficit. Housing delivery through the PPP initiative proffer solution that would best address the housing deficit.

Off the six categories of PPP challenges, the following are forefront factors mitigating against the success of PPP mode of housing delivery: unstable political situation; weak economic strength and poor prospects for economic growth of the local economy; corruption resulting from unsolicited PPP schemes; complexities in project financing; general corruption and untrustworthiness of public officials, and inability to identify and manage risks. Improve service delivery and increase efficiency in project delivery and operation are the major challenges of PPP projects. For successful application of PPP, project must be financially sound, feasible and affordable and have strong government support and commitment throughout the partnership period.

RECOMMENDATION

From the conclusions reached based on the data analysed, the following recommendations are made:

Government should encourage the use of PPP for housing provision in Lagos and create a favourable social, political, legal, and economic environment including effective institutional framework for PPPs projects. It should also ensure and maintain continuity of policies within the country;

Furthermore, government should ensure competitiveness of bid and transparency in the award of contract;

Due to the fact that some models of PPP are better suited than others in the delivering of particular PPP projects, client should consider the option that will deliver targeted outputs while ensuring the mitigation of risk involved;

Government should formulate policies that will ensure a strong capital market and oppose corruption throughout the partnership period and should as well establish a financial structure that can provide adequate security for lenders. It should equally show adequate commitment and support throughout the partnership period, and

Risk should be apportioned objectively among parties, considering the party best able to manage it.

REFERENCES


AN EVALUATION OF THE PROPERTIES OF BINARY CONCRETE CONTAINING METAKAOLIN

Okoli O.G\textsuperscript{1}, Getso A. I\textsuperscript{2} and Dahiru D\textsuperscript{3}

\textit{Department of Building Faculty of Environmental Design Ahmadu Bello University, Zaria-Nigeria}

The advantages of using binary blends of concretes are mostly in terms of improving concrete properties, economy and sustainability with less environmental impact. This research evaluated the properties of binary concrete containing metakaolin as partial replacement of an Ordinary Portland Cement exposed to aggressive environment. Grade 40 cement concrete (conventional concrete) was designed using the Building Research Establishment method. An optimal percentage replacement of cement with metakaolin was also used to produce binary concrete. The samples were cured in water and three aggressive media (3.5\%NaCl, 1\%MgSO\textsubscript{4} and 2\% MgSO\textsubscript{4}) for 7, 14, 28 and 90 days. At the end of each curing period, the concrete samples were tested for compressive strength, tensile strength and abrasion resistance. The research revealed that binary concrete has higher (improved) compressive strength by about 10.8\% and 11.9\%, higher tensile strength by about 21.6\% and 34.5\% at 28 and 90 days respectively. Also, the binary has higher abrasion resistance than the conventional concrete by about 66.7\% at 14 days and 33.3\% at 28 days, while the two concrete samples have roughly the same resistance at 90 days. It was concluded that the binary concrete is more durable than conventional concrete in the three aggressive media. It was recommended that more research be carried out with the aim of commercial production of binary concrete of metakaolin and other pozzolanas.

Keywords: metakaolin, pozzolana, binary blends

INTRODUCTION

Environmental concerns coming from the high energy consumption and carbon dioxide (CO\textsubscript{2}) emission associated with cement production have brought about pressures to reduce cement consumption through the use of new materials which can be applied for substitution of a part of clinker in Portland cement or a part of cement in concrete (Biljana\textsl{et al}, 2011). Nowadays, pozzolans are widely used as supplementary cementing materials in Portland cements and may replace part of the clinker in order to enhance the performance of the hydrated cement (Indrawati and Manaf, 2008). It was further noted that such composite or blended cements are employed for their economic, ecological and technological benefits. However, one of the materials that satisfies the requirements of sustainable development and, when added in appropriate proportions, improves the properties of cement, mortars and concrete, is metakaolin (MK), a processed pozzolana (Biljana\textsl{et al}, 2011).

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\textsuperscript{3} daudadahiru509@gmail.com

Pozzolanic materials are natural or artificial, alumino-siliceous minerals which in themselves possess little or no cementitious value, but in finely divided form and in the presence of moisture, chemically react with calcium hydroxide liberated on hydration, at an ordinary temperature, to form compounds possessing cementitious properties (Shetty, 2009). Some of pozzolans are natural and others are by-products (artificial) but both contain silica in amorphous form and that reacts with calcium hydroxide (CaOH) to form cementitious calcium silicate hydrate (C-S-H) which contribute to enhance the concrete strength (Habeeb and Mahmud, 2009 and Najigiviet al, 2010). When incorporated in binary blends, pozzolanic materials are known to react with calcium hydroxide (CaOH), which is a product of cement hydration, to produce additional reaction products, such as calcium silicate hydrate (C-S-H) which improve concrete strength (Habeeb and Mahmud, 2009 and Najigiviet al, 2010). Kaolin is found in many states of Nigeria (Kovo and Edoga 2005, Lori et al, 2007, Badmus and Olatinsu, 2009). Metakaolin is produced by heat-treatment of pulverized kaolin between (650-900°C). This alters its structure, producing a highly reactive supplementary cementitious material that is widely available for use in partial replacement of ordinary Portland cement in concrete construction (Kurtis, 2011). Research works carried out on the viability of incorporating metakaolin as supplementary cementitious materials in the production of concrete include: Justice (2005) who observed that metakaolin increases compressive strength, elastic modulus and resistance to chemical attack of concrete, as compared to conventional concrete. Ghorpade and Rao, (2011), Justice et al, (2005) observed that chloride ion permeability value decreased considerably with increase in metakaolin content in concrete, thus indicating improved durability with increasing metakaolin content. According to Kurtis (2007 and 2011), metakaolin increases compressive strength, impermeability and durability of concrete due to its high surface area and reactivity. Momtazi et al (2007) noted that metakaolin can decrease permeability, increase compressive strength and concrete durability. However, not much research has been carried out to examine the use of the abundant kaolin deposits in Nigeria especially with regards to incorporating it for the production of blended concrete. Baba and Usman (2011) investigated the heating parameters for converting Kankara kaolin to Metakaolin with a view to ascertaining the possibility of using Nigerian Kaolin Clay as supplement to cement for concrete production. It was found that the optimum thermal condition for the calcination of kankara kaolin was 650°C in 90 minutes, and that it can be used for partial replacement of ordinary Portland cement. They found that the optimum percentage replacement of cement with kankarametakaolin is 10%. Therefore, this research compared the properties of OPC concrete and binary concrete containing the kankarametakaolin using the optimum percentage replacement (10%).

MATERIALS AND METHODS

Materials:

The materials used in this study includes: Ordinary Portland Cement (OPC), fine aggregates, coarse aggregates, metakaolin and water. The OPC used was manufactured by Dangote cement company Plc. The coarse aggregate used was crushed granite while the fine aggregate was fine river sand. They were mixed with tap water fit for human drinking.

Methodology:
Test of the individual constituents of the concretes (metakaolin, fine and coarse aggregates and cement) was carried out and trial tests, so as to determine the most suitable water-cement ratio and method of compaction. The tests carried out includes: chemical composition analysis, specific gravity test, moisture content and sieve analysis of aggregates. These tests were performed in accordance to ASTM 618-05, BS 4550 (1978), BS 812 (1984), BS 812 (1985), and BS 882(1965). Trial mixes were performed using Building Research Establishment Method (BRE) at different water-cement ratios of 0.3, 0.35 and 0.4.

Based on the results of the trial test, 100mm×100mm×100mm grade 40 concrete cubes were cast, using 0.35 water-cement ratio which served as control. This was followed by producing concrete mix using the supplementary cementing material to replace the Portland cement at the optimum percentage replacement, i.e.10%, and their properties determined. A total of 72 cubes were produced. At fresh stage, the concrete samples were tested for workability using slump, while at hardened stage, the cured specimens in water and aggressive media (3.5% NaCl, 1%MgSO₄ and 2%MgSO₄.), were allowed to air dry and tested for compressive and tensile strengths, and on abrasion on the 7th day. The average value in each case was determined and recorded. The values were recorded separately for normal and binary concrete. The tests were repeated at the end of 14, 28 and 90 days curing period after casting.

The aggressive media were prepared by dissolving the 3.5% NaCl,1%MgSO₄ and 2%MgSO₄ in water. It has been observed that usually sea water contains 3.5% salts as the highest concentration by weight of water. However, 1000ppm is considered as moderately severe and 2000ppm very severe medium for magnesium sulphate in water (Gupta and Gupta, 2006).

**TEST RESULTS AND DISCUSSIONS**

The results of the different tests on the concrete constituents and concrete samples are as follows:

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Cement Content %</th>
<th>Kaolin Content %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>4.9</td>
<td>40.0</td>
</tr>
<tr>
<td>SiO₂</td>
<td>20.1</td>
<td>54.9</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.2</td>
<td>0.096</td>
</tr>
<tr>
<td>K₂O</td>
<td>0.4</td>
<td>-</td>
</tr>
<tr>
<td>CaO</td>
<td>6.5</td>
<td>0.802</td>
</tr>
<tr>
<td>Na₂O</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>MgO</td>
<td>3.1</td>
<td>0.027</td>
</tr>
<tr>
<td>MnO</td>
<td>0.02</td>
<td>-</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>2.5</td>
<td>0.082</td>
</tr>
<tr>
<td>Loss on Ignition</td>
<td>8.8</td>
<td>13</td>
</tr>
</tbody>
</table>

**Table 2: Specific Gravity of Metakaolin and Portland cement**

<table>
<thead>
<tr>
<th>Material</th>
<th>Mass of materials (g)</th>
<th>Volume of materials (ml)</th>
<th>Specific gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metakaolin</td>
<td>138</td>
<td>150</td>
<td>2.56</td>
</tr>
<tr>
<td>Portland cement</td>
<td>189</td>
<td>150</td>
<td>2.82</td>
</tr>
</tbody>
</table>
### Table 3: Average Compressive Strength

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>Type of concrete</th>
<th>Compressive strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>3.5% NaCl</td>
</tr>
<tr>
<td>7</td>
<td>Conventional</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>Binary</td>
<td>25.5</td>
</tr>
<tr>
<td>14</td>
<td>Conventional</td>
<td>37.4</td>
</tr>
<tr>
<td></td>
<td>Binary</td>
<td>35.3</td>
</tr>
<tr>
<td>28</td>
<td>Conventional</td>
<td>41.1</td>
</tr>
<tr>
<td></td>
<td>Binary</td>
<td>46.1</td>
</tr>
<tr>
<td>90</td>
<td>Conventional</td>
<td>41.4</td>
</tr>
<tr>
<td></td>
<td>Binary</td>
<td>47.0</td>
</tr>
</tbody>
</table>

### Table 4: Average Tensile Strength (N/mm²)

<table>
<thead>
<tr>
<th>Concrete samples</th>
<th>Age(days)</th>
<th>7</th>
<th>14</th>
<th>28</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPC Concrete</td>
<td>1.35</td>
<td>2.07</td>
<td>3.01</td>
<td>3.84</td>
<td></td>
</tr>
<tr>
<td>Binary concrete</td>
<td>1.35</td>
<td>2.07</td>
<td>3.84</td>
<td>5.39</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5: Abrasion Resistance of OPC concrete and Binary Concrete Samples

<table>
<thead>
<tr>
<th>Age</th>
<th>Concrete samples</th>
<th>Properties</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 days</td>
<td>OPC concrete</td>
<td>Wb(g)</td>
<td>2446</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2443</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Binary concrete</td>
<td>Wb(g)</td>
<td>2373</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2370</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.13</td>
</tr>
<tr>
<td>14 days</td>
<td>OPC concrete</td>
<td>Wb(g)</td>
<td>2445</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2442</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Binary concrete</td>
<td>Wb(g)</td>
<td>2255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2254</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.04</td>
</tr>
<tr>
<td>28 days</td>
<td>OPC concrete</td>
<td>Wb(g)</td>
<td>2459</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2456</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Binary concrete</td>
<td>Wb(g)</td>
<td>2585</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2583</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.08</td>
</tr>
<tr>
<td>90 days</td>
<td>OPC concrete</td>
<td>Wb(g)</td>
<td>2548</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2547</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Binary concrete</td>
<td>Wb(g)</td>
<td>2290</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wa(g)</td>
<td>2289</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wl(g)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%l</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Where; Wb = weight before brushing   %l = percentage loss in weight.
Wa = weight after brushing Wl = weight loss
DISCUSSION OF RESULTS

Metakaolin Made Finishing Easier

Because it is very fine and highly reactive, metakaolin gave the fresh concrete a creamy, non-sticky texture that made finishing easier. Moreover, there was no significant difference, in terms of colour, between the two concrete samples (binary is slightly brighter than the OPC concrete which was due to the colour of the metakaolin). However, efflorescence which appears as a whitish haze on concrete is caused when calcium hydroxide reacts with carbon dioxide in the atmosphere. The binary concretes appeared to have little or no whitish haze as compared to the conventional concrete. This is because metakaolin consumes calcium hydroxide which reduced efflorescence. Moreover, alkali-silica reaction is a reaction between calcium hydroxide (the alkali) and glass (the silica) which can cause decorative glass embedment in concrete to pop out. Because the metakaolin consumed calcium hydroxide, it took away the alkali and the reaction did not occur. These observations agreed with those of The Concrete Countertop Institute, 2011.

Workability

![Figure 1: Slump of OPC concrete and binary concrete](image)

It can be seen from figure 1 that the OPC concrete is more workable (31mm) than the binary concrete (23mm) by about 25.8%. This implies that the binary concrete absorbed water more than the conventional concrete which may be due to the high water requirement of metakaolin.

The results for the compressive strength of OPC concrete (conventional) and binary concrete are shown in the figure 2. It can be observed that at the early age, the average compressive strength of the binary concrete is higher by about 39.8% than that of the conventional concrete in all the four media tested (water, 3.5%NaCl, 1% MgSO₄, and 2% MgSO₄). At 14 days, the average compressive strength of the conventional concrete is higher than the binary concrete by about 5.6%. The decrease in the strength of the binary concrete might be attributed to errors in compaction (compaction was done manually). Beyond 14 days, the binary concrete showed steady increase in strength over the conventional by about 10.8% at 28 days and 11.9% at 90 days. The increase in the strength was due to the effect of metakaolin on calcium
hydroxide which accounts for up to 25% of the hydrated Portland cement according to the Concrete Countertop Institute (2011).

**Compressive strength**

![Compressive Strength Graph](image)

Figure 2 Compressive Strength of Binary and Conventional Concretes

**Tensile Strength**

![Tensile Strength Graph](image)

Figure 3: Split Tensile Strength of Binary and Conventional Concretes

The calcium hydroxide does not contribute to the concrete’s strength or durability. Metakaolin combine with the calcium hydroxide to produce additional cementing compounds, (calcium silicate hydrate), the material responsible for holding concretetogether. Less calcium hydroxide and more cementing compounds means stronger concrete. However, it can be observed that the average severity of the three
media on the concretes is highest in 2% MgSO₄, followed by 3.5%NaCl and 1% MgSO₄.

The results for the tensile strength of OPC concrete and binary concrete are shown in figure 3. It can be observed that at the early age, the average tensile strength of the OPC and binary concretes are the same. Beyond 14 days, the binary concrete showed higher tensile strength than the OPC concrete by about 21.6% at 28 days and 34.5% at 90 days. The increase in the tensile strength could be due to micro filler nature of the metakaolin and its effect on calcium hydroxide which lead to greater tensile strength.

**Abrasion Resistance**

![Figure 4: Abrasion Resistance of Binary and Conventional Concretes](image)

Results of the Abrasion resistance test of OPC concrete and binary concrete are shown in the figure above. Table 8 and figure 4 showed the average abrasion resistance of the two concrete samples in percentage loss in weight. It can be observed that the binary concrete showed more resistance to abrasion than the OPC concretes by about 66.7% at 14 days and 33.3% at 28 days, while the two concrete samples have roughly the same resistance at 90 days. The increase in the abrasion resistance of binary concrete could be due to the effect of metakaolin on calcium hydroxide produced during cement hydration to produce more cementitious compound (calcium silicate hydrate). Less calcium hydroxide and more cementing compounds means stronger concrete, therefore, greater abrasion resistance.

**CONCLUSIONS**

Based on the results of the research, the following conclusions were reached:

With regards to workability, the OPC concrete is more workable than the binary concrete. The OPC concrete has higher slump than the binary concrete by about 25.8%. The binary with metakaolin was examined to require more water to achieve the same level of workability with the OPC concrete. This is likely due to the metakaolin fine surface area.

Metakaolin was observed to make finishing easier, reduce efflorescence and mitigate alkaline silica reaction.
The inclusion of metakaolin resulted in faster early age strength development of concrete.

The binary concrete has higher compressive strength (by about 10.8% and 11.9%), and tensile strength (by about 21.8% and 34.5%) than the OPC concrete at 28 and 90 days respectively. Moreover, the abrasion resistance of the binary is higher by about 66.7% and 33.33% than the OPC concrete at 14 and 28 days, while the two concrete samples have roughly the same abrasion resistance at 90 days.

Metakaolin made from Kankara kaolin offered improvement in the properties of the binary concretes in terms of compressive strength, tensile strength and abrasion resistance.

RECOMMENDATIONS

More research should be carried out with the aim of commercial production of binary concrete with metakaolin and other pozzolans.

Government should make the use of metakaolin and other pozzolans to form part of the items in the National Building Code. Adequate measures should be taken to ensure the use of metakaolin, as partial replacement of cement, in the production of concretes for constructions which will reduce cement consumptions thereby reducing cost and environmental pollution.

Further research should be carried out to assess the setting time and the fire resistance of binary concrete made with metakaolin.

A comparative study should be carried out on metakaolins from different sources as it is abundant in Nigeria.

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ANALYSES OF THE COSTS AND BENEFITS OF SUSTAINABLE TOURISM DEVELOPMENT – EVIDENCE FROM THE LEADING TOURISM COUNTRIES AND CITIES OF THE WORLD

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Relying largely on documentation analysis, this paper explores the costs and benefits of sustainable tourism development using global evidence. The paper argues that the rapid development of global tourism industry in recent years has led to a significant employment creation with some associated negative consequences. With a bulk of evidence from the developed countries, the paper presents a longitudinal evidence of world tourism earnings, expenditure and attraction among the top 10 countries and top 21 cities most visited across the globe. It demonstrates how global tourism development can induce the governments at all levels to hugely invest in infrastructure development. It concludes that the money spent on tourism is directly or indirectly returned to the local economy; this the paper sees as a positive impact of tourism. Institutionalizing tourism development in government policy and improving the capacity to implement it are recommended to improve current trends.

Keywords: costs and benefits analyses; sustainable tourism development; evidence; global industry

INTRODUCTION

Sustainable tourism is obviously a multiple and complex issue, which is becoming increasingly a significant part of a growing world tourism. As sustainability principles encompass environmental, economic and socio-cultural aspects of tourism development, there is a need for a suitable balance between these three dimensions in order to guarantee a long-term sustainability.

Tourism sustainability in the actual sense implies seeking growth in a manner that does not affects the natural or built resources, but embraces local involvement while providing a quality product to the visitors. This strongly suggests that responsible tourism management must seek to protect the resources while adding to an area’s overall tourism product. The broad aims of economic, social and cultural values must be maintained in the process of sustainable tourism development (Marvell and Watkins, 2005).

Sustainable tourism should equally maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their awareness about
sustainability issues and promoting sustainable tourism practices amongst them (Gomez-Gomez et al., 2004).

Tourism is generally regarded as a service industry, comprising a number of Tangible and In-tangible components. The tangible elements of tourism include transportation system-Air, Rail, Road, Water and Space. Other is Hospitality services such as Banking services, Insurance, Safety and Security. While the intangible elements of tourism include Rest and Relaxation, Culture, Escapes, Adventure, new and different experiences (Dieke, P.U.C., 2000).

Furthermore, tourism is a collection of activities, services and it is an industry that delivers a travel experience, including Transportation, Accommodations, and Eating and drinking establishments, retail shops, Entertainment businesses, Activity facilities and other hospitality services provided for individual groups travelling away from. For instance, tourism provides over 6 million Jobs in the United States; making it the largest employer of labour in the world (WTTC, 2012).

Generally, the world tourism sector, can play a key role in fighting poverty and become a primary tool for sustainable development, have begun a new phase of growth, as it broke the barrier of (800 million) International arrivals. For instance, the increase in International tourist’s arrival was projected to be around 4% for (2007), which is much in line with the forecast of long term and annual growth rate of 4.1% by the year (2020), according to the W.T.O.’s barometer (Blanke and Chilsa, 2007).

**PROBLEM STATEMENT**

Despite the enormous benefits of tourism development to national economy, tourist places around the world are struggling with tourism. On the one hand, tourists bring much needed revenue to bolster the local economy. On the other hand, tourism brings massive strain on local resources. In places where local tourism has been usurped by central country capital politician/businessman deals; the shift from a local based tourism has gone from local improvement and economic development, to lining the pockets of absentee country capital big money. The subsequent damages affect the living standards, environment and revenues of the locals. A case in point is India, where New Delhi big business connected operators have usurped the small local bus operators and small family run guest houses in the Himilayan small communities. The small communities have lost the in-transit small scale tourist business, which has now been taken over by big business and massive tour bus operations that come and leave within hours. The trash, sewage and pollution problems are left for the locals to deal with as best they can. Their small scale revenue base had often gone to the big city and business operators with political connections (Belize Development Trust, 2009).

In recent years, there have been many problems with mass tourism, which raise concern about mass pollution. On the one hand, thousands of people visiting an area would cause more pollution such as air, land and water pollution. On the other hand, the overcrowding will threaten the preservation of tourist sites, which are sometimes natural heritage, such as beaches and mountains with unique features that appeal to tourists. Thus, some actions need to be taken to control the number of tourist, in order to protect our ecological system. This paper firmly believes that tourism should be developed harmoniously with environmental protection.
LITERATURE REVIEW

Generally experts in the field of tourism accepted that, the main positive economic impacts of tourism is related to foreign exchange earnings, contributions to government revenues, and generation of employment and business opportunities.

However, tourism expenditures and export import of the related goods and services normally generate income to the host economy and can stimulate the investment necessary to financial growth in other economic sectors. Some countries seek to accelerate this growth by requiring visitors/tourists to bring in a certain amount of foreign currency for each day of their stay and are not allow taking it out of the country again at the end of the trip. For instance, one of the important indicators of the role of international tourism is its generation of foreign expenditure earnings. Tourism is one of the top five export categories for as many as 83% of the countries in the world and it is the main source of foreign exchange earnings for at least 38% of the countries in the world (W.T.O. 2012).

Furthermore, government revenue from the tourism sector can be categorized as direct and indirect contributions. Direct contributions are generated by taxes on income from taxes. The indirect contributions are those originated from taxes and duties levied on goods and services supplied to tourists. For instance, the National Park Service of U.S. estimated that the 273 million visitors to American national parks in 1993 generated direct and indirect expenditures of US $10 Billion and 200,000 jobs (Crompton, 2011). While visits to land managed by other agencies, and to state, local and privately-managed parks, are added, parks were estimated to bring around US $22 Billion annually to the U.S. economy. These expenditures also generated significant tax revenues for the government. Also the world travel and Tourism council estimated that travel and tourism’s direct, indirect and personal tax contribution worldwide was over US $800 million in 1998, a figure expected to double by the year 2015 (WTTC, 2012).

In addition, the rapid expansion of international tourism has led to significant employment creation. For instance, the hotel accommodation sector alone provided around 11.3 million jobs worldwide in 1995. Tourism can also generate jobs directly through hotels, restaurants, night clubs, taxis and souvenir sales and indirectly through the supply of goods and services needed by tourism related business. Tourism also supported some 7% of the worldwide workers in 2006 (Sinclair, 2007).

However, tourism is significant as well as an essential part of the local economy. Since our environment is a basic component of the tourism industry’s asset, the tourism revenues are often used to measure the economic values of the protected areas, national park inclusive. For instance, Dorrigo-national parks in New South Wales Australia have been estimated to contribute 7% of the gross regional output and 8.4% of the regional employment opportunities (W.E.F., 2007). Also the importance of tourism to local economies can be illustrated by the impacts, when it is disrupted, for instance the catastrophic floods of 1997 that led to the closure of Yosemite National Park in California U.S.A. caused locally severe economic losses to the areas around the park. In the heavily affected and impacted area, the mariposa country, the 1997 personal income was reduced by an estimated US $1.159 per capita (US $1.67 million) in the region’s occupancy and sales, tax revenues, and 956 jobs, that is a significant number in an area with a population of 16,000 residents. There are other local revenues that are not easily quantifiable, because not all tourist expenditure is formally registered in the macro-economic statistics. The positive side of the informal
or unreported employment is that the money is returned to the local economy and has a great multiplier effect, as it is spent over and over again. For instance in (2012) the World Travel and Tourism Council (WTTC) estimated that tourism generated an indirect contribution, which is equal to 100% of the direct tourism expenditures.

Also, in many developing societies tourism is perceived as a panacea for their fragile economy that is characterized by a scarcity of development resources such as finance and professional expertise. These resources are needed to increase the economic surplus, without which these countries would be forced to rely on solely international aid to support their development efforts (NNPS, 2006). Therefore, the well-recognized benefits of tourism are usual reasons advanced for governments support for tourism. The benefits are usually felt in two levels, i.e. Macro and Micro levels (National and Local levels). At the macro level, tourism is expected to foster economic growth through foreign exchange earnings and an increase in the overall revenue, while at Micro level, an improvement in the people’s wellbeing in the area of Job creation, revenue and income distribution and balanced regional development. In this regard tourism is described as an industry, although it has no single production characteristics or defined operational parameters.

The tourism industry generates substantial economic benefits to both host countries and the tourists’ home country (rise). In developing countries, one of the primary motivations for a region to promote itself as a tourism destination is the expected economic improvement. For instance, in (2012) according to W.T.O., 698 million people have traveled to foreign countries, spending more than $478 Billion. Also International tourism receipts combined with passenger transport total more than $575 Billion, making tourism the world’s number one export earner, ahead of automobile products, chemicals, petroleum and food industries (WTTC, 2012).

However, massive economic development brings along both positive and negative consequences, tourism sector inclusive. In fact there are many hidden costs to tourism, which can have unfavorable economic effects on the host community. Often rich countries are better able to benefit from tourism than the poor ones. In a situation where the less developed countries have the most urgent need for income, employment and general rise of the standard of living by means of tourism, they are less able to realize these benefits. Among the reasons for these benefits are the large-scale transfer of tourism revenues out of the host country and the exclusion of the local businesses and products.

EMPIRICAL EVIDENCE FROM MOST VISITED TOURISM DESTINATIONS IN THE WORLD

The methods adopted for this paper is mainly that of documentation analyses and reviews of secondary materials related to the context of the paper. The analyses follow a conventional method without the use of any complex software.

World Tourism Organization reports the following countries as the most visited in between 2009 and 2011 by number of Intentional travelers. When compared to 2006, Ukraine entered the top lists, surpassing Russia, Austria and Mexico and in 2011 surpassed Germany. In 2011 the U.S dispossessed Spain from the second place. Most of the top visited countries can be found on the European continent.

However, in 2011, there were over 922 million international tourist arrivals, with a growth of 1.9% as compared to 2010. International tourism receipts grew to USS 944 billion (euro 642 billion) in 2011, corresponding to an increase in real terms of 1.8%
on 2007. When the export value of international passenger transport receipts is accounted for, total receipts in 2011 reached a record of US$ 1.1 trillion, or over US$3 billion a day.

Table 1 below shows the world’s top 10 tourism income earners for the years 2009-2011

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>United State</td>
<td>North America</td>
<td>78.9 million</td>
<td>81.9 million</td>
<td>79.3 million</td>
</tr>
<tr>
<td>2.</td>
<td>France</td>
<td>Europe</td>
<td>51.0 million</td>
<td>56.0 million</td>
<td>58.0 million</td>
</tr>
<tr>
<td>3.</td>
<td>Spain</td>
<td>Europe</td>
<td>58.2 million</td>
<td>58.7 million</td>
<td>57.3 million</td>
</tr>
<tr>
<td>4.</td>
<td>China</td>
<td>Asia</td>
<td>49.9 million</td>
<td>54.7 million</td>
<td>53.9 million</td>
</tr>
<tr>
<td>5.</td>
<td>Italy</td>
<td>Europe</td>
<td>41.1 million</td>
<td>43.7 million</td>
<td>42.7 million</td>
</tr>
<tr>
<td>6.</td>
<td>United Kingdom</td>
<td>Europe</td>
<td>30.7 million</td>
<td>30.9 million</td>
<td>30.2 million</td>
</tr>
<tr>
<td>7.</td>
<td>Ukraine</td>
<td>Europe</td>
<td>18.9 million</td>
<td>23.1 million</td>
<td>25.4 million</td>
</tr>
<tr>
<td>8.</td>
<td>Turkey</td>
<td>Europe</td>
<td>18.9 million</td>
<td>22.2 million</td>
<td>25.4 million</td>
</tr>
<tr>
<td>9.</td>
<td>Germany</td>
<td>Europe</td>
<td>23.5 million</td>
<td>24.4 million</td>
<td>25.0 million</td>
</tr>
<tr>
<td>10.</td>
<td>Mexico</td>
<td>North America</td>
<td>21.4 million</td>
<td>21.4 million</td>
<td>22.6 million</td>
</tr>
</tbody>
</table>

The World Tourism Organization reports the following countries as the top ten tourism earners for the year 2011. It is noticeable that most of them are on the European Continent, but the United State continues to be the top earner.

Table 2 showing top 10 most income earners for the years 2009-2011.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>United State</td>
<td>North America</td>
<td>$86.7 billion</td>
<td>$96.7 billion</td>
<td>$110.1 billion</td>
</tr>
<tr>
<td>2.</td>
<td>Spain</td>
<td>Europe</td>
<td>$51.1 billion</td>
<td>$57.6 billion</td>
<td>$61.5 billion</td>
</tr>
<tr>
<td>3.</td>
<td>France</td>
<td>Europe</td>
<td>$46.3 billion</td>
<td>$54.3 billion</td>
<td>$55.6 billion</td>
</tr>
<tr>
<td>4.</td>
<td>Italy</td>
<td>Europe</td>
<td>$38.1 billion</td>
<td>$42.7 billion</td>
<td>$45.7 billion</td>
</tr>
<tr>
<td>5.</td>
<td>China</td>
<td>Asia</td>
<td>$33.9 billion</td>
<td>$37.2 billion</td>
<td>$40.8 billion</td>
</tr>
<tr>
<td>6.</td>
<td>Germany</td>
<td>Europe</td>
<td>$32.8 billion</td>
<td>$36.0 billion</td>
<td>$40.0 billion</td>
</tr>
<tr>
<td>7.</td>
<td>United Kingdom</td>
<td>Europe</td>
<td>$33.7 billion</td>
<td>$38.6 billion</td>
<td>$36.0 billion</td>
</tr>
<tr>
<td>8.</td>
<td>Australia</td>
<td>Oceanic</td>
<td>$17.8 billion</td>
<td>$22.3 billion</td>
<td>$24.7 billion</td>
</tr>
<tr>
<td>9.</td>
<td>Turkey</td>
<td>Europe/Asia</td>
<td>$16.9 billion</td>
<td>$18.5 billion</td>
<td>$22.0 billion</td>
</tr>
<tr>
<td>10.</td>
<td>Austria</td>
<td>Europe</td>
<td>$16.6 billion</td>
<td>$18.9 billion</td>
<td>$21.8 billion</td>
</tr>
</tbody>
</table>

Source: WTO, 2012

Furthermore, the World Tourism Organization reports the following countries as the top ten big spenders on the international tourism for the year 2011. Also for the fifth year in a row, German tourists continue as the top spenders. Table 3 below demonstrates that.

**DISCUSSIONS**

As presented in tables 1-4 above, the direct income of an area is the amount of tourist expenditure that remains locally after taxes, profit, and wages are paid outside the area and after imports are purchased; these subtracted amount are called leakage. In fact, in most or all-inclusive package tours 80% of travelers expenditure goes to the

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airlines, hotels and other international companies (who often have their headquarters in the traveler’s home countries), and not to local businesses or workers, in addition, significant amounts of income actually retained at the destination level, can leave again through leakage.

Furthermore, in Thailand, for example a study of tourism leakage, estimated that 70% of all the money spent by tourists, ended up leaving the country, through foreign-owned tour operators airlines, hotels, imported drinks and food etc. Also the estimate for the third world countries ranges from 80% in the Caribbean to 40% in India (W.E.F. 2007). Also of each $100 spent on a vacation tour by a tourist from a developed country, only around $5 actually stays in a developing country destinations economy (Sinclair, 2007).

Table 3 Showing international tourism expenditure for the years 2009-2011.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Germany</td>
<td>Europe</td>
<td>$73.9 billion</td>
<td>$83.1 billion</td>
<td>$91.0 billion</td>
</tr>
<tr>
<td>2.</td>
<td>United State</td>
<td>North</td>
<td>$72.1 billion</td>
<td>$76.4 billion</td>
<td>$79.7 billion</td>
</tr>
<tr>
<td>3.</td>
<td>United Kingdom</td>
<td>America</td>
<td>$63.1 billion</td>
<td>$71.4 billion</td>
<td>$68.5 billion</td>
</tr>
<tr>
<td>4.</td>
<td>France</td>
<td>Europe</td>
<td>$31.2 billion</td>
<td>$36.7 billion</td>
<td>$43.1 billion</td>
</tr>
<tr>
<td>5.</td>
<td>China</td>
<td>Europe</td>
<td>$24.3 billion</td>
<td>$29.8 billion</td>
<td>$36.2 billion</td>
</tr>
<tr>
<td>6.</td>
<td>Italy</td>
<td>Asia</td>
<td>$23.1 billion</td>
<td>$27.3 billion</td>
<td>$30.8 billion</td>
</tr>
<tr>
<td>7.</td>
<td>Japan</td>
<td>Europe</td>
<td>$26.9 billion</td>
<td>$26.5 billion</td>
<td>$27.9 billion</td>
</tr>
<tr>
<td>8.</td>
<td>Canada</td>
<td>Asia</td>
<td>$20.5 billion</td>
<td>$24.7 billion</td>
<td>$26.9 billion</td>
</tr>
<tr>
<td>9.</td>
<td>Russia</td>
<td>North</td>
<td>$18.2 billion</td>
<td>$22.3 billion</td>
<td>$24.9 billion</td>
</tr>
<tr>
<td>10.</td>
<td>Netherland</td>
<td>America</td>
<td>$19.1 billion</td>
<td>$19.1 billion</td>
<td>$21.7 billion</td>
</tr>
</tbody>
</table>

Source: WTO, 2012

This phenomenon commonly occurs, in a situation when the tourists demanded for standard or qualitative equipment, food and other products which the host country cannot supply. Especially in less-developed countries, food and drinks most often are imported, since the local products are not up to the hotels or tourists standards or the country doesn’t have the supplying industry. Therefore, much of the income from tourism expenditures leaves the country again to pay for these imports. For instance, the average import-related leakage for most countries or developing countries is between 40% and 50% of gross tourism earnings for small economies and between 10% and 20% for most advanced and diversified economies, (W.E.F., 2007).

However, in developed regions of the world, local producers are often unable to supply the tourism industry appropriately even if good will is present: the 64-room hotel “Kaiser I’m Tirol”, an award-winning leader in sustainable practices cannot find organic food suppliers in the local farming networks in the appropriate quantity, quality and reliability, as production cycles and processes are not compatible with its needs (I.Y.E., 2001).

Furthermore, on the export leakage of tourism, the multinational corporations and the large foreign businesses have a substantial share in the import leakage. In fact the poor developing destinations are the only ones that possess the necessary capital to invest in the construction of tourism infrastructure and facilities. Therefore, the consequences of this, is an export leakage arises when overseas investors who finance the resorts and hotels take their profits back to their country of origin.
Table 4 showing Top 21 most visited cities in the world by tourists between 2009 and 2011.

<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>International Visitors (million)</th>
<th>Year/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris</td>
<td>France</td>
<td>15.6</td>
<td>2010 (excluding extra-mural visitors)</td>
</tr>
<tr>
<td>London</td>
<td>United Kingdom</td>
<td>14.8</td>
<td>2010</td>
</tr>
<tr>
<td>Bangkok</td>
<td>Thailand</td>
<td>10.84</td>
<td>2010(external study estimation)</td>
</tr>
<tr>
<td>Singapore</td>
<td>Singapore</td>
<td>10.1</td>
<td>2011(excluding mainland China)</td>
</tr>
<tr>
<td>New York City</td>
<td>United State</td>
<td>9.5</td>
<td>2011</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>China</td>
<td>7.94</td>
<td>2010</td>
</tr>
<tr>
<td>Istanbul</td>
<td>Turkey</td>
<td>7.05</td>
<td>2010</td>
</tr>
<tr>
<td>Dubai</td>
<td>United Arab Emirate</td>
<td>6.9</td>
<td>2010</td>
</tr>
<tr>
<td>Shanghai</td>
<td>China</td>
<td>6.66</td>
<td>2010</td>
</tr>
<tr>
<td>Rome</td>
<td>Italy</td>
<td>6.12</td>
<td>2011</td>
</tr>
<tr>
<td>Seoul</td>
<td>South Korea</td>
<td>4.99</td>
<td>2011</td>
</tr>
<tr>
<td>Barcelona</td>
<td>Spain</td>
<td>4.72</td>
<td>2011(external study estimation)</td>
</tr>
<tr>
<td>Madrid</td>
<td>Spain</td>
<td>4.64</td>
<td>2010</td>
</tr>
<tr>
<td>Mecca</td>
<td>Saudi Arabia</td>
<td>4.5</td>
<td>2010</td>
</tr>
<tr>
<td>Kuala Lumpur</td>
<td>Malaysia</td>
<td>4.4</td>
<td>2011</td>
</tr>
<tr>
<td>Beijing</td>
<td>China</td>
<td>4.4</td>
<td>2010</td>
</tr>
<tr>
<td>Moscow</td>
<td>Russia</td>
<td>4.1</td>
<td>2011</td>
</tr>
<tr>
<td>Prague</td>
<td>Czech Republic</td>
<td>4.1</td>
<td>2011</td>
</tr>
<tr>
<td>Athens</td>
<td>Greece</td>
<td>3.87</td>
<td>2010</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>Netherlands</td>
<td>3.66</td>
<td>2010</td>
</tr>
<tr>
<td>Vienna</td>
<td>Austria</td>
<td>3.53</td>
<td>2011</td>
</tr>
</tbody>
</table>

Source: WTO, 2012

On the negative look, tourism development can cost the local government and the local tax payers a great deal of money. Developers may want the government to improve the airports, road and other infrastructure, and possibly to provide tax breaks and other financial advantages, which are costly activities for the government. Public resources spent on subsidized infrastructure or tax breaks may reduce government investment in other critical areas such as education and health.

Increasing demand for basic services and goods from tourists will often cause price hikes that negatively affect the local residents whose income does not increase proportionately. Therefore, Tourism development and the related rise in real estate demand may dramatically increase building costs and land values not only does this make it more difficult for the local people, especially in developing countries, to meet their basic daily need, it can also result in a dominance by outsiders in land markets and in-migration that erodes economic opportunities for the local people, eventually disempowering residents. For instance, in Costa Rica, close to 65% of the hotels belong to foreigners (Marvell and Watkins, 2005). Long-term tourists living in second homes, and the so-called amenity migrants (Wealthy or retired people and liberal professionals moving to attractive destinations in order to enjoy the atmosphere and peaceful rhythms of life) cause price hikes in their new homes, if their numbers attain a certain critical mass.

The seasonal character of the tourism industry creates economic problems for the destinations that are heavily dependent on it. The problems seasonal workers face include job opportunity, insecurity, usually with no guarantees of employment from
one season to another, difficulties in getting training, employment related medical benefits, and recognition of their experience, and unsatisfactory housing and working conditions.

However, economic crisis normally affects all sectors including tourism industry, especially in developing countries. Malaysia and Indonesia a few years ago was devastating to inbound tourism flows affected these countries during the 1997 and 1998. Also in the Philippine, the crisis and the temporary closure of the Philippines airports affected the inbound arrivals significantly as there was a decline of almost 3.3% in 1998. In Nigeria for instance, the political turmoil from 1993 till date has seriously affected almost all the sectors, including tourism. Foreign investors have seized to visit the country as a result of the instability. Also insecurity in the oil producing states of the country (Niger Delta), has affected the exploration and exportation of petroleum products, which is the major source of income of the country, almost 80% of its income generation comes from the oil revenue (Sinclair, 2007).

CONCLUSIONS

The motivating factors for a business or region to serve tourists are generally economic. A community or a region is concerned with tourism’s overall contribution to the economy, as well as its fiscal and environmental impacts; while an individual business is primarily interested in its own costs and revenues. Therefore, a good understanding of sustainable tourism development is important for the tourism industry, governments and the communities. The fear however is that, the central government may disqualify local people and their initiatives from reasserting their own control over the territory and its resources, and will instead pursue objectives that differ markedly from those of sustainable tourism development.

SUGGESTIONS AND IMPLEMENTATION STRATEGIES

The general aim of this paper is to integrate and strengthen the global tourism industry, generating new employment opportunities, expanding micro and small business, and growing local economies.

The paper has analyzed policies and assets of global tourism and provides the following sets of recommendations:

The current national strategies and programmes should give special attention to their consistency in relation to the (touristic, natural and cultural) assets of the nation and to the needs of local entrepreneurs in the sector. There should be a bit of coordination of policies to sustain tourism with other policies related to local development.

There is an urgent need for tourist countries to invest hugely in training, skills acquisition and human capital development. This should focus more on education policies and training needs in the tourism sector, which should include both the supply and the demand side in the country.

The paper advocates the need for possible strategic policy intervention in four key areas of tourism development, which are tourist ports and harbours; low-costs flights connections; typical form of accommodations; and cultural event-based tourism.

REFERENCES

Sustainable tourism development


APPRAISAL OF THE DEVELOPMENT CONTROL ACTIVITIES OF ORIADE LOCAL GOVERNMENT PLANNING AUTHORITY, OSUN STATE, NIGERIA

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Department of Urban & Regional Planning, Osun State University, Osogbo, Nigeria

This study assesses the development control activities of Oriade Local Government Council, Osun State, Nigeria. The objectives are to examine the functions and operational procedure of the Authority, examine the plan approval process, assess the adherence to the building codes, examine the constraints to the effective functioning and suggest possible solutions to the identified constraints. Six hundred and one households were selected from six randomly selected towns out of forty in the Council. Primary data for the study were obtained through structured questionnaire. Information obtained include age, type and use of building, building plan approval process, adherence to building codes, post approval activities of the Planning Officials and general functions of planning authority. Findings reveal that 53.2% of the sampled buildings were for residential use, 47.4% did not fulfill the road setback requirement and 70% did not have adequate airspace while 8.3% did not have building permit. Appraisal of the plan approval process reveals that 49.9% of the sample processed their building permits through a third party, 30% had their plan approved in two weeks and 82% in a month. 54.2% of the sampled altered the structure and design of their development during construction without necessary permit while 33.3% reported that Town Planning Officials did not monitor their development during construction. It was concluded that the Local Planning Authority did not perform its functions adequately and recommended that adequate provision should be made for effective performance of site inspectors; qualified and adequate personnel should be employed and house numbering be done for effective administration.

Keywords: physical planning, development control, local planning authority, building permit

INTRODUCTION

Physical planning is concerned with the creation of physical environments that are orderly, economical, functionally efficient and aesthetically pleasant for living, working, recreation and relaxation and should be the nucleus of the activities of Local Planning Authorities. The slow pace of physical development in Nigeria has often been associated with the defective nature of the set-up of Local Governments, which are supposed to guide physical planning at local levels. Local Governments throughout the Federation have not enjoyed any appreciable degree of autonomy, a situation attributed to the over-concentration of powers at the Federal and State Government Levels.

The primary reason for the existence of the local governments is the efficient and effective provision of services and the enhancement of the coordination of activities

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and functions at the local level. (Gboyega, 1987; Ikelegbe, 2005). The administration of physical planning has been the responsibility of all levels of government in Nigeria over the years. The extent of each level of government is dictated by the operation of the various Town and Country Planning legislations as well as the federal constitution. Going by the sections of the Nigeria Urban and Regional Planning Decree No. 88 of 1992, physical planning and development is brought to the local level by making provisions for the establishment of Local Planning Authorities in every Local Government, and the main target of this is to enhance physical development at the local level.

The primary functions of a Local Planning Authority are to control the use and development of land in its planning area by means of building and land sub-division regulations (referred to as codes or bye-laws), prepare and implement a planning schedule for its planning area or a part of it and preserve and or conserve buildings, structures, monument or objects of architectural, historic, archeological and artistic values, as well as natural features of aesthetic, education and scientific importance in its panning areas. Adedeji (1989) asserts that the local governments formed authentic instrument for national development; which will eventually enhance national development and stability. It also builds a bridge of trust and legitimacy between the local people and the government. It has been found to ensure the provision of basic development needs and thus enhances the efforts of the central government.

The Local Planning Authorities have greater and sensitive roles to play in ensuring that towns are planned in an orderly, functional and aesthetic manner through proper monitoring, regulation and directing physical development towards a desired goal. Physical development control is an integral part of master plan and a tool for implementing the plan (Omole and Akinbamijo, 2012). It helps to ensure that the proposals of developers harmonize with the plan framework and represents the intervention of the public to insist upon established standard of comfort, privacy and aesthetics.

However, from observation, the reverse seems to be the case. This is evidenced from the chaotic and haphazard development witnessed in most towns in Nigeria. The impact of the authority is not significantly felt as manifested by the reality on ground; buildings are constructed without approved plans, setback regulations are not complied with, many buildings lack basic sanitary and infrastructural facilities, supposed open spaces are encroached upon and physical developments are not adequately supervised. Alabi and Akinbode (2010) laments that in most developing countries, especially in Africa and Latin America, the role of the local government in towns physical development have been neglected, which have excluded the local populace from infrastructures planning and physical planning.

This paper examines the functional effectiveness of the Local Planning Authority of Oriade Local Government Area in respect of physical development, with a view to providing a framework for enhancing a healthy and functional human settlement. The objectives are to:

- examine the functions and operational procedure of Oriade Local Planning Authority.
- assess the plan approval process.
- evaluate adherence to the building bye laws
- identify the constraints to the effective functioning of the Local Planning Authorities
suggest possible solutions to the identified constraints

THE STUDY AREA

The study area is Oriade Local Government area northeastern part of Osun State. It is located on latitude 7° 35' North of the equator and longitude 4° 52' east, covers a total land area of 465km\(^2\) and has a population of 148,617 according to the 2006 census. At the growth rate of 3.2%, the population is estimated to 179,534 for 2012. Its capital is Ijebu-Jesa and its inhabitants are the Ijesa people who trace their ancestry to Oduduwa the progenitor of the Yoruba race. The local government shares boundary with Ilesa East, Ilesa West, Atakunmossa East, Obokun local governments, Ekiti and Ondo states. It was carved out of old Obokun local government in 1999 and covers about forty various towns and cities such as parts of Ilesa, Ipetu-Ijesa, Erinmo, Iloko, Erin-Ijesa, Erin-Oke, Ijeda, Iwaraja, Ikeji-Ile, Iwoye, Owena, Dagbaja, Eti-Oni, Ijinmo etc.

The area lies within the rain forest belt. It is in the tropical humid region with double maxima pattern of rainfall and high temperature. The area is well drained by small rivers and streams. The good drainage favours human settlement and farming. The area lies on the geologic formation classified as metamorphic rocks. The soil is categorized into sandy, loamy, and clay soils. It is on a plain ground.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Physical planning is a process aimed at achieving orderly physical development with the overall aim of evolving a functional and live able environment where individual and common goals can be achieved. In urban centres, the substance of land use planning is to guarantee that urban activities are organized and developed in physical space with due consideration for the protection of the public interest which include health, safety, convenience, efficiency, energy conservation, environmental quality, social equality, social choice and amenity (Nnah et al, 2007).

Oyesiku (2009) argued that planning practice in Nigeria was not creating spatially sustainable new settlement and cities because planning is like preventive medicine whereas professional planners in the country have spent the last generation focusing on curative medicine. He further contended that local government throughout the federation did not exercise any appreciable degree of autonomy due to the over-concentration of power at the Federal and State Government levels (Aluko, 2000; Aribigbola, 2008; Alabi and Akinbode, 2010). One of the consequences of this is that local governments have to operate under a structure that did not enhance development of local initiative (Adekunle, 2004).

The local planning authority derives its power from the Town and Country Planning Law Cap 123 of the Law of Western State of Nigeria, Number 6 of 1946 or Cap 155 of the Laws of Nigeria promulgated in March 28 1946 and commenced in 1956. These laws have been superseded by the Nigerian Urban and Regional Planning Law, Decree No 88 of 1992, The law seeks to control development and use of land; secure proper sanitary condition of an area to which it applies; secure amenities and convenience; preserve building or other object of architectural historic or artistic interest and places of natural interest or beauty; and protect existing amenities whether in urban or rural areas.

This research work derives its conceptual thrust from the concept of organization environment relations originated by Miles et al (1974). They defined organization as open social systems, which constantly change with correspondingly fluctuating
boundaries. Environment refers to that which surrounds; but in this context, it comprises those activities the organization intends to pursue and in choosing the environment, the organization simultaneously determines its relationship with elements of the environment. The study of organizational adaptation to environmental demands should focus on the following decision points:

The decisions by which the organization selects a portion of the total environment as its particular arena of activity (i.e its domain) and chooses a basic strategic for managing the domain;

The decisions by which the organization establishes and appropriate technology for implementing its policies and priorities;

The decision by which the organization create a structure of roles and relationships to control and coordinate the technology and strategy;

The decisions made to ensure organizational continuity- the capacity to survive, adjust and growth.

These decision points represent broad categories which provide a convenient way of grouping together numerous decisions and actions which taken together define organizational relationship to its environment. In the context of this study, the selected environment represents planning while the basic strategy of management refers to development control. The technology however, represents the various instruments and techniques of development control. These include the planning laws, and other techniques such as land use zoning, sub-division control, building bye-laws etc.

The concept of organization–environment relations, in the main is concerned with organizational responses to environmental demands, management, technology, structure and process. Khera (1968) notes that the form and structure of management in public sector enterprises has come into greater focus since the beginning of the present era of economic development. The increasingly heavy commitment of governments to the concept, construction and management of enterprises of every kind inevitably brings about wide spread concern with the management of the undertaking especially the legal and organizational forms of the enterprise (Akinpelu, 1984). The government has been involved in the establishment of various public enterprises such as banking, railways, power generation, transport, shipping, post and telecommunication, irrigation, broadcasting and manufacturing.

Development control is also a state undertaking which aims at providing a better environment and enhancing functional living condition for the citizenry. As a result, it affects the public just like other government establishments. It is therefore managed as a scientific discipline based on established sound principles of management with attendant priority attention to the development of managerial science and expertise. Issues such as problems of organization, accountability, autonomy and control are therefore of paramount consideration.

THE COMPOSITION OF LOCAL PLANNING AUTHORITY

Provision of Urban and Regional Planning Law

Obateru, (2004) stated that the composition of a Local Planning Authority should be a function of its locality’s population, social, cultural, economic, and political structure. The Nigerian Urban and Regional Planning Law, Decree No 88 of 1992 made provisions for a Planning Commission at the federal level, Board at the state level and Authority at the local government level.
Generally, the Authority at the local government level is composed of the following.

A chairman

Not more than five (5) representatives of the wards in the local government area.

One representative from each of the following professions who shall be a registered member of the professions;

Architecture
Civil Engineering
Land surveying
Town planning

Supervisor for work of the local government.

Supervisor for education of the local government

Secretary appointed by the Authority who shall be Chief Executive of the Authority

As regards the Chairman, he shall have been in professional practice for a minimum of five years and registered with the Town Planners Registration Council (TOPREC).

The Secretary too should be a Registered Town Planner with a minimum of five years professional practice.

**Organization Framework**

![Organization Chart of Oriade Local Planning Authority](image)

Figure 1: Organization Chart of Oriade Local Planning Authority

Source: Information Office, Oriade Local Government Council

The key to successful administration lies in a sound organization and this is true whether one is talking in terms of government department or a business venture. Organization implies a system and this involves the structure, personnel and their interrelationship. The line of authority can affect the weight given to its proposal. The lines of authority can affect who bears professional recommendation and in what forms. Thus, the way in which an authority works is allocated and supervised can
affect the efficiency with which it functions internally and its impact on the community at large.

Oriade Local Planning Authority, like other planning authority in the state, is made up of different divisions for efficient performance of its duties. Each division in the authority contributes in one way or the other to its development physically. For example, when an application is received for planning permission, it has to go through all the divisions during processing before a decision is fully taken. Below is the organization chart of Oriade Local Planning Authority.

The Chart shows that there are four divisions namely Town Planning, Land Survey, Estate Management and Architecture. The Planning division is further sub-divided into Physical Planning, Development control and Planning Service Unit.

**METHODOLOGY**

Forty (40) towns and villages were identified in Oriade Local Government. This constituted the sampling frame. Six (6) out of the forty towns were selected and five percent of the houses in each selected settlement were systematically sampled. The household head in each selected building was surveyed. Using this method, a total of 601 household heads were successfully surveyed. Primary data was generated through questionnaire administration, observation and interview. This was coupled with secondary data acquired from the local council information office and other relevant establishment. The primary data acquired was analyzed using descriptive statistics.

Table 1: Questionnaire Administration in the selected settlements

<table>
<thead>
<tr>
<th>No</th>
<th>Settlements</th>
<th>Number of Houses</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ijebu –Jesa</td>
<td>3,615</td>
<td>181</td>
</tr>
<tr>
<td>2</td>
<td>Ipetu Ijesa</td>
<td>2,585</td>
<td>130</td>
</tr>
<tr>
<td>3</td>
<td>Owena Ijesa</td>
<td>1,913</td>
<td>96</td>
</tr>
<tr>
<td>4</td>
<td>Ilo Ayegunle</td>
<td>1,592</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>Ikeji Arakeji</td>
<td>1,293</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>Iloko</td>
<td>1,022</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>12,020</strong></td>
<td><strong>603</strong></td>
</tr>
</tbody>
</table>

Source: Author’s field survey

**DATA ANALYSIS AND RESULT**

Seventy one percent (71%) of the sampled population were males and 29% females. Of the sampled buildings, 37% were above 30 years old while the remaining were built within the last thirty years. Five different types of building were identified: traditional compound type (5.8%), bungalow of the Brazilian type (48%), storey building (9.7%), modern flat system (31.6%) and duplex type (4.9%). Slightly more than half of the sampled buildings were used for residential purpose.

Analysis of the plan approval process reveals that about 8% of the sampled buildings had no building permit or approval. About half of the respondents with approved plan processed their permit through draughtsmen, 16.6% through registered town planners and a quarter through architects and engineers. It took an average of one month to complete the processing of a typical building plan approval, though 30% of the respondents reported that they had their permit within two weeks. This was a modest achievement compared to England where 44% of major residential applications were
processed within 13 weeks and 61% of minor residential applications in 8 weeks (DCLG, 2013) and Pemudah, Malaysia, where plan approval process takes a minimum of 3 months (Pemuda, 2013). However, in the City of Melbourne and Singapore, the process is completed in 10 days and 14 days respectively provided all required information are supplied (City of Melbourne, 2013; BCA, 2006).

Figure 2: Use of building

Source: Author’s computation from field survey data

An analysis of the plan approval figures for the year 2010 reveals a ninety-one percent success.

Table 2: Number of Plans Submitted/Approved 2010.

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Plans Submitted</th>
<th>Number of Plans Approved</th>
<th>Monthly Percentage Approval</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>50</td>
<td>44</td>
<td>88.00</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>62</td>
<td>48</td>
<td>77.41</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>48</td>
<td>46</td>
<td>95.83</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>53</td>
<td>49</td>
<td>92.45</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>31</td>
<td>30</td>
<td>96.77</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>20</td>
<td>16</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>12</td>
<td>10</td>
<td>83.33</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>9</td>
<td>9</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>24</td>
<td>22</td>
<td>91.66</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>54</td>
<td>51</td>
<td>94.44</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>61</td>
<td>58</td>
<td>95.08</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>68</td>
<td>66</td>
<td>97.05</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>492</td>
<td>449</td>
<td>91.26</td>
<td></td>
</tr>
</tbody>
</table>

Source: Oriade Local Planning Authority, 2010

In addition, about forty-seven percent (47%) of the sampled buildings did not fulfill the setback requirements while seventy percent (70%) fail the airspace requirement. This is an indictment on the monitoring activities of the Planning Authority.

With regards to post-approval activities of the Planning Authority, much still need to be done as fifty-four percent (54%) of the respondents altered the design of their
buildings at the construction stage and such alteration were not reported or processed as expected. Of the 54%, only a third were detected and served contravention notice, and made to comply with the necessary conditions. Thirty-three percent (33%) of the respondents reported that town planning officers monitored their construction work while the remaining sixty-seven percent (67%) reported the opposite. This implies that Town Planning Officials in Oriade Local Planning Authority were not effective in the area of building construction work monitoring and it has negative implication on adherence to planning rules and regulations.

Fig. 3: Monitoring of construction work by Town Planning Officials
Source: Author’s computation from field survey data

In respect of the conduct of the planning officers, an opinion poll reveals that a quarter of the respondents reported that the town planning personnel were corrupt, seventeen percent (17%) agreed they were not effective in discharging their duties while the remaining fifty-eight percent (58%) agreed they were effective in their duties.

A survey at the Local Planning Authority reveals that about sixty percent (60%) of the personnel agreed that the Authority had not lived up to expectation due to certain factors beyond their control. These include:

- inadequate staff in terms of number and qualifications
- lack of equipment such as vehicles for site inspection and monitoring, bulldozers and graders, office accommodation and furniture, computer system and others.
- the local council lacks a good database for planning, up-to-date base map and master plan upon which developments could be directed.
- political interference which hampers effective enforcement of planning rules and regulations
- uncooperative and recalcitrant public who contravene planning regulations ignorantly or wilfully.

**CONCLUSION**

From the foregoing, it is obvious that the Planning Authority of Oriade Local Government Council did not perform its development control activities adequately as to direct physical development towards desired direction. This has negative implications for the functionality of the towns and cities, health and safety of the
inhabitants, social and economic development of the council. Following from this, the following are recommended:

adequate provision in terms of equipment, vehicles, computers and office accommodation should be made to enhance effective performance of site inspectors and other staff of the planning authority. Inspectors especially, need vehicles for easy access to the nooks and crannies of the town to ensure quick detection and processing of contraventions cases.

qualified and adequate personnel should be employed to meet the demands of the job as inadequate staffing will definitely lead to poor output.

preparation of development plans or master plan for the towns and cities in the local government; this will give direction and focus to physical development activities in the towns and help to strengthen the enforcement of planning laws.

provision of adequate fund to finance the activities of the Planning Authority and house numbering be done to provide an effective address system which will foster quick identification of buildings for efficient planning administration.

Adherence to these recommendations will go a long way to improve the effectiveness of the Local Planning Authority in ensuring a functional, orderly, aesthetic and economic human settlement.

This study employs only descriptive statistics to analyze the acquired data, it is noteworthy that a more rigorous statistical analysis would yield a deeper understanding of the subject matter.

REFERENCES


AWARENESS OF ARTIFICIAL INTELLIGENCE (AI) METHODS FOR COST ESTIMATING IN THE NIGERIAN CONSTRUCTION INDUSTRY

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Accurate estimate is desired by both clients and contractors at the early project stage for determining a realistic price for incorporation into the bid package. Alternative methods of cost estimating are therefore important in the early planning or conceptual design phases of projects before detailed information is available to allow for quantity takeoff estimate to be performed. The study investigates the extent of awareness of the use of Artificial Neural Network (ANN) and Fuzzy logic (FL) techniques by professionals in the estimation of construction cost in the Nigerian Construction Industry. Questionnaire survey (with a response rate of 64%) was used to obtain information from professionals for analysis. The results of descriptive statistic revealed that professionals in the industry do not use any of the AI methods for cost estimation due to the lack of knowledge of their concepts. The study further revealed that the traditional methods are still the most widely used methods for cost estimation. From the study, the continued use of the traditional methods of cost estimation is undermining the call for paradigm change.

Keywords: artificial intelligence, cost estimation, neural network, fuzzy logic, Nigeria.

INTRODUCTION

Early stage cost estimates play a significant role in the initial construction project decision by allowing project managers to choose alternatives and to avoid misjudging solutions. One of the vital considerations with any method of estimating is the accuracy by which anticipated cost can be predicted. The quality of early estimates has been identified to be crucial for feasibility analysis and budget allocation decision for public projects (Sonmez and Ontepeli, 2009; Feng et al., 2010). As the scale, structure, capacity and use of Buildings are getting more sophisticated, cost estimation is becoming more and more difficult. Practitioners and researchers however have long recognized the uncertainty in construction cost estimates and the need to improve prediction capability in the industry by using newer, more innovative and dynamic cost estimating techniques (Cheng and Wu, 2005; Lowe, et al., 2006; Marzok et al., 2008; Hwang, 2009; Cheng et al. 2009a and Cheng et al. 2009b).

The current development in computer and software technology facilitates emerging novel approaches to cost estimation through the application of artificial intelligence techniques. It provides the ability to undertake rapid modelling of systems in which the interactions between input and output variable is unknown but where representative examples of inputs and output exist. This study therefore sets to

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investigate the level of awareness of the use of artificial intelligence methods in supporting the estimating process of building projects in the Nigerian Construction Industry.

ARTIFICIAL INTELLIGENCE

The field of (AI) according to Sahare et al. (2011) was proposed in the 1950s with the aim of making computer programmes capable of solving complex problems. Lugger and Stubblefield (1993) defined AI as the branch of computer science that is concerned with the automation of intelligent behaviour. Kurzweil (1990) defined it as the art of creating machines that perform functions that require intelligence when performed by people. Winston (1992) defined it as the study of the computations that make it possible to perceive, reason and act. The use of AI according to Rossini (2000) is now extending into the social sciences including business studies. AI applications range from custom-built expert systems to mass produced software and consumer electronics. The applications of AI are numerous and ever increasing with the most common applications including among others; games, speech recognition, understanding natural language and expert systems. Some commonly used branches of AI in the field of construction management include artificial neural network, fuzzy set, fuzzy logic and hybrid AI models.

Artificial Neural Network (ANN)

Artificial neural network is an Artificial Intelligence method which is based on the principle of how the human brain functions in processing data, and learns to identify objects. The method was inspired by biological findings that the brain is a network of units called neurons. These neurons receive signals through synapses that control the effects of the signal on other neurons. This structure is believed to have a key role in the functioning of human brain. Hence, these neurons being mathematically modelled forms the fundamental units of artificial neural networks Geon, 2005). The structure of a typical neural network has input, output and hidden layers as shown in fig 1. The output layer receives the input and signals flow from the input layer through the hidden layers which are between the output and input layers. The number of hidden layers varies according to the application. One of the most common types of neural network models is the multilayer perceptron. In this type of model, the inputs, are fed into the input layer and multiplied by connection ‘weights’ as they are passed from the input layer to the hidden layer. Within the hidden layer, they get summed then processed by an activation function. This process gets repeated at each hidden layer until the data finally reaches the output layer. At the output layer the data is multiplied by interconnection weights then processed one last time within the output layer to produce the neural network output. An artificial neural network is configured for a specific application, such as estimation of productivity, voice recognition or data classification, through a learning process. Initially artificial neural networks randomize weights for all their neurons. Then they are trained to solve the specific problem for which they are intended. Training process contains adjustments to the synaptic connections that exist between the neurons. Finally, the output layer neurons produce the network predictions. The aim of neural network training algorithms is to determine the most suitable set of weight values for the problem under consideration. Finding the optimal set is often a trade-off between computation time and minimizing the network error.
Neural networks has certain performance characteristics in common with human neural biology (Razi and Athappilly, 2005; Sivanandam et al., 2005). The characteristic according to Razi and Athappilly (2005) includes, ability for strong knowledge and making it available for use wherever necessary, propensity to identity pattern even in the presence of noise, aptitude for taking past experience into consideration and make inferences and judgements about new situations. The performance of NNs is data dependent and therefore improves with sample size. Razi and Athappilly (2005) further revealed that statistical methods such as regression perform better for extremely small sample size and also when theory or experience indicates an underlying relationship between dependent and predictor variables. Adeli (2001) asserted that NNs operate as black box, model free and adaptive tools to capture and learn significant structures in data. The computing abilities have been proven in the fields of prediction and estimation, pattern recognition and optimization (Adeli and Hung, 1995). NNs are suitable particularly for problems too complex to be modelled and solved by classical mathematics and traditional procedures. The application of NN has become popular because of the development of the simple error back propagation BP training algorithm which is based on a gradient descent optimization technique.

Fuzzy Logic

The fuzzy logic derived from the fuzzy set theory is also categorized under artificial intelligence methods. The concept of fuzzy set theory was developed to deal with problems consisting of uncertain and unexpected situations that are often present in real-world applications. The fuzzy logic method provides a way to deal with problems where the source of imprecision is due to the absence of precisely defined criteria or mathematical models (Yaman, 2007 and Bala et al., 2008). The technique needs only to set a simple controlling method based on engineering experience. In that respect,
fuzzy logic approach does not require many observations as other forecasting models do. Hence, fuzzy forecasting methods are appropriate under incomplete data conditions (Yaman, 2007).

Fuzzy logic systems comprise of three operations, namely fuzzification, fuzzy output engine (or inference engine) and defuzzification. The fuzzification comprises the process of transforming crisp values into grades of membership for linguistic terms of fuzzy sets. The membership function is used to associate a grade to each linguistic term. The core section of a fuzzy system is the fuzzy output engine, which combines the facts obtained from the fuzzification with the fuzzy rule base and conducts the fuzzy reasoning process. As a result of applying these steps, one obtains a fuzzy set from the reasoning process that describes for each possible value, a grade of membership which in turn describes to what extent this value is reasonable to use. Using a fuzzy system as a controller, the fuzzy information is transformed into a single value that will actually be applied. This transformation from a fuzzy set to a crisp number is called a defuzzification.

Artificial Intelligence and Cost Estimation

The outstanding performance and application of artificial intelligence methods (neural networks, fuzzy logic, genetic algorithm, neuro-fuzzy models, etc.) in cost estimating has been studied by many researches (Pearce, 1997; Bhoka and Ogunlana, 1999; Sonmez, 2004; Adeli and Wu, 2005; Sonmez and Ontepelli, 2009; Cheng et al., 2009a, Feng et al., 2010; Bala and Waziri, 2011). Razi and Athappilly (2005) asserted that regression and neural network methods have become competing model building methods. Pearce (1997) developed a technique for generating range estimates to evaluate the risk of cost escalation in building construction using artificial neural network. Results of the research indicate that NNs can serve as a robust tool for cost estimation. Hegazy et al. (1998) used a neural network approach to manage construction cost data and developed a parametric cost estimating model for highway projects. In the study, two alternative techniques were introduced to train network weights: Simplex optimization (Excel’s inherent solver function) and Genetic Algorithm (GA). Hegazy and Ayed (1998) also used neural network for conceptual cost estimation of highway projects. In the study three neural network models with 10 input variables were developed by different methods. Adeli et al. (1998) in their study of highway cost modelling using neural network approach, indicated that highway construction costs are very “noisy” and this noise results from many unpredictable factors such as factors related to human judgement, random market fluctuations and weather conditions. Adeli et al. (1998) were successful in introducing a regularization neural network model based on a mathematical foundation for estimating the cost of construction projects, making it more reliable and predictable. Bhoka and Ogunlana (1999) developed an ANN model for predicting the construction cost of building projects at the pre-design stage. The result of the study reveals that on the overall 42.7% of the sample were underestimated while 57.3% were overestimated. Sonmez (2004) compared regression and neural network models for conceptual cost estimation. The best model has an accuracy level of 12%. Sodikov (2005) also examined cost estimation for highway projects by ANN and argued that neural network approach might cope with noisy data or imprecise data. He reported that ANN could be an appropriate tool to help solve problems which comes from a number of uncertainties such as cost estimation, because back propagation neural network has a good nonlinear approach ability and higher prediction accuracy. Cheng and Wu
Artificial intelligence

(2005) used Support Vector Machine (SVM) to develop model for construction conceptual cost estimate. Both quantitative (total

floor area, floors over ground and floors underground) and qualitative (geology property, earthquake impact, decoration class and facility class) cost drivers were used in the study. Bala et al. (2008) developed a computer based Whole Life-Cycle Cost (WLCC) model for building projects using the fuzzy set theory approach. The model was able to mitigate data scarcity and uncertainty problem inherent in WLCC. The algorithm for the model was outlined and the model was implemented on the computer. Araf a and Alqedra (2011) used neural network to develop an early stage cost prediction model in the Gaza strip. The results revealed that the neural network model reasonably succeeded in predicting the cost of building at the early project stages. It is recommended that more reliable project data to be collected and added to the training set to improve the predictions. Cheng et al. (2009a) presented a new method combining three different soft computing methods namely, genetic algorithms, fuzzy logic theory and neural networks under a mechanism called Evolutionary Fuzzy Hybrid Neural Network Model (EFHNN). The proposed mechanism is developed for design phase cost estimation of projects in Taiwan. They achieved an overall estimate error of 10.36%. Cheng et al. (2009b) developed a web based hybrid model incorporating genetic algorithms, fuzzy logic theory and neural networks under a mechanism called Evolutionary Fuzzy Neural Inference Model (EFNIM). However, EFNIM is time consuming due in large part of its use of Genetic Algorithm (GA). Feng et al. (2010) developed a combination (GA) and Back Propagation (BP) GA-BP model. The results revealed that the GA-BP model has got a high reliability and it can be used for construction cost estimates. Bala and Waziri (2011) developed an ANN model for predicting pre-design building cost estimating the model developed had satisfactory results on the test sample with average error of -3.62%, maximum error of 6.24% and MAPE of 8.6%

RESEARCH METHODS

The study investigates the extent of application of neural network and fuzzy logic in the estimation of construction cost. The research design was based on a survey of related works and data collected through structured questionnaires. Questionnaire survey was found effective because of the relative ease of obtaining appropriate data for realizing the study objectives. 150 structured questionnaires were randomly distributed to professionals in the offices of contractors, consultants and clients who are involved in cost estimation and project management. 96 questionnaires (64%) were successfully collected and analysed. Descriptive statistic was used to analyse the demographic information of the respondents while significant/importance index and incidence in use index was used for the responses for the questions. The data collected were analysed using the statistical software SPSS 16 for windows.

The index for each of the factors was calculated to reflect relative importance/significance/frequency of use using equation 1.

\[
Index = \left( \frac{\sum_{i=1}^{5} a_i x_i}{\sum_{i=1}^{5} x_i} \right) \times 100\%
\]

Where \( a_i \) = constant expressing the weight given to \( i \); \( x_i \) = variable expressing the frequency of the response for \( i = 1, 2, 3, 4, 5 \) and illustrated as follows:

\( x_i \) = frequency of the “not important/not used” response and corresponding to \( a_i=1 \);
\( x_2 \) = frequency of “somewhat important/used” response and corresponding to \( a_2 = 2 \);

\( x_3 \) = frequency of “averagely important/used” response and corresponding to \( a_3 = 3 \);

\( x_4 \) = frequency of “very important/used” response and corresponding to \( a_4 = 4 \);

\( x_5 \) = frequency of “extremely important/most frequently used” response and corresponding to \( a_5 = 5 \);

The average index for each major criterion is the average of all the indices of the individual criteria within the category. The indices were grouped to reflect the respondents’ ratings as follows: extremely important/most frequently used: \( 70 < I \leq 100 \); very important/frequently used: \( 60 < I \leq 70 \); averagely important/used: \( 50 < I \leq 60 \); somewhat important/used: \( 40 < I \leq 50 \); and not important/used: \( 0 < I \leq 40 \).

RESULTS AND DISCUSSION

Respondents’ profile

Information on the respondents revealed that 35.4% are from the offices of promoters, 33.33% of the respondents are from the offices of the consultants and 31.25% are from various contractors’ organisation as illustrated in Fig. 1.

Majority of the respondents (60%) possesses a high level of academic qualification i.e. master degree (9%), first degree or H.N.D (51%). Therefore the information provided by the respondents can be considered as reliable.

Fig. 3 shows that 25% of the respondents have 1-5 years of working experience, 32% have between 6-10 years of working experience, 23% have between 11-15 years of working experience while 21% have over 15 year of working experience.
Factors influencing the choice of estimating technique

The choice of cost estimating method is influenced by several factors. The study revealed that information and time available for estimating is the most important factor with RII value of 82.67. This is followed by complexity of the project with RII of 81.20. The result is presented in Table 1.

Table 1 Factors Influencing the choice of Cost estimating technique

<table>
<thead>
<tr>
<th>Factor</th>
<th>EI</th>
<th>VI</th>
<th>I</th>
<th>SI</th>
<th>NI</th>
<th>RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of project</td>
<td>35</td>
<td>27</td>
<td>18</td>
<td>12</td>
<td>4</td>
<td>76.01</td>
</tr>
<tr>
<td>Complexity of project</td>
<td>42</td>
<td>32</td>
<td>10</td>
<td>10</td>
<td>2</td>
<td>81.20</td>
</tr>
<tr>
<td>Information and time available</td>
<td>47</td>
<td>29</td>
<td>12</td>
<td>7</td>
<td>1</td>
<td>82.67</td>
</tr>
<tr>
<td>Experience of the estimator</td>
<td>39</td>
<td>32</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>80.04</td>
</tr>
<tr>
<td>Purpose of the estimate</td>
<td>29</td>
<td>32</td>
<td>19</td>
<td>10</td>
<td>6</td>
<td>74.16</td>
</tr>
</tbody>
</table>

EI= extremely important, VI= very important, I= important, SI= somewhat important, NI=Not important

Table 2. Frequency of use of Traditional methods of cost estimating

<table>
<thead>
<tr>
<th>Traditional Method</th>
<th>Cost Estimating Method</th>
<th>MFU</th>
<th>FU</th>
<th>AU</th>
<th>SU</th>
<th>NU</th>
<th>RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference</td>
<td></td>
<td>33</td>
<td>25</td>
<td>16</td>
<td>14</td>
<td>8</td>
<td>72.70</td>
</tr>
<tr>
<td>Financial method</td>
<td></td>
<td>25</td>
<td>21</td>
<td>19</td>
<td>16</td>
<td>15</td>
<td>65.20</td>
</tr>
<tr>
<td>Functional unit</td>
<td></td>
<td>32</td>
<td>23</td>
<td>24</td>
<td>10</td>
<td>7</td>
<td>73.12</td>
</tr>
<tr>
<td>Superficial</td>
<td></td>
<td>25</td>
<td>24</td>
<td>17</td>
<td>14</td>
<td>16</td>
<td>65.83</td>
</tr>
<tr>
<td>Superficial-perimeter</td>
<td></td>
<td>23</td>
<td>26</td>
<td>27</td>
<td>13</td>
<td>7</td>
<td>69.38</td>
</tr>
<tr>
<td>Cube</td>
<td></td>
<td>23</td>
<td>23</td>
<td>12</td>
<td>15</td>
<td>23</td>
<td>61.66</td>
</tr>
<tr>
<td>Storey enclosure</td>
<td></td>
<td>22</td>
<td>24</td>
<td>23</td>
<td>16</td>
<td>11</td>
<td>66.25</td>
</tr>
<tr>
<td>Approximate quantities</td>
<td></td>
<td>28</td>
<td>27</td>
<td>18</td>
<td>14</td>
<td>9</td>
<td>76.01</td>
</tr>
<tr>
<td>Elemental estimating</td>
<td></td>
<td>27</td>
<td>25</td>
<td>19</td>
<td>16</td>
<td>9</td>
<td>69.30</td>
</tr>
<tr>
<td>Bill of quantities</td>
<td></td>
<td>37</td>
<td>29</td>
<td>22</td>
<td>4</td>
<td>4</td>
<td>78.95</td>
</tr>
</tbody>
</table>

MFU= Most frequently used, FU= frequently used, AU= used, SU=somewhat used, NU= not used, RI= relative index

Use of Traditional methods of estimating
Early stage cost estimation is characterised by inadequate information which makes it a little bit difficult. At the early stage the traditional methods being used includes among others the conference method, the functional method, the superficial perimeter methods, e.t.c. the frequency of utilization of these methods is presented in Table 2. The result revealed that the most frequently used method is the BOQ. The entire respondents indicated the use of the BOQ in their practices with an importance index of 78.95. The BOQ was ranked first followed by the approximate quantities method with importance index of 76.01. This is in consonance with the findings of Anigbogu et al. (2007). This result is not unconnected with the familiarity of the estimators with the method as stated by Odusami and Onukwube (2008).

Use of artificial Intelligence methods

The frequency of use of artificial intelligence methods is presented in Table 3. The result shows that both the NN models and the Fuzzy Logic techniques are not being used for cost estimating in the Nigerian construction industry. The lack of usage of these methods may be due to the lack of familiarity of the methods and the degree of sophistication of the methods as reported by.

Frequency of use of Artificial Intelligence Methods

<table>
<thead>
<tr>
<th>Artificial Intelligence method</th>
<th>MFU</th>
<th>FU</th>
<th>AU</th>
<th>SU</th>
<th>NU</th>
<th>RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neural Networks</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>95</td>
<td>21.01</td>
<td></td>
</tr>
<tr>
<td>Fuzzy Logic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>96</td>
<td>20.00</td>
<td></td>
</tr>
</tbody>
</table>

MFU= Most frequently used, FU= frequently used, U= averagely used, SU=somewhat used, NU= not used

CONCLUSION

The overall purpose of accurate cost estimate is use in establishing the budget and as a tool used for scheduling and cost control. One of the major factors affecting the accuracy of the estimating process is the insufficient time allowed for the preparation of estimates. The main objective of the study is to investigate the extent of application of AI methods (NNs and FL) in cost estimating in the Nigerian Construction Industry with the view to improving estimating practice. The study revealed that none of the AI techniques is being used for cost estimating. It is expected that by now AI methods would be used with increasing frequency as a substitute for the conventional methods of estimating because of their performances. They are also considered a viable alternative to the conventional methods if one has a poor idea of the underlying cost behaviour or suspects that there is significant non-linearity especially in the data sets. It is recommended that Construction managers and Clients should embrace the use of the ANN in order to enhance productivity and accuracy.

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The construction industry in Ghana is considered the second largest sector contributing to the Gross Development Product (GDP) of the economy. The concept of sustainability which means meeting the needs of the present without compromising on that of future generations has emerged as a possible remedy to using resources prudently with immense benefit. However, its application in the Ghanaian construction industry is yet to be fully explored due to perceived barriers. This research paper aims to examine the concept of sustainability in the Ghanaian construction industry with the main objective of identifying the barriers affecting sustainable construction in the Ghanaian construction industry. In this research, data were collected through a questionnaire survey by respondents randomly selected from the construction professionals in Ghana. Data collected were mainly analyzed using relative importance index to rank barriers identified during extensive literature review. The results show that key barriers to sustainable construction are lack of demand for sustainable buildings, lack of strategy to promote sustainable construction, initial higher cost, lack of public awareness and lack of Government support.

Keywords: sustainability, sustainable construction, barriers, construction industry

INTRODUCTION

Globally, the construction industry constitutes more than half of the national capital of most countries and represents as much as 10% of GNP. The GDP released for the third quarter of 2012 by Ghana Statistical Service, indicates that the construction industry contributed 19.2% to the economy. Thus the construction industry was the second largest sector in the Ghanaian economy illustrating its contribution to an undeniable impact on the environment irrespective of its social and economic gains. In spite of the social and economic gains, construction activities extend beyond the erection of houses, hospitals, schools, offices and factories to civil engineering works such as roads, bridges and communication infrastructure which support the economy. In meeting these demands, the construction industry exerts enormous pressures on global natural resources. The environmental significance of such pressures comes into play when some of these resources are depletable and non-renewable, bringing the construction industry in direct conflict with the physical environment. The construction sector is therefore a major consumer of non-renewable resources, a substantial source of waste, a polluter of air and water, and an important contributor to

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land dereliction (Wallbaum and Buerkin, 2003). It is also seen as the largest destroyer of the natural environment (Woolley, 2000). Also, the basic impact of construction activities on the environment is evident on examining the consumption of energy and its subsequent emission of greenhouse gases noticeable among such are concrete and steel; the most commonly used material for construction in the developed and developing countries. The contribution of concrete is twice the total of all building materials put together. Steel is also one of the most energy-intensive materials and for that reason contributes immensely to climate change. The usage of these materials leads to the destruction of the environment, through pollution (both in extracting raw materials and construction of building), dust and hazardous contamination through toxic waste (CIB Report, 1999). However, it is possible these shortfall could be reduced if the construction industry adopts sustainable measures and construction processes. In addition to minimising these environmental concerns, sustainable practices in the built environment also can achieve potential economic and social benefits while preserving or enhancing the functionality of the building.

Sustainable design and construction is rapidly becoming a strong force in the construction industry. The goal of achieving sustainability considers the triple bottom line and takes into account the ecological and social performance as well as the financial performance of a project (Ahn, 2013). Sustainability as a concept has been defined by number of researchers and organizations noticeable amongst these is that by the World Commission on Environment and Development (1987) which defines sustainability as meeting the needs of the present without compromising on the ability of future generations to meet their own needs. Also according to Chambers (1993) sustainability can be defined as that which is capable of being sustained; in ecology the amount or degree to which the earth’s resources may be exploited without deleterious effect. Thus sustainable construction is considered as the creation and responsible management of a healthy built environment based on the prudent use of resources ecological principles (Kirbert, 1994). This concept has been successful especially in some developed and developing countries where stakeholders require cooperate sustainability policies and also the development of various policy documents to enforce sustainability in all aspects of their development.

There is also a more optimistic and positive response to calls for promoting sustainability but real progress needs to be made in environmentally friendly construction and design techniques (Morton, 2008). Due to the many benefits associated with sustainable design and construction, public governments and their agencies are increasingly incorporating sustainable design and construction practices into not only new buildings, but also existing buildings constructed (Ahn, 2013). These design techniques results in sustainable buildings, green buildings or eco-friendly with vast benefits mainly amongst which reduced operational/energy cost and a reduction in raw materials is used.

In spite of these benefits, unsustainable design and construction processes as well as constant degradation of the environment for construction purposes still exist in most developing countries, of which Ghana is no exception. According to Häkkinen and Belloni, (2011), Zhang et al. ,(2011) and Ahn et. al. (2013), although various steps have been taken by the developed world to fully practice sustainable construction, there exist barriers . This research paper therefore seeks to identify key barriers to achieving sustainable construction in the Ghanaian construction industry.
AIM
The aim of this paper is to identify barriers to sustainable construction in the Ghanaian construction industry.

LITERATURE REVIEW
SUSTAINABLE CONSTRUCTION
Sustainable construction can be defined as ‘the creation and responsible management of a healthy built environment based on the prudent use of resources and ecological principles’ (Kibert, 1994). Sustainable construction ethos requires a ‘cradle to grave’ appraisal of project, which involves managing the serviceability of project during its life-time and eventual deconstruction’ focus on the economic aspect of sustainability (Wyatt, 1994).

PRINCIPLES OF SUSTAINABLE CONSTRUCTION
There are six principles for sustainable construction, proposed by Miyakate (1996); CIB (1996)
Minimisation of resource consumption;
Maximisation of resource reuse;
Use renewable and recyclable resources;
Protect the natural environment;
Create a healthy and non-toxic environment; and
Pursue quality in creating the built environment.

BARRIERS TOWARDS SUSTAINABLE CONSTRUCTION
In order to endorse and drive the agenda of sustainable construction within the Ghanaian Construction Industry, the barriers that impede these practices must first be identified. The barriers identified in literature can be grouped into four primary categories: cultural, financial, steering and professional barriers.

CULTURAL BARRIERS
The Ghanaian construction industry process has been used over the past decades as such it presents itself as a sector which is traditionally very difficult to change especially with respect to construction methods practiced and building materials used. Construction in Ghana favours the use of blocks and reinforced concrete and discourages any other alternative to these building materials and services. This illustrates a typical change resistance; a major barrier. This change resistance results in a lack of demand by clients and stakeholders of construction projects affecting its eventual supply. Williams and Dair (2006) in that same vain identified lack of sustainability measure by stakeholder as by far the most commonly recorded barrier and further stated the lack of demand by the client as a commonly recognized barrier. This barrier was also cited as the most significant barrier by eighty-four per cent (84%) of respondents as a building project cannot be done along sustainable lines without the owner or developer’s “full support for sustainable concepts” (Landman, 1999).

This can nevertheless be overcome by client demand and willingness as it was found that in the UK, pioneering of sustainable buildings have often been procured by
owner-occupiers who are less constrained by market norms. The Toronto Green Development Standard (2006) also acknowledged that public awareness about green building has been an important component that led to high demand. Thus a continual public awareness of sustainable concepts on sustainable construction and its benefits will lead to an increased demand compelling products to be tailored to their needs to be produced.

FINANCIAL BARRIERS

The fear of higher investment costs for sustainable buildings compared with traditional building and the risks of unforeseen costs are often addressed as barriers for sustainable buildings (Häkkinen and Belloni, 2011). The adoption of sustainable building solutions may be hindered because clients are concerned about the higher risk (Hydes and Creec, 2000; Larsson and Clark, 2000; Nelms et al., 2005) based on unfamiliar techniques, the lack of previous experience, additional testing and inspection in construction, a lack of manufacturer and supplier support, and a lack of performance information. These costs are also high as according to Bartlet and Howard (2000), cost consultants have overestimated the capital cost and underestimated the potential cost savings. Hydes and Creech (2000) also state that these higher costs may be as a result of increases in the consultant’s fees and indirectly from the unfamiliarity of the design team and contractors with sustainable building methods.

Even though it’s a known fact that sustainable practices in construction are estimated to increase initial capital cost generally in the range of 1 – 25%, this can often be offset by significant savings in the operational costs (Kats 2003) and user comfort however these savings are not made known to prospective clients. If however life-cycle thinking is critically applied to this practice, developers and building owners will appreciate and receive the benefits or those benefits are rapidly discounted. Sustainability will not only reduce life-cycle cost but also increase productivity of staff using the building (Wargocki, 2000).

CAPACITY/PROFESSIONAL BARRIERS

The most critical barrier to sustainable construction is the lack of capacity of the construction sector to actually implement sustainable practices (CIB Report, 1999). This is further reiterated by Häkkinen and Belloni (2011) that sustainable buildings can be hindered by ignorance or a lack of common understanding about sustainability. Rydin et al. (2006) claim that while designers demonstrate confidence in their ability to access and use knowledge in general, this confidence falls when sustainable building issues are addressed. This presupposes that professionals within the built environment need to be fully acquainted with sustainable construction principles in order to implement its practice. Not only are they supposed to be knowledgeable, these professionals need to form an integrated team from conception to inception comprising of the developer/owner, project manager, contractor, architect, services engineer, structural engineer, civil engineer, environmental engineer, landscape consultant, cost planner and building surveyor. This team needs to have the best available information on products and tools to achieve sustainable construction however Williams and Dair (2006) identified that was not the case. In their research, evidence of hindrance due to a lack of information was an experience common to most stakeholder groups. In several cases, stakeholders admitted to not being aware of sustainable measures or alternatives that fall within their remit. Similarly, installing sustainable technologies and materials requires new forms of competencies and
knowledge, yet it was evident from the research that not all those with responsibilities in this area had the necessary experience or expertise to meet the challenge.

The workforce of every industry is its backbone as such the need to involve professionals who are not only knowledgeable but can promote sustainable construction working as a team. This barrier if unattended will indicate a considerable knowledge and skills gap in the construction sector.

STEERING BARRIERS

A major characteristic of the construction industry is the involvement of a large number of individuals ranging from clients to the builder thus an effective steering or strategy will be required to implement sustainable construction. The lack thereof or wrongful steering may rather stifle sustainable construction whilst on the other hand, steering measures can promote it. Steering barriers include but not limited to the lack of building codes, government policies/support and measurement tools amongst others. On the contrary, a new kind of orchestrating and pioneering role of the building authorities and other public actors in the building sector is called for (Rohracher, 2001).

Measurement tools have been developed in some advanced countries to measure the application of sustainable principles in buildings. Popular amongst them is the LEED for the US and BREEAM for the UK. The lack of methods is a barrier, but methods as such do not improve the sustainability of built environment. The impact will depend on the implementation of methods. (Häkkinen and Belloni, 2011).

Figure 1: Barriers to sustainable construction

RESEARCH METHODOLOGY

A comprehensive literature review on barriers to sustainable construction was carried out, a pre-survey questionnaire was developed. These barriers have been addressed in previous studies which can be compiled into a list, as presented in Table 1. The pre-survey questionnaire aimed to validate 42 barriers that had been identified through the literature review. In addition, interviews with industry experts were conducted to fine-tune the list of barriers to sustainable construction in the Ghanaian construction industry. To highlight the barriers identified, pre-survey interviews were also conducted. The results enhanced the understanding of the rationale for the barriers that
were to be included in the survey. Professionals who have registered with their professional institutions (Ghana Institution of Engineers, Ghana Institution of Surveyors, Ghana Institution of Architects, etc.) were engaged. Also considered was their working experience. Five professionals from each professional body having more than 10 years of experience in managing construction projects and for that matter sustainable construction were interviewed. The reason for the main survey was to discover and establish key barriers they encounter in sustainable construction. The results from the pre-survey and interviews served as a basis in developing the main survey questionnaire. Consequently the figure was trimmed down from 42 to 20 and was used to carry out the survey. The first section of the survey questionnaire captured the respondent’s profile. The structure of the questionnaire mainly includes the major barriers of applying barriers to sustainable construction projects Ghana. The respondents were asked to rate the extent to which each of the barriers affects sustainable construction using a 5-point Likert scale. The respondents were invited to give the importance of each listed barrier.

Out of the 200 questionnaires sent out, 62 sets of completed survey questionnaires were received and analyzed. The response rate was relatively low because those that were not completed or properly answered were rejected. In addition only the responses from the respondents who had experience and had clear understanding of sustainable construction were used. Under the respondent’s profile the information sought were professional background, year of experience and type of projects respondents usually undertake at their individual companies. The results indicate that, twenty-five (25) respondents representing 34% of the sample size were Architects with thirteen (13) respondents being Civil/Structural Engineer, fifteen (15) were Quantity Surveyor and nine (9), Project/Construction Manager. None of the respondents had years of experience above 20 years. The survey revealed that out of the sixty-two responses received 22%, 14%, 56%, and 8% have been in construction industry for less than 2 years, between 2–5 years, 6–10 years, and 11–20 years respectively.

ANALYSIS OF DATA

The data provided by the respondents in the questionnaire was presented and analyzed using the Relative Importance Index (RII). The Relative Importance Index (RII) was also used to rank barriers affecting the implementation of sustainable construction in Ghanaian construction industry. The Index is computed in Adnan et al (2007) as:

$$RII = \frac{5n5 + 4n4 + 3n3 + 2n2 + n1}{5(n5 + n4 + n3 + n2 + n1)}$$

Where:  
- n1 - number of respondents who answered “strongly disagree” or “very low”  
- n2 - number of respondents who answered “disagree” or “low”  
- n3 - number of respondents who answered “neutral” or “medium”  
- n4 - number of respondents who answered “agree” or “high”  
- n5 - number of respondents who answered “strongly agree” or “very high”

RESULTS AND DISCUSSIONS

Barriers to Sustainable construction
Table 1: Barriers that affect sustainable construction in the Ghanaian construction industry

<table>
<thead>
<tr>
<th>Item</th>
<th>Barriers to sustainable construction</th>
<th>Relative Important Index (RII)</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of Building Codes and Regulation</td>
<td>0.74</td>
<td>8th</td>
</tr>
<tr>
<td>2</td>
<td>Lack of incentives</td>
<td>0.63</td>
<td>15th</td>
</tr>
<tr>
<td>3</td>
<td>Higher investment cost</td>
<td>0.72</td>
<td>9th</td>
</tr>
<tr>
<td>4</td>
<td>Risk of investment</td>
<td>0.76</td>
<td>7th</td>
</tr>
<tr>
<td>5</td>
<td>Higher final cost</td>
<td>0.82</td>
<td>3rd</td>
</tr>
<tr>
<td>6</td>
<td>Lack of Public awareness</td>
<td>0.79</td>
<td>4th</td>
</tr>
<tr>
<td>7</td>
<td>Lack of Demand</td>
<td>0.90</td>
<td>1st</td>
</tr>
<tr>
<td>8</td>
<td>Lack of strategy to promote sustainable construction</td>
<td>0.87</td>
<td>2nd</td>
</tr>
<tr>
<td>9</td>
<td>Lack of Design and Construction team</td>
<td>0.56</td>
<td>17th</td>
</tr>
<tr>
<td>10</td>
<td>Lack of Expertise</td>
<td>0.54</td>
<td>18th</td>
</tr>
<tr>
<td>11</td>
<td>Lack of professional knowledge</td>
<td>0.44</td>
<td>20th</td>
</tr>
<tr>
<td>12</td>
<td>Lack of database and information</td>
<td>0.63</td>
<td>16th</td>
</tr>
<tr>
<td>13</td>
<td>Lack of Technology</td>
<td>0.52</td>
<td>19th</td>
</tr>
<tr>
<td>14</td>
<td>Lack of Government support</td>
<td>0.78</td>
<td>5th</td>
</tr>
<tr>
<td>15</td>
<td>Lack of a measurement tool</td>
<td>0.68</td>
<td>10th</td>
</tr>
<tr>
<td>16</td>
<td>Increased Documentation</td>
<td>0.64</td>
<td>13th</td>
</tr>
<tr>
<td>17</td>
<td>Extensive Pre-contract planning</td>
<td>0.65</td>
<td>12th</td>
</tr>
<tr>
<td>18</td>
<td>Change Resistance</td>
<td>0.64</td>
<td>14th</td>
</tr>
<tr>
<td>19</td>
<td>Lack of training</td>
<td>0.67</td>
<td>11th</td>
</tr>
<tr>
<td>20</td>
<td>Lack of cooperation</td>
<td>0.77</td>
<td>6th</td>
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Table 2: Highly ranked barriers

<table>
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</table>

Major barriers identified by the respondent have been shown and expressed in table 4 and fig.2. The responses by the key players indicate that Lack of Demand with RII of 0.90, Lack of strategy to promote sustainable construction, RII of 0.87, Higher final cost ranked 3rd with RII of 0.82, Lack of public awareness ranked 4th with RII of 0.79
and Lack of government support also ranked 5th with RII of 0.78. The others are lack of cooperation with RII 0.77, risk of investment with RII of 0.76, lack of building codes and regulations with RII of 0.74. High investment cost with RII of 0.72 and lack of a measurement tool also with RII of 0.68 for 6th, 7th, 8th, 9th and 10th respectively. However, lack of expertise (0.53), lack of technology (0.52) and lack of professional knowledge (0.44) are the least in ranking with respect to the barriers that affect the implementation of sustainable construction 18th, 19th and 20th respectively as shown in Table 2.

Figure 2: Highly ranked barriers

Naturally demand leads to supply. As demand increases, it pushes supply to also go up. Generally there is lack of demand from clients and customers when green market is still at initial stage (Zhang et al.; 2011). This result confirms Williams and Dair (2007) position and it is consistent with (Anderson et al., 2000; Davis, 2001; Landman, 1999; Owen, 2003) assertion that most clients are not convinced there is the need to demand for such green buildings. There is an urgent need for demand of sustainable construction because the demand and willingness of clients eventually determines the development of and also the extent to which sustainable construction can be used (Häkkinen and Belloni, 2011). Albeit demand is closely related to such issues as supply, only few clients and customers may have a significant desire to own sustainable buildings (SBs) (Bon and Hutchinson, 2000), but Bordass (2000) found that UK’s pioneering SBs have often been procured by owner-occupiers who are less constrained by market norms. The result further strengthens earlier claim that clients do not ask for sustainable construction. Rao and Brownhill (2001) posit that the ideas of the circle of blame game still persist: ‘designers and contractors say clients don’t ask for it, clients say designers don’t provide it’.

Lack of strategy to promote sustainable construction was ranked second. There must be a policy on sustainable construction which has to show clearly when, how and who enforces what. In Ghana, even where there is such a policy, the will to properly enforced it is always a problem. A sustainable policy seeks to drive forward the sustainable construction by providing clarity around the existing policy framework, signaling the future direction of Government policy and showing what can be done.
towards making sure they are enforced. The lack of steering or the wrong type of steering may hinder sustainable construction (Häkkinen and Belloni, 2011). Furthermore, sustainable construction can also be promoted at least to a certain extent with the help of right policies and regulations. The fragmented nature of the sector and the high number of actors involved may lead to a situation where regulations are considered as the only possible way to proceed (Femenı´as, 2005). A combination of legislations or policies to enforce companies and market to sustainable development and incentive package for construction firms that practice sustainability in their projects is the best approach that can be applied as a strategy tailored towards sustainable construction (Samari, 2013).

According to Rehm and Ade (2013) green building construction costs is higher on average, although the difference was not statistically significant than conventional buildings. Also Kats et al. (2003) emphasis that the average cost premium of sustainable construction over just building to code is less than 2%. Most at times new ideas, systems and components are considered expensive. This therefore leads to the general apathy attached to such products. According to the results, higher final cost was ranked the third barrier. This result confirms (Zhang et al. 2011) position that cost is considered as the biggest barriers in promoting green strategy in real estate development process. Again, Bandy et al.2007 posit that that higher upfront cost (new design, technology and construction method) is the main impediment to green building development. Furthermore, using green materials would cost between 3 to 4 percent more than using conventional construction materials (Urban Land Institute., 2002). According to Williams and Dair (2007) the cost of proving environmentally green features and developments was significantly higher than for standard schemes. If the construction costs for green real estate do exist, what method can be adopted to control this conflict of interest? Who is willing to pay this extra cost? (Zhang et al.; 2011). Furthermore, according to Zhang et al.(2011) financial cost is usually considered as the critical barrier for real estate developers who are hesitating whether to develop green real estate project or not.

Public awareness about green building has been an important component that led to high demand (Toronto green development standard, 2006). Improving Sustainable construction among construction professionals in Ghana was identified necessary. Observations in most of major cities in the country show how most of our designs are deemed not sustainable, thereby leading to high energy demand, the emission of CO2 etc. The design phase lacks powerful methods (de Jonge, 2005). The materials and methods are just not sustainable. This is as a result of the lack of awareness with respect to sustainable construction. SB can be hindered by ignorance or a lack of common understanding about sustainability (Häkkinen and Belloni, 2011) . Also the results go to emphasis Rydin et al. (2006) claim that while designers demonstrate confidence in their ability to access and use knowledge in general, this confidence falls when SB is addressed. Clearly the lack of awareness is a serious barrier. This is because Mills and Glass (2009) enforce it by stating that the ability of construction design managers to integrate sustainability into building design; it requires that the sustainability issues are clearly communicated in a project’s brief. Ala-Juusela et al. (2006) claim that especially in the residential sector the lack of information is a problem for energy-efficient building. The normal house builder who makes the decisions about energy systems has often very little knowledge about energy efficiency.
According to (Atsusaka, 2003; Samari, 2012) the role of governments in promoting green building is undeniable and effective. Rules and regulations should be replaced with enforcing new ones to support green building development. Governments can facilitate green building development by a variety of instruments. According to (Varone et al., 2000; Fisher et al., 1989; Sutherland, 1991; Golove et al., 1996; Ofori, 2006) governments have important role to promote green building. Naturally for a developing country like Ghana, the need to have a government ready to lead in the provision of sustainable construction is vital and critical. The result indicates that the lack of maximum support from government is a major barrier to the adoption and use of sustainable construction processes. Government should be a key player in terms of promoting green building in the construction industry. Government can affect the construction industry by a variety of instruments. Regulatory and incentive instruments are the main tools for governments to develop green building (Yung et al., 2002).

CONCLUSIONS AND RECOMMENDATION

The objective of this paper is to identify barriers to sustainable construction in the Ghanaian construction industry. Consequently, this paper has identified, the top ten barriers to sustainable construction encountered as lack of demand, lack of strategy to promote sustainable construction, higher final cost, lack of public awareness and lack of Government support. The others are lack of cooperation, risk of investment, lack of Building Codes and Regulation, higher investment cost and lack of a measurement tool. It is therefore clear that majority of the identified barriers are related to lack of knowledge of green technologies, lack of green awareness and expertise and lack of government support. In line with this, an improvement of skills in this sector is required. This suggests that there is a need for policy and regulations on green issues, which may be achieved by the initiatives promoted by government. Furthermore, there is another urgent need to stimulate demand for sustainable construction.

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BRIDGING THE FINANCE GAP IN INFRASTRUCTURE PROCUREMENT THROUGH BUILD-OPERATE-TRANSFER (BOT) MECHANISM IN NIGERIAN TERTIARY INSTITUTIONS

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Recent surveys suggest that the usual delays experienced in the procurement of infrastructure and abandonment cases which arise as a result of insufficient fund necessitate the need for the adoption of BOT towards financing housing infrastructure in Nigerian tertiary institutions of learning. Yet, the adoption of the initiative is argued to be influenced by a variant of factors which introduced elements of doubt on its relative effectiveness compared with traditional procurement method (TPM). Hence, this study therefore examines the stakeholders’ perception on the level of effectiveness of BOT as a private finance initiative, compared with TPM. It also determines the influence of respondents’ years of experience in PPP/BOT procurement and the outcome of assessment based on the identified factor frameworks. It further compares the respondents’ assessment status of BOT and TPM systems in housing infrastructure. To achieve the objectives, questionnaires were administered on a purposive sample of the core professionals who are staff in Physical Planning and Development Units (PPDU), Housing unit, works and Maintenance sections of the selected tertiary institutions in South-western Nigeria. Using descriptive statistics, Chi-square and t-test analysis, the result indicates higher level of effectiveness in favour of BOT than TPM. It also found that, except for cost/funding, there is a significant relationship between the respondents’ years of experience and duration of the project, nature of the project, accountability/due process, economic/environmental compliance, client satisfaction/risk distribution and political influence. It also found that there is significant difference in the respondents’ assessment of BOT and TPM systems based on all the factor frameworks.

Keywords: BOT, finance, infrastructure, tertiary institution

INTRODUCTION

Sustaining and improving the existing infrastructure in Nigerian tertiary institutions of learning is very germane to the government of the nation. As part of the effort to augment the frantic effort of the government, campaign for economy deregulation, privatization and commercialization has been embraced in other to encourage private participation in both education and economic sectors. Inadequate infrastructure is one of the challenges confronting Nigeria tertiary institutions of learning which is perceived emerge from insufficient funding. The menace of infrastructure decay stemmed from the inability to sustain and upgrade the existing facilities such as

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student – hostels, lecture halls, road network, sport facilities, staff housing, administrative blocks and offices, laboratories and others. The importance of infrastructure in Nigerian tertiary institutions today cannot be over emphasized as efficient infrastructure facilities act as catalysts for educational and research activities. The effects of the inadequate maintenance and renewal of equipment and facilities are visible in all subsectors, education inclusive. Hence, BOT (private finance initiative) is currently being adopted in selected tertiary institutions in southwestern Nigeria.

Private Finance Initiative (PFI) is one of several procurement routes that falls under the general heading of Public Private Partnership (PPP), the rationale for PPP is described as the combination of the resources of the public and private sectors in the quest for more efficient service provision (Akintoye et al., 2003). This idea has been used over the past 20 -30 years by governments in developed countries to finance infrastructure projects to meet the public demand for service. Wilson et al. (2010) opine that in today turbulent “post – global financial crisis” environment, governments, at any level are confronted with an increasing demand for services but with significantly diminished revenue base.

Empirical studies have identified various routes of PFI in procuring infrastructure, some studies are concerned with public ownership and operation through public enterprises or government department, or public ownership with private sector management and operations or private ownership and private operation or community provisioning. The choice of any of the above options depends on economic, institutional and social characteristics which vary among countries. Recent trends according to Ogunlana and Dey’s (2004) study in the industry indicates continuous use of alternative procurement methods to compliment traditional procurement approach.

As long as infrastructure is sine qua non to educational and research success, there is need for alternative finance strategies like BOT in the emerging economy. Budgetary constraint in the developing nation like Nigeria, have led governments to seek alternative methods of financing infrastructure provision even in educational sector. In this study, the adoption of the initiative is argued to be influenced by a variant of factors which introduced elements of doubt on its relative effectiveness compared with traditional procurement method (TPM). Against the foregoing, the following research questions emanate:

- What is the status of respondents’ experience on project procurement?

What is the perception of stakeholders on the effectiveness of BOT mechanism when compared with TPM within the pace of time it operates in the selected tertiary institutions in southwestern Nigeria?

Do the years of experience in PPP/BOT have influence on the respondent’s assessment status of BOT and TPM, based on the set of measuring factors?

Is there any significant difference between the respondents’ assessment status of BOT and TPM?

Hence, this study therefore examines the stakeholders’ perception on the level of effectiveness of BOT as a private finance initiative, compared with TPM. It also determines the influence of respondents’ years of experience in PPP/BOT procurement and the outcome of assessment based on the identified factor frameworks. It further compares the respondents’ assessment status of BOT and TPM.
system in housing infrastructure. The last two objectives generate two null hypotheses:

Ho: Respondents’ years of experience in PPP/BOT procurement methods have no significant influence on their assessment of each of the assessment factors.

Ho: There is no significant difference in the respondents’ assessment of BOT and TPM systems based on each of the factor frameworks.

LITERATURE REVIEW

BOT PROJECT PROCUREMENT

The concept of BOT is examined by Morris (1994) as a scheme more applicable to projects which are primarily infrastructure projects, instead of being financed by the public sector, as in normal practice, they are financed by private promoters who build and subsequently own and operate the facility. The private promoters obtain their profit not from being paid for the work, but from the revenue stream obtained by charging the public a ‘toll’ for using the facility. The author identified two important reasons for BOOT/BOT; a growing trend towards replacing public sector financing with private sector, and encouragement of the principal participants to concentrate on its overall business success. In the study conducted by Shalakany (1996) which was further supported by Asker and Gab-Allah (2002) revealed major reasons for private sector through BOOT/BOT among which are; the need of the government to get the project, unwillingness of the government to finance infrastructure project, willingness of the government to share risk in such projects, availability of offering finance from lending institutions and investors.

The model and arrangement in BOT is well described in literature: Nassar (1996); Concession Company providing the finance, design, construction, operation and maintenance of all privatized infrastructure projects for a fixed period. Zhang (2001); a structure that uses private investment to undertake infrastructural development for public sector. Shalakany (1996); a concession by the government to provide a promoter known as concessionaire who is responsible for the financing, construction, operation and maintenance of a facility over the concession period. Badran (1996); a contractual arrangement and a new legal concept to encourage private enterprises and entrepreneurs to help the government in its development effort. Katz and Smith (2003), Haley (1992); phases of development such as pre-investment, pre-construction, construction, operation and transfer which involve consultants, project sponsors, contractors and equity holders.

BOT has also been viewed to incorporate some downsides. Kumaraswamy et al., (2002) researched that BOT is neither well possible nor advisable on all civil engineering mega-projects, yet provides an excellent vehicle to reverse the over fragmentation of functions that has led to development agendas of the multiple participants. In the opinion of Katz and Smith (2003), conflicts of interest might work against the success of the scheme especially when it comes to the issues of environmental impacts or the availability to disadvantaged segments of the community of low or no-cost access to such facilities or infrastructure. Asker and Gab – Allah (2002) opine that risks manifest in various stage of BOT arrangement; off-take arrangement which entails the uncertainty of total product distribution, supply arrangement, environmental law, technical problems, domestic political events and high development cost. In the study conducted by Wang et al.(2000), Ogunlana and Dey (2004), Kumaraswamy et al. (2002), various risk associated with BOT system are
identified: such as political risk, construction risk, operation risks, financial risk, market and revenue risks. This study hence compares the initiative-BOT to traditionally procured methods using some variables identified in literature.

TRADITIONAL PROCUREMENT METHODS (TPM)

Traditional infrastructure procurement represents the acquisition by government of infrastructure such as roads and buildings (i.e. hospital buildings, school buildings) (Burger and Hawkesworth (2011). It is called traditional because it has been in existence for a long time and has been the only choice available for most years. Onwusunye (2002) describes traditional method as a multiplex contractor) usually outsourced using competition bidding, agreed price. According to Ojo and Gbadebo (2012), this procurement method usually involves relationship between a public or private organization. The sole responsibility for financing of the project lies on the client’s organization. However, independent multi-discipline consultants on behalf of the client organization undertake the management of the project to completion. Burger and Hawkesworth (2011) further posit that in traditional procurement system, the governments specifies the quality and quality of the service, while the infrastructure is constructed by private companies to whom the construction is typically awarded through tender. At the completion, the asset is delivered to and operated by the government. OECD (2008) opine that a traditionally procured project, the transfer of risk to the private parties involved is very limited and usually does not extend beyond the construction phase of the project.

JCT (2008) posits that TPM is characterized by the separation of services- design and full documentation required before the award and construction commences by the contractor. The method at this juncture has been criticized because of burden of bureaucracies and poor contract management. Mathonsi and Thwala’s, (2012) study indicates that TPM entails client entering into an agreement with the design consultant to actually carry out the design work and prepare contract documents.

TPM incorporates tender invitation either selective tendering which requires client submitting the lists of contracts adjudged qualified based on technical competence and profiles or open tendering which entails an interested contractor to submit a tender for the work placed on public advertisement or tendering through negotiation whereby a single contractor is invited for a special or specific project (Pilcher, 1992). Ojo and Gbadebo (2012) confirmed that TPM has been a standard practice in the building industry for long years, and it is still widely used for range of situations and condition, despite the advent of new initiatives of PPP in the emerging economies.

COMPARING BOT AND TPM: LITERATURE SEARCH

Comptroller and Auditor General (2003) indicates that under the private finance initiative (PFI) the performance of projects in terms of completion of work within time and budget is a considerable improvement when compared to projects procured in a traditional manner. TPM is known to be the usual approach asides the idea of PPP. BOT has emerged to serve as an infrastructural arrangement scheme. Algarni et al. (2007) reported that the Build –Operate – Transfer (BOT) delivery system has gained world- wide popularity as a mechanism to limit spending on government budgets and facilitate private financing of desirable public facility projects. The adoption of BOT initiative is argued to be influenced by a variant of factors which introduced elements of doubt on its relative effectiveness compared with traditional procurement method (TPM). These factors include; Duration /timing of project,
cost/budget factors, accountability factors, economic factors, environmental factors, political factors, client factors and nature of projects factors.

Table I: Summary of the factors framework that gauge the performance and selection criteria of BOT and TPM as identified from literature

<table>
<thead>
<tr>
<th>Authors</th>
<th>Summarized Factors</th>
<th>Procurement Issues</th>
<th>Subject</th>
<th>Adapted and Validated Factors/Criteria (Appendix A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li (2003), Cheung et al. (2010)</td>
<td>Duration/timing, competition, cost/financing, budget, risk distribution, project innovation, Economic development, technology etc.</td>
<td>PPPs large project in Hong Kong, Australia and UK</td>
<td>-Construction duration, cost/funding, -Clients’ satisfaction, -Risk distribution, -Nature of project, -Political influence and policy -Accountability, due process -Economic and environmental compliance</td>
<td></td>
</tr>
<tr>
<td>Mathonsi and Thwala (2012); Ojo and Gbadebo (2012); Maison et al. (2006)</td>
<td>Duration, cost/budget, political consideration, economic condition, emerging technology, government policy, nature of projects, level of knowledge, risk, etc.</td>
<td>Criteria for procurement strategy for project delivery in Nigeria.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>De Marco et al. (2012), Graham (2011)</td>
<td>Time taken to award contract, deliver the asset, transaction costs, cost certainty, whole of life maintenance, budget certainty, project due diligence, environmental approvals, performance requirement, regulatory quality, country index, currency exchange rate and partnership</td>
<td>Assessment of PPP and Traditional Procurement Methods</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is also important to state that these factors are rooted in the studies conducted by Zayed and Chang (2002) and Zhang (2005) on financial risk factors, Li (2003); Time, project innovation, economic development, completion, technology etc., Cheung et al. (2010); duration, cost, budget, risk, economic, environment etc, Mathonsi and Thwala (2012); project risk, political consideration, client level of knowledge, economic factor, due diligence, project, competition and technology, Ojo and Gbadebo (2006); Project management, technicality, risk management and policy. The assessment is therefore based on the adapted identified factors in Table 1.

**METHODOLOGY**

To achieve the objectives of this study, factors that measure the performance and selection criteria of procurement systems were adapted as indicated in Table I. Variables were developed on 4-point Likert scale-(Very effective to not effective) under each framework. The instrument-Procurement Checklist (Appendix A) were administered on seventy five respondents, sampled at the initial pilot survey, twenty five questionnaires for each of the three surveyed institutions. This sample technique was chosen because the time taken for conducting the survey is lessened and the response rate is reasonably high.

Data Validation and Reliability Test

The internal consistency test of all the 28 factors indicated in the Procurement checklist-Appendix A provides a cronbach alpha of 0.886. The individual factor of the instrument indicates the following results:
Source: Authors’ Statistical Analysis Result (2013)

The Foregoing results provide a sufficient and strong reliability test on the data collected through project procurement checklist.

Table II: Validity and reliability test

<table>
<thead>
<tr>
<th>Factors</th>
<th>No of sub-factors</th>
<th>Cronbach’s Alpha(Reliability Test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration/Timing</td>
<td>3</td>
<td>0.660</td>
</tr>
<tr>
<td>Cost/Financing</td>
<td>4</td>
<td>0.790</td>
</tr>
<tr>
<td>Nature of Project</td>
<td>5</td>
<td>0.801</td>
</tr>
<tr>
<td>Accountability/Due Process</td>
<td>3</td>
<td>0.644</td>
</tr>
<tr>
<td>Economic/Environmental Compliance</td>
<td>5</td>
<td>0.781</td>
</tr>
<tr>
<td>Political Influence/Policy</td>
<td>3</td>
<td>0.718</td>
</tr>
<tr>
<td>Client Satisfaction</td>
<td>4</td>
<td>0.763</td>
</tr>
</tbody>
</table>

Data Description and Empirical Analysis

Out of seventy five questionnaires administered, 59 completed sets were received useful, given a response rate of 79%. Table III presents the descriptive analysis of the respondents’ demographics.

Table III: Demographic Characteristics of the Respondents

<table>
<thead>
<tr>
<th>Variables</th>
<th>Status</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>56</td>
<td>94.9</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>59</td>
<td>100.0</td>
</tr>
<tr>
<td>Age</td>
<td>20-30yrs</td>
<td>12</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td>31-40yrs</td>
<td>18</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td>41-50yrs</td>
<td>25</td>
<td>42.4</td>
</tr>
<tr>
<td></td>
<td>Above 50yrs</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>59</td>
<td>100.0</td>
</tr>
<tr>
<td>Academic Qualification</td>
<td>Diploma/Certificate</td>
<td>7</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td>HND/Bachelor of</td>
<td>42</td>
<td>71.2</td>
</tr>
<tr>
<td></td>
<td>science</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>5</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>Ph.D.</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>59</td>
<td>100.0</td>
</tr>
<tr>
<td>Years of Experience</td>
<td>1-10yrs</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>11-20yrs</td>
<td>39</td>
<td>66.1</td>
</tr>
<tr>
<td></td>
<td>21-30yrs</td>
<td>10</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>Over 30yrs</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>59</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Survey (2012)

Table I indicates that 56 (94.9%) of the respondents are male while 1 (1.7%) is female. Out of them 25 (42.4%) fall within the age of 41-45, 18(30.5%) within the age bracket of 31-35 and 12 (20.3%) within the age of 20-30 years. It is also important to state that 42 (71.2%) possess either HND or B.Sc, 5 (8.5%) possess masters degree, 7 (11.9%) possess Diploma/certificate and 2 (3.4%) possess PhD. The foregoing information imply that response on this study emanate from reliable source who are
well disposed in age with requisite academic qualifications. Another basis for the reliability of the data collected, is indicated in the confirmed years of service.39 (66.1%) possess 11-20 years of service, 10 (16.9%) possess 21-30 years of experience.

To investigate the level of experience in project procurement, Table IV presents the result.

Table IV: Level of experience in project procurement

<table>
<thead>
<tr>
<th>Experience in project procurement</th>
<th>Frequency (f)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>11</td>
<td>18.6</td>
</tr>
<tr>
<td>High</td>
<td>16</td>
<td>27.1</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>25</td>
<td>42.4</td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>11.9</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table IV shows that 11(18.6%) of the respondents had very high level of experience in project procurement, 16(27.1%) indicated their experience as high, 25(42.4%) described it as satisfactory while 7(11.9%) had low experience in project procurement. This implies that the respondents possess substantial years of experience in project procurement which qualifies them suitable respondents for the study.

Objective 2: To examine the respondents’ perceived effectiveness level, based on the identified component of factor framework on BOT and TPM in procurement of housing infrastructure in tertiary institutions. Responses to each component of factor framework in the instrument (Appendix A) were scored and subjected to descriptive analysis. Their respective mean and standard deviation were therefore obtained. Items 8 to 10 represent “duration/timing factor”, items 11 to 14 represent “cost/financing factor”, items 15 to 19 represent “the nature of project factor”, items 20 to 22 represent “accountability/due process factor” items 23 to 27 represent “economic/environment compliance factor” items 28 to 30 represent “political influence/policy factor” and items 31 to 34 represent “client knowledge /risk distribution factor”. The summary of the result is presented in Table V:

Table V shows mean and standard deviation of the assessment of individual component of factor framework on BOT and TPM in procurement of housing infrastructure in tertiary institutions. The mean and standard deviation for time taken to negotiate/award contract respectively for BOT were 3.66 and 0.58 while 2.00 and 0.59 for TPM. Time taken to deliver the project; Mean and Standard Deviation for BOT (3.53, 0.50), TPM (1.95, 0.61). Time taken to organize for finance; BOT (3.63, 0.49), TPM (1.81, 0.66). Also, the Mean and Standard Deviation for transaction cost; BOT (3.58, 0.50), TPM (1.73, 0.69), cost certainty; BOT (3.58, 0.53), TPM (1.71, 0.70), funding arrangement; BOT (3.47, 0.50), TPM (1.95, 0.71) while for budget certainty; BOT (3.51, 0.54), TPM (2.00, 0.67).

Similarly for the nature of project, the Mean and Standard Deviation of the individual component are as follows: whole of life maintenance; BOT (3.32, 0.68), TPM (1.97, 0.61), design innovation; BOT (3.22, 0.74), TPM (1.86, 0.66), construction innovation; BOT (3.31, 0.73), TPM (1.75, 0.63), size & technical complexity of the project; BOT (3.40, 0.56), TPM (1.83, 0.62), and flexibility of the design; BOT (3.25, 0.51), TPM (1.86, 0.60).
Table V: Mean and standard deviation of respondents’ perceived effectiveness of each component of factor framework on BOT and TPM in housing infrastructure procurement in tertiary institutions

<table>
<thead>
<tr>
<th>Procurement Methods</th>
<th>Factors/Scaling</th>
<th>BOT (PPP)</th>
<th>TPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
<td>MEAN</td>
</tr>
<tr>
<td>C8</td>
<td>3.66</td>
<td>0.58</td>
<td>2.00</td>
</tr>
<tr>
<td>C9</td>
<td>3.53</td>
<td>0.50</td>
<td>1.95</td>
</tr>
<tr>
<td>C10</td>
<td>3.63</td>
<td>0.49</td>
<td>1.81</td>
</tr>
<tr>
<td>C11</td>
<td>3.58</td>
<td>0.50</td>
<td>1.73</td>
</tr>
<tr>
<td>C12</td>
<td>3.58</td>
<td>0.53</td>
<td>1.71</td>
</tr>
<tr>
<td>C13</td>
<td>3.47</td>
<td>0.50</td>
<td>1.95</td>
</tr>
<tr>
<td>C14</td>
<td>3.51</td>
<td>0.54</td>
<td>2.00</td>
</tr>
<tr>
<td>C15</td>
<td>3.32</td>
<td>0.68</td>
<td>1.97</td>
</tr>
<tr>
<td>C16</td>
<td>3.22</td>
<td>0.74</td>
<td>1.86</td>
</tr>
<tr>
<td>C17</td>
<td>3.31</td>
<td>0.73</td>
<td>1.75</td>
</tr>
<tr>
<td>C18</td>
<td>3.40</td>
<td>0.56</td>
<td>1.83</td>
</tr>
<tr>
<td>C19</td>
<td>3.25</td>
<td>0.51</td>
<td>1.86</td>
</tr>
<tr>
<td>C20</td>
<td>3.19</td>
<td>0.51</td>
<td>1.86</td>
</tr>
<tr>
<td>C21</td>
<td>3.43</td>
<td>0.60</td>
<td>1.60</td>
</tr>
<tr>
<td>C22</td>
<td>3.58</td>
<td>0.50</td>
<td>1.59</td>
</tr>
<tr>
<td>C23</td>
<td>3.56</td>
<td>0.53</td>
<td>1.56</td>
</tr>
<tr>
<td>C24</td>
<td>3.39</td>
<td>0.56</td>
<td>1.69</td>
</tr>
<tr>
<td>C25</td>
<td>3.46</td>
<td>0.54</td>
<td>1.75</td>
</tr>
<tr>
<td>C26</td>
<td>3.61</td>
<td>0.56</td>
<td>1.78</td>
</tr>
<tr>
<td>C27</td>
<td>3.61</td>
<td>0.59</td>
<td>1.88</td>
</tr>
<tr>
<td>C28</td>
<td>4.07</td>
<td>3.88</td>
<td>1.92</td>
</tr>
<tr>
<td>C29</td>
<td>3.42</td>
<td>0.53</td>
<td>1.76</td>
</tr>
<tr>
<td>C30</td>
<td>3.42</td>
<td>0.56</td>
<td>1.89</td>
</tr>
<tr>
<td>C31</td>
<td>3.51</td>
<td>0.54</td>
<td>1.62</td>
</tr>
<tr>
<td>C32</td>
<td>3.62</td>
<td>0.52</td>
<td>1.77</td>
</tr>
<tr>
<td>C33</td>
<td>3.45</td>
<td>0.54</td>
<td>1.62</td>
</tr>
<tr>
<td>C34</td>
<td>3.40</td>
<td>0.56</td>
<td>1.81</td>
</tr>
</tbody>
</table>

Accountability/due process has Mean and Standard Deviation for its component as follows: Due diligence; BOT (3.19, 0.51), TPM (1.86, 0.69), due process; BOT (3.43, 0.60), TPM (1.60, 0.78), and relative level of accountability/ transparency; BOT (3.58, 0.50), TPM (1.59, 0.77). For economic/environment compliance: availability of resources; BOT (3.56, 0.53), TPM (1.56, 0.70), competition; BOT (3.39, 0.56), TPM (1.69, 0.68); market/economic compliance; BOT (3.46, 0.54), TPM (1.75, 0.68), environmental approval; BOT (3.61, 0.56), TPM (1.78, 0.65), while change in performance requirement; BOT (3.61, 0.59), TPM (1.88, 0.56).

For component of political influence/policy: positive political influence; BOT (4.07, 3.88), TPM (1.92, 0.57), political support; BOT (3.42, 0.53), TPM (1.76, 0.66), while for affirmative action/policies; BOT (3.42, 0.56), TPM (1.89, 0.63). Finally, for client knowledge/risk distribution: familiarity of procurement system; BOT (3.51, 0.54), TPM (1.62, 0.71), client’s specific requirement; BOT (3.62, 0.52), TPM (1.77, 0.64), risk allocation/ reduction; BOT (3.45, 0.54), TPM (1.62, 0.69), and client’s level of knowledge BOT (3.40, 0.56), TPM (1.81, 0.62).

The results of the whole analysis indicate that the identified factor frameworks were considered to be more relevant to BOT than TPM. Also, political influence/policy produced component with highest mean rating in BOT whereas, duration/timing and cost/financing have such highest mean with regards to TPM.
Objective 3: To determine the influence of respondents’ years of experience in PPP/BOT procurement method based on each factor assessment

Ho: Respondents’ years of experience in PPP/BOT procurement methods have no significant influence on their assessment of each of the assessment factors. Tested with chi-square

In order to achieve the stated objective, constituting items were scored and the respective mean and standard deviation is obtained, for each of the category. Any score below the mean value was considered as “not effective”, scores of mean value plus one standard deviation is considered as “fairly effective” while mean plus two standard deviation is considered as “very effective”. The assessment factors framework such as duration/ timing, cost/financing, nature of the project, accountability/due process, economic/environment compliance, political influence/policy and client satisfaction/risk distribution were subjected to a chi-square analysis. The results are presented separately in Table VI through XII:

Table VI: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on duration/time factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Not Effective</th>
<th>Fairly Effective</th>
<th>Very Effective</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>7</td>
<td>21</td>
<td>37</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td><strong>13</strong></td>
<td><strong>18</strong></td>
<td><strong>28</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

Table VI shows that the Chi square value obtained is 19.679, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods have significant influence on the assessment of duration/time factor framework.

Table VII shows that the Chi square value obtained is 11.101, df =6, p > .05). Since p-value is greater than 0.05, the stated null hypothesis is upheld. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods have no significant influence on the assessment of cost/financing factor framework.

Table VIII shows that the Chi square value obtained is 21.229, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods have significant influence on their assessment of the nature of the project factors framework.
Table VII: Chi-square analysis of influence of respondents’ years of experience in PPP/BOT procurement methods on the assessment of cost/financing factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Not effective</th>
<th>Fairly effective</th>
<th>Very effective</th>
<th>Total</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>37</td>
<td>6</td>
<td>11.101</td>
<td>.085</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>18</td>
<td>19</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table VIII: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on the assessment of the nature of the project factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Not Effective</th>
<th>Fairly Effective</th>
<th>Very Effective</th>
<th>Total</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>20</td>
<td>8</td>
<td>37</td>
<td>6</td>
<td>21.229</td>
<td>.002</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>26</td>
<td>12</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table IX: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on the assessment of accountability/due process factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Not Effective</th>
<th>Fairly Effective</th>
<th>Very Effective</th>
<th>Total</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>11</td>
<td></td>
<td>30.249</td>
<td>.000</td>
</tr>
<tr>
<td>High</td>
<td>12</td>
<td>22</td>
<td>3</td>
<td>37</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfactory</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>36</td>
<td>6</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table IX shows that the Chi square value obtained is 30.249, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods
have significant influence on their assessment of accountability/due process factors framework.

Table X: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on the assessment of economic/environment compliance factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Assessment of economic/environment compliance</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Not Effective</td>
<td>Fairly Effective</td>
<td>Very Effective</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>High</td>
<td>11</td>
<td>14</td>
<td>12</td>
<td>37</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>27</td>
<td>17</td>
<td>59</td>
</tr>
</tbody>
</table>

Table X shows that the Chi square value obtained is 18.226, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods have significant influence on the assessment of economic/environment compliance factors framework.

Table XI: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on the assessment of political influence/policy factors framework.

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT procurement methods</th>
<th>Assessment of political influence/policy</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Not Effective</td>
<td>Fairly Effective</td>
<td>Very Effective</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>High</td>
<td>11</td>
<td>13</td>
<td>13</td>
<td>37</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>26</td>
<td>19</td>
<td>59</td>
</tr>
</tbody>
</table>

Table XI shows that the Chi square value obtained is 22.715, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondent’s years of experience in PPP/BOT procurement methods have significant influence on their assessment of political influence/policy factors framework.

Table XII shows that the Chi square value obtained is 12.795, df =6, p < .05). Since p-value is less than 0.05, the stated null hypothesis is rejected. This result therefore concludes that respondents’ years of experience in PPP/BOT procurement methods have significant influence on the assessment of client satisfaction/risk distribution factors framework.
Table XII: Chi-square analysis of influence of respondent’s years of experience in PPP/BOT procurement methods on the assessment of client satisfaction/risk distribution factors framework

<table>
<thead>
<tr>
<th>Year of experience in PPP/BOT</th>
<th>Assessment of satisfaction/Risk</th>
<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Effective</td>
<td>Fairly Effective</td>
<td>Very Effective</td>
<td>Total</td>
</tr>
<tr>
<td>Very high</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>High</td>
<td>10</td>
<td>20</td>
<td>7</td>
<td>37</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>35</td>
<td>10</td>
<td>59</td>
</tr>
</tbody>
</table>

Objective 4: To compare the respondents’ assessment of BOT and TPM systems based on each of the factor framework.

To achieve the stated objective, respondents’ assessment of BOT and TPM systems based on each of the factor framework were subjected to Paired Samples t-test of significance. A null hypothesis which serves as guide to the testing is stated thus:

Ho: There is no significant difference in the respondents’ assessment of BOT and TPM systems based on each of the factor framework.

Table XIII: Test of significant different in the assessment of BOT and TPM system based on the identified factor framework.

<table>
<thead>
<tr>
<th>Assessment of BOT&amp;TPM</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>duration/time(BOT)</td>
<td>10.7627</td>
<td>59</td>
<td>1.35620</td>
<td>19.601</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>duration/time(TPM)</td>
<td>5.6271</td>
<td>59</td>
<td>1.85601</td>
<td>18.661</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>Cost/financing (BOT)</td>
<td>14.1356</td>
<td>59</td>
<td>1.62372</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost/financing (TPM)</td>
<td>7.3898</td>
<td>59</td>
<td>2.41416</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Project(BOT)</td>
<td>16.2712</td>
<td>59</td>
<td>2.80904</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Project(TPM)</td>
<td>9.2712</td>
<td>59</td>
<td>2.55849</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accountability/Due process (BOT)</td>
<td>10.0847</td>
<td>59</td>
<td>1.46556</td>
<td>16.935</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>Accountability/Due process (TPM)</td>
<td>4.8983</td>
<td>59</td>
<td>2.15515</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic/Environment compliance(BOT)</td>
<td>17.6271</td>
<td>59</td>
<td>2.02483</td>
<td>20.479</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>Economic/Environment compliance(TPM)</td>
<td>8.6610</td>
<td>59</td>
<td>2.63668</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Political influence/policy(BOT)</td>
<td>10.4068</td>
<td>59</td>
<td>1.35339</td>
<td>17.990</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>Political influence/policy(TPM)</td>
<td>5.3729</td>
<td>59</td>
<td>1.59631</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client satisfaction/Risk distribution(BOT)</td>
<td>13.7966</td>
<td>59</td>
<td>2.03232</td>
<td>15.677</td>
<td>58</td>
<td>.000</td>
</tr>
<tr>
<td>Client satisfaction/Risk distribution(BOT)</td>
<td>6.1356</td>
<td>59</td>
<td>3.03120</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table XIII shows that the respondents’ Mean scores for BOT are generally higher than those of TPM for all factors. With t-values results at p-values which are less than 0.05, with 58 as the degree of freedom, the stated null hypothesis is rejected. These results conclude that there is significant difference in the respondents’ assessment of BOT and TPM systems based on all factor frameworks.

**SUMMARY OF FINDINGS AND CONCLUSION**

In this study, four objectives are examined: First, it investigated the level of experience in project procurement. Second, it examined the respondents’ perception on effectiveness of BOT and TPM in procuring housing infrastructure, based on identified framework. Third, it determined the influence of respondent’s years of experience in PPP/BOT procurement using chi-square, based on the identified factors. Lastly, it compared respondents’ assessment of BOT and TPM system using paired t-test.

Consequently, the study revealed a high level of experience in Project procurement. It is confirmed that BOT has relative advantages than TPM using all identified factors which include duration, cost/financing, nature of project, accountability, political influence, client satisfaction and risk distribution, economic and environmental compliance. It is further confirmed that apart from cost/financing, there is significant relationship between the respondents’ years of experience and project duration, accountability, economic/environmental compliance, nature of project, client satisfaction and risk distribution.

Finally, the respondents’ Mean scores for BOT are generally higher than those of TPM for all factors. With t-values results at p-values which are less than 0.05, with 58 as the degree of freedom, the stated null hypothesis is rejected. These results conclude that there is significant difference in the respondents’ assessment of BOT and TPM systems based on all factor frameworks.

**LIMITATION**

The first limitation of this study is that, the purposive sampling techniques adopted might have created biases from respondents since predictive variable used are subjective, however, this is not expected to nullify the result as the sample is not in any way inferior to the sample used for similar study conducted by Zhang (2001).

**REFERENCES**


DEPARTMENT OF ESTATE MANAGEMENT
OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

QUESTIONNAIRE ON BUILD-OPERATE –TRANSFER (BOT) SYSTEM AND TRADITIONAL PROCUREMENT METHOD (TPM):D&B IN SELECTED TERTIARY INSTITUTIONS IN SOUTH-WESTERN NIGERIA

Dear Sir/Ma,

This questionnaire is designed to collect information on BOT and TPM. The purpose is to investigate the perception and comparing the influencing factors. Please be assured that this questionnaire is strictly anonymous and the information supplied is of great importance. Such information will also be treated with the utmost confidence.

Thanks for your co-operation. GBADEGESIN J.T. and OYEWOLE M.O.

1. Sex: (a.) Male [ ] (b.) Female [ ]

2. Age: (b.) Btw 20- 30 [ ] (b.)Btw 31 – 40 [ ] (c.)Btw 41 – 50 [ ] (d.) above 50 years [ ]

3. Academic Qualification: (a.) Certificate/Diploma [ ] (b.) HND/B.Sc [ ] (c.) Master [ ] (d.)PhD [ ]

4. Years of Experience:
   (a.) 1 – 10 yrs [ ] (b.) 11 - 20 yrs [ ] (c.) 21 – 30 yrs [ ] (d.)Over 30yrs.
5. Indicate your level of awareness on BOT: (a.) very high [  ] (b.) high [  ] (c.) satisfactory [  ] (d.) low [  ] (e.) very low[  ]

6. How do you rank your personal experience on development project procurement? (a.) Very high [  ] (b.)High [  ] (c.) Satisfactory [  ] (d.) Low [  ] (e.) Very low [  ]

7. Please indicate your experience in PPP/BOT procurement methods (a.) Very High [  ] (b.) High [  ] (c.) Satisfactory [  ] (d.) Low [  ] (e.) Very Low.

In your own opinion, assess BOT and TPM systems based on the following frameworks: Very Effective (4) Fairly Effective (3), Effective (2), Not Effective (1).

<table>
<thead>
<tr>
<th>S/N</th>
<th>Procurement Methods</th>
<th>BOT (PPP)</th>
<th>TPM (D&amp;B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factors/Scaling</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Time taken to negotiate/ award contract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Time taken to deliver the asset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Time taken to organize for finance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Transaction costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Cost certainty</td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td>Funding arrangement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Budget Certainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whole of life maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Design innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Construction Innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Size &amp;Technical Complexity of the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Flexibility of the design</td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>Due diligence</td>
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<td></td>
</tr>
<tr>
<td>21</td>
<td>Due Process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Relative level of accountability/Transparency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Availability of resource</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Competition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Market/economic Compliance</td>
<td></td>
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</tr>
<tr>
<td>26</td>
<td>Environmental approval</td>
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<td></td>
</tr>
<tr>
<td>27</td>
<td>Change in performance requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Positive Political influence</td>
<td></td>
<td></td>
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<tr>
<td>29</td>
<td>Political support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Affirmative action/policies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Familiarity of procurement system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Client’s specific requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Risk allocation/reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Client’s level of knowledge</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Building Design Practice and Household Energy Use in Urban Centres in Nigeria: A Case Study of Bauchi Town

Ibrahim Udale Hussaini
Architecture Programme, School of Environmental Technology, Abubakar Tafawa Balewa University, Bauchi-Nigeria.

Architecture and the general art/science of building design play a significant role in household energy use. This is because the efficiency of the inherent energy in use is dependent to some extent on the pattern of the building design, the nature and/or the technology of the appliances in use, and the occupant behaviour. This paper attempts to present the role of design practice in attaining household energy efficiency through a qualitative study approach of case study (inventory) of selected households; and interview of housing design stakeholders in Bauchi town. The objective is to determine the level of energy efficiency consideration in housing design practice by the housing stakeholders in Bauchi, Nigeria. The result reveals a low level of energy efficiency consideration in design practice; requiring a strategic programme to boost energy efficiency practice of the nation in a bid to meeting the global quest for energy efficiency; and subsequently sustainable energy development.

Keywords: building design practice, energy efficiency, households, energy use, appliances technology, Bauchi-Nigeria.

Introduction

Energy development strategy is today a major determinant in the global economy of nations; and as such, energy efficiency has become a basic requirement for the designing professionals. In fact, energy efficiency has moved from being largely the preserve of specialists, to being a required skill of each and every design professional. This is because it is a primary mechanism to limiting the environmental damage caused to our planet-earth by energy use. At the present, the environmental damage is threatening the survival of the lives on earth (human and animal alike) through global climate change (Roaf and Hancock, 1992).

Invariably, architecture and buildings in general offer the greatest potential for a sustainable shaping of the environment through clever planning and design decisions which eventually would culminate into sparing use of resources, improve durability of buildings and reduced environmental damage. As such, efficiency in the use of energy and resources has become a key quality indication for a building (Hegger, Fuchs, Stark and Zeumer, 2008); with a direct bearing on the efficiency of practice by professional designers.

Santamouris (2005) asserts that energy efficiency is a critical issue for high-quality housing; as energy not only represents a high percentage of the running cost of a

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building but it also has a major effect on the thermal and optical comfort of the occupants. Also, the fact that more than one third of the world’s energy is used in buildings; and a majority in houses and apartments (Wulfinghoff, 2003) makes the issue of energy efficiency in housing more cogent.

However, recent developments in energy technology is improving the possibility to decrease significantly the energy consumption of buildings to create housing that is more comfortable and to implement a major decrease in emissions to the environment; a development that is yet to have a significant impact on the shore of Nigeria, and particularly Bauchi town.

Currently, the national economy of Nigeria is beguiled by energy poverty which provides the background and needed basis for accomplishing energy-efficient households. According to Eleri, Ugwu and Onuvae (2012), Nigerians experience the worst forms of energy poverty in the world. Over 15.3 million households lack access to grid electricity; and for those connected to the national grid, the supply is erratic at best (World Development Indicators, Little Green Data Book 2011). The poor power production and supply is further exacerbated by high distribution losses due to inefficient distribution system (UNDP-Nigeria EE Appliances Project Document 2010). To further understand the energy poverty scenario, Adenikinju (2008) laments that Nigeria with her higher population of over 150 million people has an installed electricity generating capacity of 6,000MW; while UAE has 4,740MW to a population of 4 million, and South Africa has 46,000MW to 44 million people. In fact, the poor electricity supply has resulted in Nigeria being the largest importer of generators (independent power plants) in the world; leading to enormous environmental and social costs to the individuals and the entire nation (Iwayemi, 2008).

Therefore, imbibing in energy efficient culture will help to eliminate or reduce the rampant use of generators, spread grid electricity supply to all parts of Nigeria; and as well minimize the growing demand to have more power stations. Thus, more money for building power stations will then be spent on other sectors of the economy; and the environmental pollution by generators (i.e. CO₂ emission and noise) would be minimized. This requires good energy management (inclusive of energy-efficient design practice) at the residential, public and private sectors so as to avert the current energy poverty evident in the erratic and alternating power supply (i.e. load shedding). This effort will equally reduce the emission of GHGs (from burning fossil fuel) and reduce the reliance on petroleum to drive the Nigerian economy. The need for further discussions on the benefits of energy-responsive housing design to individual housing occupants and the society in general becomes paramount.

ENERGY-RESPONSIVE HOUSING DESIGN PRACTICE

The goal of energy-responsive housing design practice is to provide energy-efficient households which when compared with houses of similar size, costs less to heat, to light, and to operate its essential services. It creates the best environment for human habitation while minimizing the cost of energy consumed without affecting the level of services provided (Davidson and Henderson 1989, Ahsan 2009 and Janssen 2004). This therefore signifies that an energy-efficient house has good thermal insulation, efficient heating and lighting systems; and probably a well-conditioned occupant behaviour.

In fact, majority of the buildings that are designed, built and used today contribute to serious environmental problems because of the excessive consumption of energy and
other natural resources. Undoubtedly, the global energy resources are dwindling due to the immense pressure imposed on it by accelerated urbanization; and the subsequent energy-intensive solutions that are sought to construct buildings, meet their demands for heating, cooling, ventilation and lighting which cause severe depletion of invaluable environmental resources. However, this problem can be alleviated by designing and developing future buildings on sound concepts of energy efficiency and sustainability. This can be accomplished with the determination to resolving the fundamental issues of design (architecture) and technology (of services/appliances); buttressed by a social scheme towards sustaining the desired occupant behaviour. In effect, energy efficiency in buildings (housing) can eventually be achieved through a multifarious approach involving climate/environmental conscious design, the use of materials/appliances with low embodied energy, reduction of transportation energy, implementation of energy-efficient building systems, and effective utilization of renewable energy sources to power the building; and conditioning occupant behaviour for effective and sustainable energy efficiency practice (Majumdar 2002 and Hussaini 2012).

Lovins and Lovins (2002) reiterate that energy systems designed to be efficient, decentralized, and diversified are what national security demands, the public wants, and the market is ready to supply. This can be achieved in Nigeria through collective efforts of the government (providing policy framework and legislation); and the housing stakeholders (providing energy-efficient designs) in a bid to addressing the current problems of energy-inefficient households.

**ENERGY-CONSCIOUS DESIGN PROCESS**

Energy efficiency plays a central role in any good design and is exceptional in cost-effectiveness over the life cycle of the building. As such, the designers should seek a balance between overall cost and good design practice while meeting the occupants’ needs. The success of this venture depends on the understanding of the interactions between people, building fabric and services. This integrated design approach requires the successful collaboration of client and the housing stakeholders at the early conceptual stage of the project (CIBSE guide 1998 and Hussaini 2012).

Baker (1992) further stressed that, the performance of a building is due to the three factors of; building, systems and occupants;

that which is inherent in the building design,

that which relates to services systems design and efficiency, and

that which is due to the effect of occupant behaviour.

Accordingly, Horsley et al. (2003) reiterate that majority of decisions which affect building performance is made at the design stage, and that energy performance is not being given the due consideration in the design development. And that, energy performance assessments, where they are made at all, are done at a detail design stage when the opportunity to make any significant improvements is significantly diminished. Although the role of the design practitioners is fundamental, a culture of energy conservation from planning to design, through construction to occupancy will have to be fostered amongst all members of the project delivery chain, from clients to architects and contractors to building users before any significant performance will be noted (Hussaini 2012 and Horsley et al. 2003).
THE STUDY APPROACH AND METHODS

This study is focused on determining the energy efficiency consideration in housing design practice in Bauchi, Nigeria. This was undertaken using qualitative research approach of case study and interviews essentially to accomplish validity and generalization of data.

Bauchi is a typical urban town with increase in energy demand arising from the continuous process of urbanization. That is, a growing population, increase in living standards and a rising number of apartments. It is the capital of Bauchi State; located in the north eastern region of the country with a population of over 493,730 inhabitants. It has five tertiary institutions; two university campuses, two polytechnics and a school of nursing and midwifery. Due to the relatively high concentration of educational facilities and commercial activities coupled with the population density in Bauchi town, the energy demand has surpassed many of the towns within the region, thereby making it a high potential for energy efficiency. Typical residential buildings in Nigeria consist of both traditional and conventional (modern) typologies. However, this study was limited to housing with the conventional typology of flats and apartments in Bauchi town. In fact, Bauchi metropolis is a complete Local Government Area (Bauchi L.G.A.) which is made up of three (3) geographical districts as; Bauchi, Zungur and Galanbi.

The interview process

The interview process was phenomenological, and meant to identify the influence of professional experiences about the phenomenon of energy efficiency in housing design practice. The interview was employed to underscore the energy use phenomenon as perceived or practiced by the housing stakeholders (architects, building service engineers and builders) in Bauchi, Nigeria through open-ended, semi-standardized interview questions. The population was the entire Bauchi housing stakeholders and the sampling was judgmental (form of purposive sampling). As a result only (10) number professionals were interviewed due to the following criteria for selection of participants;

- must be a resident architect (4nos)/building service engineer (3nos)/builder (3nos)
- must be in practice for not less than 10 years
- must be practicing in Bauchi town
- must be registered with the professional body at least 3 years preceding the study.

The semi-standardized questions allowed the interviewer the freedom to digress and probe beyond the answers to the prepared questions. Some of these questions (13 in all) are as follows;

- How and when has the issue of energy efficiency been of concern to you?
- Does energy efficiency consideration influence your practice; and how?
- What challenges are you having from the public, i.e. are they demanding EE services?
- Are there professional practice regulations/codes on energy efficiency?
- How do you update yourself (if at all) on energy efficiency issues; and how often?
- From your point of view, what are the barriers to energy efficiency housing design practice in Bauchi, and Nigeria in general? Etc.
The case study (evaluation of common housing design elements)

The case study was undertaken with the proposition that ‘Climate-Sensitive Design’ in consideration of other environmental factors like landscape and other existing features/adjacencies on site enhances the energy efficiency condition of buildings; as the theoretical lens of study using the common design elements (i.e. climate/environmental-responsive design parameters) as yardstick. This involved the selection of twelve (12) housing units from six created housing clusters in Bauchi town (i.e. 2 houses from each cluster). There are 3 geographical districts in Bauchi town (i.e. Bauchi, Galanbi and Zungur), and two housing estates (clusters) are selected from each district; and two (2) housing units are selected from each of the selected housing estate. To adequately undertake the case study, an evaluation form was designed to take inventory of housing design elements to address the issues of;

a. Design/Planning Consideration;
   - building site,
   - building type/typology
   - planform,
   - building orientation,
   - functional distribution(room orientation)
   - landscaping

b. Building Envelope;
   - external walls
   - fenestrations (ventilation, window size, shading devices)
   - surface finishes (texture, colour)
   - thermal insulation
   -roof (pitch, materials)

c. Appliances in use; (not a factor in this study)
   - lighting,
   - cooling
   - heating
   - others.

The selection criteria for the buildings are;
Residential (either public or private)
Flats/Apartment typology
Either bungalow, semi-detached or row houses
Made of conventional and not traditional materials of mud, thatch/wood or stones
No age limit, but not of colonial architecture.
RESULTS AND DISCUSSION

The data obtained from the qualitative study are two fold - interview and case study results respectively.

The results obtained from the interview were categorized into meaningful themes and further coded accordingly as either ‘favourable as 1’ or ‘unfavourable as 2’ (see table 1a). This is necessary in order to set up a numerical scale for observations as suggested by Sekaran (2005) in a process referred to as content analysis. This further led to a creation of interval-like data on a numerical scale that can be submitted for analysis. Thus, the use of the favourable responses’ scale of 1- 5 in consideration of subjects/responses count as shown in table 1b. The essence is to provide the data for appropriate analysis as in tables 1b, 2b and 3b respectively.

Table 1a: Stakeholders Interview Transcript Themes/Response Categorization and Coding

<table>
<thead>
<tr>
<th>SN.</th>
<th>THEMES</th>
<th>RESPONSE CATEGORIZATION/CODING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Architects</td>
</tr>
<tr>
<td>1.</td>
<td>Practice Experience</td>
<td>1 1 1 1 1 1 1 1 1 1</td>
</tr>
<tr>
<td>2.</td>
<td>Professional Registration</td>
<td>1 1 1 1 1 1 1 1 1 1</td>
</tr>
<tr>
<td>3.</td>
<td>Concern for Energy Efficiency</td>
<td>1 1 1 1 1 1 1 1 1 1</td>
</tr>
<tr>
<td>4.</td>
<td>Influence of Energy Efficiency on Practice</td>
<td>1 1 1 2 2 2 1 1 2 2</td>
</tr>
<tr>
<td>5.</td>
<td>Consideration of Energy Efficiency in Design Practice</td>
<td>2 2 1 2 1 2 1 2 2 1</td>
</tr>
<tr>
<td>6.</td>
<td>Public (clients’) Challenge on Energy Efficiency Practice</td>
<td>2 2 1 2 2 2 2 1 2 2</td>
</tr>
<tr>
<td>7.</td>
<td>Availability of Guidelines/Regulations on Energy Efficiency Practice</td>
<td>2 2 2 2 2 2 2 2 2 2</td>
</tr>
<tr>
<td>8.</td>
<td>Update on Energy Efficiency Issues</td>
<td>2 2 2 1 1 2 1 1 2 1</td>
</tr>
<tr>
<td>9.</td>
<td>Level of Concern by Professional Bodies</td>
<td>2 2 1 2 1 1 1 2 2 2</td>
</tr>
<tr>
<td>10.</td>
<td>Level of Concern by Government</td>
<td>2 1 2 2 1 2 2 2 2 2</td>
</tr>
</tbody>
</table>

The categories A, B, C and D above indicate the persons interviewed in respect of Architects, Engineers and Builders.

Although, there is a satisfactory level of ‘concern for energy conservation,’ the level of awareness of a majority of stakeholders on energy efficiency is neutral (low); and consequently, energy efficiency consideration in practice is dampened. One factor responsible is that there are no avenues for skill enhancement or training on energy efficiency like seminars/workshops/conferences. And even when these are skeletally and periodically provided, there are no motivations/regulations for attendance. The
summary of the interview result has indicated only 3 counts out of 10 in the range of ‘satisfactory’ and ‘very satisfactory’, while the remaining 7 counts are within ‘neutral’ to ‘very unsatisfactory’ (i.e. 30% efficiency record).

Table 1b: Stakeholders Interview Themes Response Categorization based on frequency on 1 – 5 scale

<table>
<thead>
<tr>
<th>SN</th>
<th>THEMES</th>
<th>RESPONSE CATEGORIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Very</td>
</tr>
<tr>
<td>1.</td>
<td>Practice Experience</td>
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</tr>
<tr>
<td></td>
<td>Professional Registration</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Concern for Energy Conservation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Influence of Energy Efficiency Awareness on Practice</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Energy Efficiency in Design Practice</td>
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</tr>
<tr>
<td></td>
<td>Public (clients’)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Challenge on Energy Efficiency Practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Availability of Guidelines/Regulations on Energy Efficiency Practice</td>
<td></td>
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<tr>
<td>5.</td>
<td>Update on Energy Efficiency Issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level of Concern by Professional Bodies</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Level of Concern by Government</td>
<td></td>
</tr>
</tbody>
</table>

Results obtained from the inventory study (case study) as shown in tables 2 (a and b), 3 (a and b) has indicated ‘satisfactory’ and ‘very satisfactory’ outcome on design elements of building typology, building orientation, the building paved area, window size/openability, daylighting, cross ventilation; while the building aspects of planform, functional distribution, shading from trees/structures, placing of windows against solar radiation, plant landscaping, ratio of built-form to open spaces, incorporation of water bodies, shading devices, etc. were found to be in the range of ‘neutral,’ ‘unsatisfactory’ and ‘very unsatisfactory’ on a 5-point scale (see tables 2b and 3b respectively). This is not encouraging as any result in the range of ‘neutral’ to ‘very unsatisfactory’ is not favourable to accomplishing energy efficiency. In fact, the overall result obtained indicates some varying levels of adequacies and inadequacies in design practice with respect to energy efficiency.
The summary of the case study result has indicated 13 counts out of 24 in the range of ‘satisfactory’ and ‘very satisfactory,’ while the remaining 11 counts are within ‘neutral’ to ‘very unsatisfactory’ (i.e. 54% efficiency record). This score is still below the expected 60-80% efficiency consideration level; hence a low level of energy efficiency design practice in Bauchi.

<table>
<thead>
<tr>
<th>Building Site</th>
<th>Shading from Buildings/Trees</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>1</th>
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<tbody>
<tr>
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<tr>
<td></td>
<td>Ratio of Built-form to Open Spaces</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<td></td>
<td>Water Bodies around and within the Site</td>
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<td>Compact/ Open-form</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</table>

Table 2b: House Evaluation/Categorization based on frequency -using scale: 1-5

<table>
<thead>
<tr>
<th>SN</th>
<th>THEMES</th>
<th>RESPONSE CATEGORIZATION</th>
<th>Very Unsatisfactory</th>
<th>Unsatisfactory</th>
<th>Neutral</th>
<th>Satisfactory</th>
<th>Very Satisfactory</th>
</tr>
</thead>
<tbody>
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<td>Ratio of Built-form</td>
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<td></td>
<td>to Open Spaces</td>
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<td></td>
<td>Water Bodies around</td>
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<td>and within the Site</td>
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<tr>
<td>2</td>
<td>Building Typology</td>
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<td>3</td>
<td>Plan Form</td>
<td>X</td>
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<td>4</td>
<td>Building Orientation</td>
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<td>Functional Distribution</td>
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<td>6</td>
<td>Plant Landscaping</td>
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</tr>
</tbody>
</table>

Very unsatisfactory | Neutral | Very satisfactory
1 2 3 4 5 6 7 8 9 10 11
12 Unsatisfactory Satisfactory

Scale: 1-5 (for 12 households in six clusters)
Apparently, most of the shortcomings in design practice are occasioned by the lack of appropriate policies/guidelines to regulate the application of energy efficiency principles in housing design practice. After all, there are no concrete or defined channels to update stakeholders on the general and global challenges of energy efficiency. On this account, it can be generally inferred that energy efficiency consideration in housing design practice is currently on a low level (i.e. 30% for interview and 54% for case study) in Bauchi, Nigeria as stakeholders are not conversant with the precepts of engagement in energy efficiency design practice.

**CONCLUSION**

Going by the objective of study (i.e. to determine the level of EE housing design practice in Bauchi), the overall result has shown that energy efficiency housing design practice is on a low level in Bauchi, Nigeria. The finding has obviously depicted the outstanding challenges of energy efficiency in the housing sector. It is evident from the forgoing that the existing residential buildings are energy-inefficient, and are the direct product/result of inadequate EE housing design practice in Nigeria. Paramount among the looming challenges are; the rising building energy consumption, the lack of adequate attention to energy matters by the government, the inadequate capacity building of relevant stakeholders in building energy efficiency, the enormous task of promoting building energy efficiency among the public; and the lack of technology and management needed for promoting the application of renewable energy in building energy efficiency. Attempts at addressing the notable challenges require a strategic scheme to stipulate regulations on basic design guidelines to facilitate good energy efficiency housing design practice, and should be safeguarded with appropriate practice codes. In addition, a research and development scheme should be put in place.
to embrace developing technologies, techniques and tools for making residential buildings more energy-efficient, productive and affordable. This should include conservation technologies and practices in the built environment. Further to this, the professional bodies must uphold adequate capacity building of personnel through seminars, workshops, conferences and design competitions to rejuvenate energy efficiency practice culture; and also to keep practitioners abreast in new trends. Ethical issues of professional practice should be addressed with energy efficiency undertone so as to inculcate an enduring culture of energy conservation and environmental sustainability.

Very unsatisfactory  Neutral  Very satisfactory

Table 3b: House Evaluation/Categorization based on frequency

<table>
<thead>
<tr>
<th>RESPONSE CATEGORIZATION</th>
<th>Very Unsatisfactory</th>
<th>Unsatisfactory</th>
<th>Neutral</th>
<th>Satisfactory</th>
<th>Very Satisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING ENVELOPE THEMES</td>
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<td></td>
</tr>
<tr>
<td>1. External Walls</td>
<td>Openings Protection</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wall Overhanging Eaves</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Light-coloured Surfaces</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smooth/Reflective External Walls</td>
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<tr>
<td></td>
<td>Thicker External Walls (especially on the east-west side)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Thermal Insulation on external walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Window Sizes</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows Openability</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross-ventilation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fenestra tions</td>
<td>Windows Placement Against Solar Radiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shading Devices Provided Where Necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daylighting Provision</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roof Overhangs Where Necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Roof</td>
<td>Roof Insulation System /Reflective Roof Surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roof Vents Provided</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skylighting Provided</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 2 3 4 5 6 7 8 9 10 11 12

Unsatisfactory Satisfactory

Scale: 1-5 (for 12 households in six clusters)

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CAUSES OF MATERIALS WASTE ON CONSTRUCTION SITES IN GHANA

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Construction site waste management has become an important issue in the construction industry given the need for sustainability in construction. Despite its importance, in the Ghanaian construction industry, contractors do not give much attention to managing site waste. This research investigates the causes of material wastage on construction sites in Ghana by the use of a questionnaire survey involving contractors. The findings reveal that the wrong dimensions, wrong orders, multiple handling, and inaccurate cutting are the most significant causes of material waste arising from design, material procurement, material handling, and operational activities respectively. These findings should help provide some stimuli for contractors in Ghana to devise robust measures to reduce materials waste on site. Designers also ought to be mindful of the dimensions they provide in drawings and specifications.

Keywords: construction waste, Ghana.

INTRODUCTION

Construction waste reduction at all stages of the construction process is a major concern in the construction industry because of the strive to improve performance in terms of cost, quality and sustainability. According to Garas (2001), contractors perceive that where there is waste it can be sold to waste dealers thereby giving value to it rather than classifying it as valueless. Even though material loss may be inevitable, where it reaches unacceptable levels it can lead to increased cost to both clients and contractors.

According to the UK Green Building Council (2013), construction and demolition are the largest contributors of waste (in the UK), responsible for generating about 30% of all waste. It is estimated that materials contribute between 50-65% of the total cost of a building (see Wahab and Lawal, 2011). Clearly, materials waste can therefore have a significant effect on a contractor’s profit (Trigunarsyah, 2007). Construction waste can contribute to increased cost in terms of cost of disposal, cost of waste transportation and cost of materials replacement. Although there are recommended levels of waste for various materials, materials waste can be much higher than the recommended levels (Ekanayake and Ofori, 2000). If the significant causes of materials waste are identified, minimisation measures can then be implemented early to curb waste and hence avoid extra cost and loss of profits. Professionals in the

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industry are thus trying their best to come up with waste minimisation measures (Poon et al., 2004a)

Whilst there are several published studies on construction waste, in the main they are based on the context of developed countries (see Lingard et al., 1997, 2001; Hao et al., 2008; Domingo et al., 2009; Price, 2010; Bon-Gang et al. 2011). In developing contexts such as the Ghanaian construction industry, very limited published work exists. Among the very few studies which focus on the Ghanaian construction industry are the research by Agyekum et al. (2012) and Ayarkwa et al. (2011). Both studies reported on consultants’ perceptions of materials waste reduction measures. They assessed the level of contribution of a number of waste reduction measures to waste reduction, and also the extent to which the measures are practised. Whilst such works are important, it is also important to primarily investigate the significant causes of materials waste so that waste reduction measures can be properly developed and well aligned to deal with the problem of materials waste.

This research therefore investigates the causes of materials waste on construction sites in Ghana. The study commences by highlighting the causes and sources of construction waste as reported in the construction literature. This is followed by the research method employed for the study, the findings and their discussion, and the concluding remarks.

**SOURCES AND CAUSES OF CONSTRUCTION WASTE**

Whilst many definitions have been used for construction waste (see Ferguson, 1995; Building Research Establishment (BRE), 2005) a common feature of several definitions is that construction waste is a by-product or unwanted material generated from the construction process. Construction waste can be classified into direct and indirect material waste (see Urio and Brent, 2006). According to Urio and Brent (2006), direct waste includes waste due to substitution, production waste, operational waste and negligence. Indirect waste includes waste arising from site storage, internal site transit, conversion, management, criminal activity, fixing and application (Urio and Brent, 2006). According to Gavilan and Bernold (1994) waste is categorised into design, procurement, material handling, operation, residual and others such as theft. Ekanayake and Ofori (2000) also identified four major sources of waste as design, operational, material handling and procurement. According to Bossink and Brouwers (1996), there are several causes of construction waste contributed by six sources and these are as shown in Table 1. Due to inadequate material control on project sites to mitigate these causes large volumes of materials are wasted (Formoso et al., 1999; Poon et al., 2004a; Hoe et al., 2006). Once materials are controlled very well on site, waste can be minimised. However, robust waste control measures can only be developed and implemented if the causes of waste are identified and well understood (Hoe et al., 2006).

Whilst several sources and causes of onsite materials waste have been reported in the literature, it is unclear from the literature the extent to which they apply to project sites in the Ghanaian construction industry. As such insight is key in order for Ghanaian contractors to implement robust waste reduction measures, this study investigates the significant causes of materials waste with a focus on the construction industry of Ghana. The following sections now present the empirical aspect of the study.
Table 1: Sources and causes of construction waste (Bossink and Brouwers, 1996)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>CAUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Error in contract document.</td>
</tr>
<tr>
<td></td>
<td>Incomplete contract documents.</td>
</tr>
<tr>
<td></td>
<td>Changes to design.</td>
</tr>
<tr>
<td></td>
<td>Choices about specifications of products.</td>
</tr>
<tr>
<td></td>
<td>Choices of low quality to sizes of used products.</td>
</tr>
<tr>
<td></td>
<td>Designer being unfamiliar with possibilities of different products.</td>
</tr>
<tr>
<td></td>
<td>Lack of influence of contractors and lack of knowledge about construction.</td>
</tr>
<tr>
<td>Procurement</td>
<td>Ordering error, over ordering, and under ordering.</td>
</tr>
<tr>
<td></td>
<td>Lack of possibilities to order small quantities.</td>
</tr>
<tr>
<td></td>
<td>Use of products that do not fit.</td>
</tr>
<tr>
<td>Material Handling</td>
<td>Damage during transportation to site/on site.</td>
</tr>
<tr>
<td></td>
<td>Inappropriate storage leading to damage or deterioration.</td>
</tr>
<tr>
<td></td>
<td>Unpacked supply.</td>
</tr>
<tr>
<td></td>
<td>Throwaway packaging.</td>
</tr>
<tr>
<td>Operational</td>
<td>Error by tradesmen or operatives.</td>
</tr>
<tr>
<td></td>
<td>Equipment malfunction.</td>
</tr>
<tr>
<td></td>
<td>Inclement weather.</td>
</tr>
<tr>
<td></td>
<td>Accidents</td>
</tr>
<tr>
<td></td>
<td>Damage caused by subsequent trades.</td>
</tr>
<tr>
<td></td>
<td>Use of incorrect material</td>
</tr>
<tr>
<td></td>
<td>Required quantity of product unknown due to improper planning.</td>
</tr>
<tr>
<td></td>
<td>Late onsite arrival of information about types and sizes of products.</td>
</tr>
<tr>
<td>Residual</td>
<td>Off cuts from cutting material to length.</td>
</tr>
<tr>
<td></td>
<td>Over mixing of materials for wet trades due to a lack of knowledge of requirements.</td>
</tr>
<tr>
<td></td>
<td>Waste from application process.</td>
</tr>
<tr>
<td></td>
<td>Packaging.</td>
</tr>
<tr>
<td>Others</td>
<td>Criminal waste due to damage or theft.</td>
</tr>
<tr>
<td></td>
<td>Lack of onsite materials control.</td>
</tr>
</tbody>
</table>

**RESEARCH METHOD**

A quantitative research strategy, in particular a questionnaire survey, was used as this approach is useful in obtaining a ‘snapshot’ or generic view of a phenomenon, which in the case of this research is causes of material waste on construction sites in Ghana (Fellows and Lui, 2008). Drawing on the literature on the sources and causes of material wastage a questionnaire was developed. The questionnaire was limited to the four major sources of waste (i.e. design, operational, material handling and procurement) as reported in Ekanayake and Ofori (2000).
In Ghana, there are over 1,350 contractors operating across the 10 regions (see Kheni, 2008). Due to limited resources, the survey was restricted to contractors operating in the Greater Accra Region which is the home of the national capital city and as such has the highest level of construction activity. Again due to resource constraints, the survey covered 35 contractors randomly selected from a list of contractors registered with Ghana’s Ministry of Water Resources, Works and Housing. Given the limited number of contractors, it was important to achieve a good response rate. To ensure that a 100% response rate was achieved the questionnaires were hand delivered. Whilst this was a laborious process, it eventually paid off as all the contractors responded.

The contractors fall under three classifications of Ghana’s Ministry of Water Resources, Works and Housing contractor classification which is based on contractor size (i.e. $D_1 K_1$, $D_2 K_2$, $D_3 K_3$, with $D_1 K_1$ contractors being the largest). The contractor sizes a based on the range of value of works a contractor is permitted to undertaken. The questionnaire was completed by project engineers, project managers, quantity surveyors, and site supervisors.

The respondents were asked to rate various causes of waste on site (derived from the literature) on a scale of 1 to 5 based on their significance. The interpretation of the scale ratings are: 5 - major/most significant cause, 4 - significant cause, 3 – neutral/no response, 2 - insignificant cause, and 1 - not a cause of waste.

The demographic data on the respondents were analysed using frequencies. Mean score (MS) and relative importance index (RII) were used to analyse the data on the causes of wastage. The RII technique has also been used in a number of construction management surveys (see Chan and Au 2009; Park 2009; Newton and Chileshe, 2012).

Relative importance index, $RII$ is computed as;

$$RII = \frac{\sum W}{AN}$$

Where $w$ is the weighting given to each factor by the respondents ranging from 1 to 5, $A$ is the highest weight (i.e 5 in the study) and $N$ is the total number of Samples

The indices were then ranked to determine the most significant causes of waste.

**FINDINGS AND DISCUSSION**

The demographic information on the participating contractors and also the responding professionals within the contractors’ organisations are given in Table 2 and 3. Table 2 shows that majority of the contractors (i.e. 85.7%) are $D_2 K_2$ and $D_3 K_3$. These groups of contractors are considered to be small and medium-sized (SME) contractors (Eyiah and Cooke, 2003). This implies that the findings may be more of a reflection of the views of SME contractors. Table 3 also shows that majority of the responding practitioners are site engineers. More importantly, Table 3 shows that a large portion (over 70%) of the respondents are personnel who are usually site-based (i.e. project engineers, site managers, quantity surveyors, and site supervisors).
engineers, project managers, and site engineers) and therefore are well placed to provide credible information on issues relating to site waste. The findings (i.e. the aggregated responses) resulting from the individual responses can therefore be taken as being a credible representation of the on-site causes of materials waste.

Table 2: Participating Contractors

<table>
<thead>
<tr>
<th>Contractor Classification</th>
<th>Number participants</th>
<th>Percentage of response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D₁K₁</td>
<td>5</td>
<td>14.3</td>
</tr>
<tr>
<td>D₂K₂</td>
<td>23</td>
<td>65.7</td>
</tr>
<tr>
<td>D₃K₃</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Positions of respondents

<table>
<thead>
<tr>
<th>Position</th>
<th>Number of Respondents</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Engineers</td>
<td>10</td>
<td>28.5</td>
</tr>
<tr>
<td>Project Managers</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Quantity Surveyors</td>
<td>8</td>
<td>22.9</td>
</tr>
<tr>
<td>Site Engineers</td>
<td>15</td>
<td>42.9</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4: Causes of wastage through design

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>MS</th>
<th>RII</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong dimensions</td>
<td>4.31</td>
<td>0.86</td>
<td>1</td>
</tr>
<tr>
<td>Changes in design</td>
<td>3.72</td>
<td>0.74</td>
<td>2</td>
</tr>
<tr>
<td>Lack of knowledge in construction processes by designers</td>
<td>2.17</td>
<td>0.43</td>
<td>3</td>
</tr>
<tr>
<td>Complex detailing</td>
<td>2.14</td>
<td>0.43</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5: Causes of wastage through procurement

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>MS</th>
<th>RII</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong Orders</td>
<td>4.80</td>
<td>0.96</td>
<td>1</td>
</tr>
<tr>
<td>Low quality materials</td>
<td>4.73</td>
<td>0.95</td>
<td>2</td>
</tr>
<tr>
<td>Theft and vandalism</td>
<td>4.31</td>
<td>0.86</td>
<td>3</td>
</tr>
<tr>
<td>Materials damaged on site</td>
<td>3.31</td>
<td>0.66</td>
<td>4</td>
</tr>
<tr>
<td>Availability of only bulk orders</td>
<td>2.03</td>
<td>0.41</td>
<td>5</td>
</tr>
</tbody>
</table>

Tables 4 – 7 show the summary of results from the analysis of the causes of waste. From the Tables, it can be seen that all the MS are above 2 implying that none of the factors is considered “not a cause of waste”. The findings are therefore generally in accordance with the sources and causes of waste reported in the literature (e.g. Bossnik and Brouwers, 1996). The results also show that the most significant causes
of waste from each of the four sources are: wrong dimensions (MS = 4.31; RII = 0.86), from design; wrong orders (MS = 4.80; RII = 0.96), from procurement; multiple handling on site (MS = 4.46; RII = 0.89), from material handling; and inaccurate cutting of materials by operatives (MS = 4.86; RII = 0.97), from operations. These are further discussed below.

Wrong Dimension
Specifying wrong dimensions is the most significant cause of material waste arising from design. In some respect, this finding is corroborated by the study by Domingo et al. (2009). In this study, all the respondents (including client representatives, designers and contractors) indicated incorrect drawing details as a relevant cause of construction waste which arise from design in health care infrastructure construction.

Table 6: Causes of wastage through material handling

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>MS</th>
<th>RII</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple handling on site</td>
<td>4.46</td>
<td>0.89</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate storage facilities</td>
<td>3.89</td>
<td>0.78</td>
<td>2</td>
</tr>
<tr>
<td>Wrong packaging</td>
<td>3.46</td>
<td>0.69</td>
<td>3</td>
</tr>
<tr>
<td>Damage during transportation</td>
<td>3.37</td>
<td>0.67</td>
<td>4</td>
</tr>
</tbody>
</table>

Wrong Orders
Wrong orders of materials are the most significant cause of material waste arising from procurement. Materials that are delivered to site are sometimes ordered with the wrong specifications and thus creating the need to purchase new materials. The wrongly ordered materials could become waste on a project especially when they cannot be returned or used for some other works on the project. This finding is supported by the study by Nagapan et al. (2011). Through a critical review of studies on causes of construction, Nagapan et al. (2011) identified ordering errors as the most frequently reported cause of waste arising from procurement.

Multiple Handling of Site
This is ranked the most significant cause of material waste on site arising from materials handling. This finding is also corroborated by the review by Nagapan et al. (2011) in which they found that poor material handling is the second most frequently reported cause of waste arising from handling. Wrong material storage emerged as the most frequently reported cause due to handling.
Inaccurate Cutting of Materials

This is ranked the most significant cause of material waste arising from on-site operational activities. Materials such as timber, steel reinforcement bars, tiles, and pipes are often cut such that the remaining ones cannot be used again and thereby becoming waste. In a study by Poon et al. (2004b), it was found that cutting of materials was the greatest contributor of waste from tiles, bricks/blocks, light weight concrete, and steel reinforcement bars. Given that these materials are commonly used in construction (including construction in Ghana), it is not surprising that inaccurate cutting of materials is ranked the most significant cause of material waste arising from operational activities.

CONCLUSION

Whilst a number of causes of materials waste have been reported in the literature, it is now evident that in the context of the Ghanaian construction industry the significant causes of waste are arising from design, procurement, material handling, and on-site operational activities are: wrong dimensions, wrong orders, multiple handling on site, and inaccurate cutting of materials respectively. Contractors therefore ought to place more attention on these significant causes, in particular the ones arising from procurement, material handling, and on-site operational activities. Designer also ought to ensure that accurate dimensions are given in drawings and specifications.

The study however has some limitations which deserve recognition. Firstly, due to the limited number of participants, the findings cannot be taken as representing the views of all construction organisations in the Ghanaian construction industry. Also, it is important to highlight that as majority of the respondents were from SMEs, the findings (in particular the causes of waste relating to procurement, materials handling, and operations) may be more applicable to SME contractors than their large counterparts.

REFERENCES


The District Assemblies of local Authorities in Ghana are mandated to exercise considerable responsibility towards providing the needed infrastructure in their area of jurisdiction. In the exercise of this mandate the District Assemblies engage in construction contract administration using “in-house” personnel as against employing external contract administration firms. Such contracts administered could face challenges. The aim of this paper is to carry out detailed examination of the contract administration procedures of some of the District Assemblies in Ghana to find out the challenges faced by the in-house personnel that administer such contracts. In addition to desk based and exploratory study to find out and examine the nature of contract administration at the District Assemblies level, structured questionnaires and face to face interviews were used to carry out a case study of three District Assemblies in the Ashanti Region in order to identify challenges faced in the contract administration process. It was discovered from the survey that pertinent challenges militate against effective contract administration at the district level by the “in-house” actors. Inadequate contract monitoring logistics was determined as the major challenge facing the district assemblies’ in-house actors in the administration of contracts.

Keywords: challenges, contract administration, district assemblies, Ghana, in-house personnel

INTRODUCTION

In many ways, the pace of economic growth of any nation can be measured by the development of physical infrastructure, such as buildings, roads and bridges (Takim and Akintoye, 2002). The district assemblies' concept of local governance, as practiced in Ghana is to ensure that national infrastructure development is decentralized to enhance quick economic growth. To achieve this, authority of decision making is delegated to the district assemblies and local communities to make development more responsive to local needs for greater commitment and participation (Nsiah-Gyabaah, 1997). According to the Public Procurement Act, 2003 (Act 663) this delegation of power includes construction contract administration. Most of the district assemblies administer contracts for such developmental projects through the use of their in-house personnel as against contract administrators outsourced. However such contracts have been reported to have been bedevilled with poor performance (Mensah et. al, 2011). Furthermore, contracts for both works and consultancy services take very lengthy periods to complete and are subject to unnecessary delays [Badu et al, 2012; Crown Agents, 1998; Westring, 1997]. It is
believed that there could be some challenges facing the administration of such contracts by the in-house personnel at the district assemblies. The capacity of human resources at the decentralized organizations is also reported to be a matter worth researching (Antwi and Analoui, 2008). This study therefore basically seeks to look at challenges facing district assemblies’ in-house-administered construction contracts. Three District Assemblies in the Ashanti region of Ghana have been selected to be case-studied. The in-house personnel, whose contract administration activities form the focus of this study, are the government officials employed as permanent workers at the assemblies who are entrusted with the responsibility of administering construction contracts without the involvement of external project consultants.

This paper is organized as follows. The next section reviews literature pertaining to the challenges faced in construction contracts administration, followed by the description of methods employed to execute the research. The results obtained from the interview and survey of the selected cases, are explained next before challenges faced in administration of district assemblies construction contract are discussed. As a result, recommended steps for overcoming the identified challenges are discussed in the conclusion of the paper.

**Understanding construction contract administration**

Chong et al. al. (2011) explains that construction contracts are written agreements signed by the contracting parties, which bind them, defining relationships and obligations in a particular project. Contract administration, on the other hand, is a process of administrating a business or matter that governed the contracting parties' interests. In the construction industry, it revolves around the pre-construction stage, construction stage, and post-construction stage. In like manner, the subject matter of contract administration is divided into two broad stages, namely, pre-contract stage and post-contract. At the pre-contract stage the consultant(s) is normally the only party to have been employed by the client (employer). The main activity carried out by the consultant at this stage includes preparation of contract documentation and management of the tendering process. Upon signing of the contract there emerge three main visible parties, viz. client, consultant and contractor. The poor performance of each party could have an adverse effect on the realization of a smooth execution of construction works, which may further result in escalation of project cost, delays in the completion of the project, shoddy works and at times suspension and determination of the contract.

According to Garret (2007) a construction contract is an agreement between the client and the contractor, which details their legal requirements and obligations. Effective contract administration process helps to ensure that project’s goals and needs are on track and on schedule and the seller is behaving appropriately. In order to ensure this, the project manager prepares appropriate plans and the needed contract documentation to ensure that work is properly completed on time, on budget, and meets contractual requirements. Such planning could include a Work Breakdown Structure (WBS), Organizational Breakdown Structure (OBS), Responsibility Assignment Matrix (RAM), and an earned value management system (EVMS.) Other contract documentation includes the contract schedules, requested unapproved contract changes, approved change requests, any contractor-developed technical documentation, and work performance information.
Nature of Contract Administration at the District Assemblies

The 1992 constitution of the Republic of Ghana establishes the districts assembly and mandates it to be the highest political entity in a district. Act 1993 (Act 462), section 4 (2), gives the assembly power for discharge of any of its functions to acquire and hold moveable or immovable property, to dispose such property and to enter any contract or other transaction. The National Development Planning (Systems) Act, 1994, (Act 480), Public Procurement Act 663 also mandates the Assembly to administer contract, especially construction contracts, in the District.

Construction contract administration involves managerial and technical activities performed by project professionals and supervisors after a contract has been awarded. The purpose is to ensure that the contractor performs to meet the requirements of the contract (Obo, 2010). The activities include contract signing, supervision of works, vetting of valuations and certificate preparation and resolution of disputes that may arise. In contract administration, the focus is on obtaining works and services, of requisite quality, on time, and within budget and technical specification to meet client satisfaction. While the legal requirements of the contract are determinative of the proper course of action of officials in administering a contract, the exercise of skill and judgment is often required in order to protect effectively the public interest (Obo, 2010).

At the beginning of contracts at the District Assemblies, pre-construction meetings include such functions as determining the authority of government personnel who will administer the contract, ensure quality control and testing, see to the delivery of specific contract requirements, determination of special contract provisions to be taken note of, determination of the procedures for monitoring and measuring performance and payment procedures. The assembly performs these functions through the Executive Committee chaired by the District Chief Executive and a network of sub-committees that collate and deliberate on issues relevant to the following functional areas:

- Economic Development planning
- Social Services
- Works
- Finance and Administration
- Justice and Security

Construction contract administration falls under the “Works” section. Below are personnel structures at the District Assembly as per the constitution, Acts 462 and National Development Planning (Systems) Act, 1994, (Act 480), Public Procurement Act 663 to carry out construction contract administration: District Chief Executive (DCE); District Coordinating Director (DCD); District Planning Officer District Budget Officer; District Works Engineers; District Tender Committee; District Tender Review Board; Works Sub Committee; and District Planning and Co-coordinating Unit. The above are responsible for monitoring and controlling construction contracts with or without the involvement of external consultants.

It is necessary for management and other stakeholders of projects to make regular monitoring of the execution process to ensure that desirable results are produced. Monitoring the implementation of physical projects at the district level is done by visiting construction sites to supervise and direct workers as well as note and report...
on the successes and lapses which are later reported for the attention and necessary action of the appropriate authority. It takes the efforts of the District Assembly and its decentralized substructures in partnership with contractors, traditional authorities and individual people residing in the projects catchment areas to monitor and steer the implementation of the projects to desirable end.

There is usually evaluation task in the contract administration process and this involves inspection and passing judgment over work done in project implementation against pre-set standards. If judgment is positive then the project is considered complete and accepted. If the judgment is negative then the project is considered uncompleted and is rejected for work to be redone by the builder, which is the contractor.

**Challenges of Contract Administration in Ghana**

Contract challenges cannot be ignored as issues with the contract are a very common reason for claims that cost the construction industry millions of dollars per year (Sturgill and Vorster, 2006) due to unmet contractual obligations and expectations by the contracting parties. Project implementation has itself been characterised by extensive cost and time overruns and poor quality [World Bank, 1996; 2003]. The process for payment to contractors and suppliers is also long, involving over thirty steps from invoice to receipt of the payment cheque, and often over-centralized, thus leading to delays in project execution [Eyiah and Cook, 2003; Westring, 1997; World Bank, 2003]. Fiscal constraints and poor procurement practices and contract management could lead to difficulties in securing funding for construction projects. The qualification and management skills of personnel involved in managing such projects could also pose a threat to smooth running of the administration process. Given that construction industry has the potential of leading growth agenda of the economy it is very necessary to look into the challenges that are faced by “in-house” construction contract administration officers in executing contract administration duties in order to facilitate and strengthen growth of the Assemblies as well as the construction industry too. The main aim of the study is to identify the challenges facing construction administration process of construction contracts administered by the “in-house” personnel of the District Assemblies in Ghana.

Westring [1997] attributes the causes of the delays to extensive post-award negotiations, delays in the preparation of technical specifications and drawings, delays in evaluation, an extensive system of controls, reviews and approvals, and land ownership disputes. Badu et al., (2012) have also decried the failure of the traditional method of financing infrastructural projects in Ghana. Also, the parts played by each project team member in design and execution of the proposed development project are very critical to project success and poor participation of each team member may pose challenges to smooth project execution.

**RESEARCH METHODS**

The type of study embarked upon in this paper is case study. Case studies normally involve close and detailed examination of the subject of study. The general approach adopted was a triangulation of both quantitative and qualitative methodologies. Questionnaire was developed, based on the objectives of the study Naoum (1998), to capture both quantitative and qualitative data. In view of the fact that this is a case study a lot of details on the nature of contract administration structure and processes
at the district assemblies were considered in the design of the questionnaire such as to enhance the validity and reliability of the data (Omar 2009).

In view of the designated area of study, respondents were purposively selected for the administration of structured questionnaire. Thirty-two respondents participated in the answering of the questionnaire whilst 18 of them were involved in the face-to-face interview. The questionnaire served as a tool for collecting data on the kind of in-house personnel involved in the contract administration at the district level. Also, the challenges, which could pose as bottlenecks against smooth contract execution, faced on such projects that were investigated with the aid of the structured questionnaire and unstructured face-to-face interview. During the interview, peripheral comments were made to enhance discussion of the results obtained via the analysis. Respondents were made to select most important challenge from a list of challenges identified earlier. The analysis was carried out using simple descriptive statistics on the data that were quantitative in nature. This quantitative technique was necessary in order to determine the most important challenge. Further, cross tabulation of qualitative data, such as challenges that were listed by the respondents, which, in their opinion, raised barriers to smooth contract administration, was carried out to determine the emerging pattern.

Three district assemblies were chosen for the study in view of the high level of involvement of in-house personnel, for those particular districts, in the administration and execution of the construction projects in their area of jurisdiction. In order to obtain pertinent challenges that are recent, construction projects that were at the post contract stages during the past three years (2010, 2011 and 2012) were covered under study. In studying the nature of contract administration processes at the district levels relevant literature on the structure, mandate and developmental agenda of the district assemblies were closely examined. This was done in order to obtain adequate information on all personnel that could possibly be involved in the management of construction projects by virtue of being employed by the district assembly.

RESULTS AND DISCUSSIONS

Fig. 1 indicates the management structure adopted by the district assemblies for the administration of all construction projects. This confirms the stipulations given in Acts 462 and National Development Planning (Systems) Act, 1994, (Act 480).
Fig. 1 – Organizational structure for contract administration at the district assemblies: (Field survey, February, 2013)

The task of construction contract administration at the district assemblies was found to be pivoting around the District Works Engineer (DWE), who acts as the project coordinator. The main activities carried out include planning the scope of activities, ensuring quality standards, designing of and implementing monitoring plans, collating and summarizing the findings of monitoring exercises as well as reporting on progress/status. From the interview, it was found out that the DWE is referred to as the projects manager on some contracts. The educational background of all the District Engineers at all the case study areas was identified to be up to a Higher Diploma Status in the areas of Building Technology and Civil Engineering.

It was realized that the educational qualification of most of the “district engineers” who reportedly play a pivotal role in contract administration at the district assemblies does not give them the full capacity and skills required of a qualified project manager or project engineer.

**Identified challenges of the contract administration process:**

Table 1 – Common challenges facing district assemblies contract administration process

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Importance Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate monitoring logistics</td>
<td>0.78</td>
</tr>
<tr>
<td>Lack of office accommodation</td>
<td>0.28</td>
</tr>
<tr>
<td>Inadequate funding</td>
<td>0.83</td>
</tr>
<tr>
<td>Inadequate staff</td>
<td>0.72</td>
</tr>
<tr>
<td>Low skills of staff</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Table 1 outlines the common contract administration challenges identified as barriers to contract administration process for contracts overlooked by the in-house personnel of the district assemblies. In all the three district assemblies comprising the case study areas 36 respondents were made to rank the importance of the challenges that had been gleaned from interviews held. Inadequate funding and inadequate project monitoring logistics for the execution of projects emerged as the most important challenges hampering the smooth administration of contracts. The lack of skills of personnel managing was ranked the least important of all the challenges. This implies that the in-house personnel believe in their competence in contract administration and project management. However, from the interviews many of the technical personnel accepted that they require more training to enable them manage projects more effectively. This result is not surprising since human beings find it difficult to accept shortcomings when given the chance to assess themselves.

**Participation levels of in-house personnel in contract administration**

It is expected of the DWE, who acts as the “in-house” project coordinator, to integrate all concerned persons in the contract administration process. He or she is to ensure that all individuals and groups involved should have total commitment and loyalty to the “project” (Harrison, 1999:21)

In the light of this thought, the study investigated the extent of involvement of concerned individuals in various contract administrations of project functions at the
The functions of contract administration in the implementation of projects are as listed in Table 2. The results indicate that all the personnel and committee members given in Fig. 1 are involved in carrying out all the functions meant for managing projects at the district assembly. It is expected that the level of participation oversaturates the function performance required on the contract administration train and this could dilute the quality of contract administration output required.

Table 2 – Typical contract administration functions performed

| Planning of the implementation process |
| Monitoring the implementation process |
| Evaluation of the implementation |
| Checking time of implementation |
| Checking cost of implementation |
| Checking quality of implementation |

Table 3 also indicates external challenges/factors, as noted from the interviews, which pose barriers to carrying out effective contract administration. Some of the challenges were described by interviewees as external and therefore beyond the control of the assemblies.

CONCLUSION

Considerable construction projects at the district assemblies, where local governance is carried out, are administered by in-house personnel as against having external firm as contract administrators on some other projects of the assemblies. It was found out that there is a contract monitoring structure is put in place to enable the in-house
personnel administer construction projects. The ‘District Works Engineer’ (DWE), who is considered as the technical person in charge of the assemblies’ works, performs the role of the project coordinator for the administration of a construction contract. The major challenge that militates against smooth contract administration by the in-house personnel was found to be inadequate monitoring logistics for the execution of the contracts. Low level of skills in administering the contracts was found to be the least important challenge from the perspective of the in-house personnel. Nonetheless, all interviewees admit that obtaining regular training in contract administration is necessary for further improvement of the contract administration function at the district assembly level especially on contracts where only in-house personnel are involved in the administration. Other challenges that were found to have external origin and were beyond the control of the district assemblies (i.e. environmental, political and economical) were also found as bottlenecks hampering the smooth execution of contracts. It is however important that, the in-house contract actors appreciate the influence of these external challenges and put predetermined measures in place to minimize their negative impacts on the contract administration process.

Acknowledgement
The efforts of Eric Jimifoster Donkor\(^3\) in assisting in data collection cannot go unmentioned. His highly appreciated assistance has contributed to the timely completion of this study.

REFERENCES


\(^3\) Atwima Nwabiagya District Assembly, Nkawie, Ashanti Region, Ghana


CODES OF PRACTICE: PREREQUISITE FOR QUALITY STRUCTURAL DESIGN AND MANAGEMENT OF BUILDINGS IN NIGERIA

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The high incidence of collapse of buildings in Lagos state in particular, and the country, Nigeria in general, calls for the assessment of the whole construction industry and the codes of practice and standards being used in the country. The goal of the research work is to determine the influence of the usage of British Standards and Codes on the Nigerian construction industry generally and specifically on the strength of concrete. One partially collapsed building was studied. Cored cylindrical samples were taken from parts of the buildings that were yet to collapse and subjected to compressive strength tests. Also, five samples of sand were sourced from borrowed pits in Akure metropolis. From each sand sample, 10 cubes of concrete using mix ratio 1:2:4 by weight were casted and subjected to compressive strength tests. The results of the compressive strength test of the cylindrical specimens taken from parts of the building that were yet to collapse, showed that the characteristic strength of concrete used for the building is 8.2N/mm² as against the 20N/mm² recommended by the consultant structural engineer, in charge of the building. Furthermore, the results of cube tests conducted showed that the characteristic strengths of concrete cubes produced from the five samples of sand are between 11.23N/mm² and 18.54N/mm². Since the actual characteristic strengths from both the cylindrical tests and cube tests is less than the expected characteristic strength of 20N/mm² for concrete of mix ratio 1:2:4 based on CP114 (1957), which had long been superseded newer versions, the structural integrity of structure built from such concrete would have been compromised, and liable to collapse. Research work should be focused on concrete mix design methods using locally available aggregates.

Keywords: collapse, building, codes of practice, standards, concrete.

INTRODUCTION
Codes of practice or standards are set of guidelines for the production of certain works, prepared by professionals and approved by the relevant government agencies. Currently, British Standards are being used in Nigeria. This is basically wrong, as the environments for which these Standards are developed are quite different from what obtains in Nigeria. Despite this, the British Standards are being used in the country without any modification to make it compatible with the local environment and the available local materials. This lack of indigenous code of practice affects, negatively our building industry, especially as it concerns concrete production. Apart from the fact that it is illogical to use directly, without any modification, the British Standards are not readily available and are expensive.

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Concrete is essentially stone and as such, has the same basic properties as stone. Its great advantage is that as a man-made material, it can be poured into moulds of any shape where it sets, thus removing the necessity to form the material by carving, as is the case with stone (Narayanan and Beely, 2001). A further advantage is that its properties may be tailored to a considerable degree to meet different situations (Fullerton, 1979).

The basic ingredients of concrete are: gravel (usually stone in the range of 5-20mm), sand, cement and water (Neville and Brooks, 1993). The cement is the only industrially produced ingredient and is used in relatively small quantities compared with the sand and gravel (typically about 15% by weight of the concrete). This makes concrete a cheap construction material compared with steel ((Narayanan and Beely, 2001). However, the quality of concrete produced depends on the quality of its constituent materials and their mix ratios, the higher the percentage of clay/silt content of sand, the lower the characteristic strength (Olanitori and Olotuah, 2005). In order to mitigate the effect of clay/silt content of sand on the strength of concrete produced from it, there is need to increase the cement content of the concrete, depending on the clay/silt percentage (Olanitori, 2006). Olanitori (2012) determined the cost implication of mitigating the effect of clay/silt content of sand using mathematical models. The causes of collapse of building in Nigeria can be due to lack of quality control and good supervision during construction. For example, the provision of inadequate anchorage length of both tension and compression reinforcements, inadequate spacing of shear reinforcements as well as usage of low quality concrete for construction due to lack of proper supervision and good quality control measures might lead to collapse of building (Olanitori, 2011).

In the past few years a considerable improvement has taken place in the understanding of structural concrete and has been incorporated in the revised codes of practice. The British Standard CP110 (1972), has superseded the British Standard Codes of Practice CP114 (1957), for reinforced concrete. Similarly, in America the ACI Standard ACI 318-71 (1971) has replaced the previous standard ACI 318-63 (1963). The major aspects of the revised codes is the limit state approach for designing reinforced concrete structures and the separation of methods of concrete mix design procedures from that of concrete design considerations.

The British Code of Practice CP114 (1957) provided the use of one of the following two methods for the design of individual structural members i.e., beams, columns, slabs and walls etc.


Load factor method, indicated as ultimate strength method in ACI 318-63 (1963).

Apart from this, CP114 also makes provision for mix prescription method for concrete. In the code, concrete mix ratios 1:2:4, 1:1 1/2 : 3 and 1:1:2 are expected to have strengths of 21N/mm², 25.5N/mm² and 30N/mm² respectively at 28 days.

In CP110 (1972) and BS8110 (1985), this portion of CP114 (1957) that dealt with concrete mix prescription was expunged from the code and standard. This is to the superior knowledge that concrete produced from different types of sand but of same mix proportion will produce concrete with different strengths. With the publication of BS8110 in 1985, CP110 (1972) was withdrawn. The publication of CP110 and
BS8110 were accompanied with several BS standards which dealt with different aspects of concrete production.

In 1992, BS882 was published. This standard dealt with quality requirements for aggregates, while BS1881 gave guidelines for various tests that can be carried out on concrete. BS 5328-1, 1997 dealt with the guide for specifying concrete, while BS 5328-2 gives the methods for specifying concrete mixes.

BS5328-2 gives four methods of specifying concrete:

1. Designed mix - Mix for which the purchaser is responsible for specifying the required performance and the producer is responsible for selecting the mix proportions to produce the specified performance. The mix is specified by its required performance in terms of a grade, subject to any special requirements for materials, minimum or maximum cement content, maximum free water/cement ratio and any other properties. Strength testing forms an essential part of the assessment of conformity.

2. Prescribed mix - Mix for which the purchaser specifies the proportions of the constituent materials, their properties or qualities and is responsible for ensuring that these proportions produce a concrete with the required performance. The assessment of the mix proportions forms an essential part of the conformity requirements. Strength testing is not used to assess conformity. A prescribe mix should be specified only when there is reliable previous evidence or data, established from trial mixes, that with the materials and workmanship available the concrete produced will have the required strength, durability and other characteristics.

3. Standard mix - Mix selected from the restricted list given in section 4 of BS 5328: Part 2:1997 and made with restricted range of materials. The assessment of the mix proportions forms an essential part of the conformity requirements. Strength testing is not used to assess conformity. These mixes have been developed to give assurance that generally they will produce concrete of the required characteristic strengths except where there is poor control of production or where poor materials are used. Where strength is important, a designed mix should be specified and where the producer operates suitable quality assurance arrangements a designated mix should be specified. Standard mixes are applicable for the site batching of concrete for housing and similar construction. They should be specified only where the work or economy does not justify the application of mix design procedures, or enable work to start where there is insufficient time for the collection of data to support mix design proposals.

4. Designated mix - Mix produced in accordance with the specification given in section 5 of BS 5328: Part 2:1997 and requiring the producer to hold current product conformity certificate based on product testing and surveillance coupled with approval of the producer’s quality assurance system.

In the 1950’s, the construction industry was dominated by both foreign and indigenous consulting firms and construction companies and the British Standards were being used for both design and construction purposes. In 1954 The Federation of Building and Civil Engineering Contractors (now known as The Federation of Construction Industry in Nigeria) was incorporated. This body is an umbrella association for both local and foreign construction companies. In 1958, The society of Engineers was founded. The primary objective of the society is to promote the advancement of engineering education, research, and practice in all its ramifications.
However 55 years after the Nigerian Society of Engineers was founded, the Society failed to achieve their loft objective in the areas of engineering education and research, since the British Standards are still being used for both design and construction purposes in Nigeria. Till date, the Nigerian engineers continue to rely on the British Standards for design, concrete and construction works. Out of the four methods of specifying concrete, the prescribed method is the most popularly used by the Nigerian engineers, in which the expected concrete strength at 28 days is based on the provision of CP114 (1957), which has been superseded by many British Standards.

MATERIALS AND METHODS
The materials used for this study are structural detailing, portable rotary drilling machine. Fifteen samples of 75 mm diameter cores of concrete, five soil samples (sourced from five different borrowed pits), and a manually operated universal testing machine.

The client of the collapsed building was not willing to provide the architectural plan and structural detailing. Consequentially, as-built architectural plan and the structural detailing were produced from site inspection and by exposing the structural components such as slab, beams and columns. From the as-built structural detailing in conjunction with the as-built architectural plan, the reassessment of the structural integrity of the building was carried out. Results of the reassessment of structural elements for tension reinforcement are given in Table 1, whereas the summary of the results of the reassessment of the structural elements for anchorage length is presented in Table 2 and the summary of the reassessment of the beam for shear reinforcement is presented in Table 3.

Fifteen samples of 75 mm diameter cylindrical cores of concrete were taken from slabs, beams and columns. Five samples each were taken from each structural element. The cores were vertically and horizontally drilled with a portable rotary drilling equipment using water as the drilling fluid and diamond impregnated bit. The retrieved cores were taken to the laboratory for examination and tested for strength using universal testing machine in accordance with BS 1881-120 (1983). The result of the test is given in Table 4, while the characteristic strength is presented in Table 5.

In order to investigate the influence of the usage of method of concrete mix prescription according to CP114 (which is still widely used in Nigeria) on the strength of concrete that can be achieved using sand from Akure metropolis, five samples of sand were sourced from different borrowed pits. From each sand sample, 10 cubes of concrete using mix ratio 1:2:4 were casted and subjected to compressive tests. The results of the tests were presented in Table 6.

ANALYSIS AND DISCUSSION OF RESULTS
The results of the structural reassessment of the collapsed building are presented in Tables 1 to 3. Table 1 shows that the design of the structural elements for tension reinforcements (for slab and beam) and compression reinforcements (for column) is adequate and could not have been the cause of the collapse. However, Table 2 shows that the anchorage length provided for tension reinforcements is not adequate. An anchorage length of 75 mm was provided for slab, beam and column. However, anchorage length of 144 mm is required for slab, while 192mm anchorage length is required for both beam and column. Table 3 indicated that the stirrup spacing...
provided is inadequate. Spacing of the stirrups was provided at 300 mm instead of 250 mm.

Table 1: The summary of the results of the reassessment of the structural elements for area of tension reinforcement

<table>
<thead>
<tr>
<th>S/N</th>
<th>Member checked for area of reinforcement</th>
<th>Area of reinforcement provided ok</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slab (150 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Beams (250 mm × 400 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Columns (250 mm × 250 mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The summary of the results of the reassessment of the structural elements for anchorage length

<table>
<thead>
<tr>
<th>S/N</th>
<th>Member</th>
<th>Dia. of bars (mm)</th>
<th>Provided anchorage length (mm)</th>
<th>Required anchorage length (mm)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slab</td>
<td>12</td>
<td>75</td>
<td>144</td>
<td>Not ok</td>
</tr>
<tr>
<td>2</td>
<td>Beams</td>
<td>16</td>
<td>75</td>
<td>192</td>
<td>Not ok</td>
</tr>
<tr>
<td>3</td>
<td>Columns</td>
<td>16</td>
<td>75</td>
<td>192</td>
<td>Not ok</td>
</tr>
</tbody>
</table>

Table 3: The summary of the results of the reassessment of beam for shear reinforcement

<table>
<thead>
<tr>
<th>S/N</th>
<th>Span</th>
<th>Provided shear reinforcement</th>
<th>shear reinforcement required</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Span1</td>
<td>Y10@300</td>
<td>Y10@250</td>
<td>Not ok</td>
</tr>
<tr>
<td>2</td>
<td>Span2</td>
<td>Y10@300</td>
<td>Y10@250</td>
<td>Not ok</td>
</tr>
<tr>
<td>3</td>
<td>Span3</td>
<td>Y10@300</td>
<td>Y10@250</td>
<td>Not ok</td>
</tr>
</tbody>
</table>

From Table 4, the cube strength ranges between 7.9 and 10.8N/mm². From Table 5, the characteristic strength of the concrete is 8.2 N/mm². In Table 5, \(\varepsilon\) is the arithmetic mean of sample strength; \(x\) is the strength of a sample; \(n\) is the number of samples; \(\sigma\) is the standard deviation and \(F_k\) is the characteristic strength.

Tables 6 shows the results of the compressive tests on concrete cubes from sand samples A to E. From Table 7, sample D with lowest % content of clay/silt of 4.0% has the highest values of both average compressive and characteristic strengths of 19.93N/mm² and 18.54N/mm² respectively, while sand sample E with highest % content of clay/silt of 7.8% has the lowest values of both average and characteristic strengths of 12.23N/mm² and 11.23N/mm² respectively. Also, Figure1 shows the variation of average compressive and characteristic strengths against percentage content of clay/silt.
### Table 4: Results from universal testing machine

<table>
<thead>
<tr>
<th>Structural member</th>
<th>Compressive strength (N/mm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab</td>
<td>10.0, 9.8, 9.4, 9.0, 9.7</td>
</tr>
<tr>
<td>Beam</td>
<td>9.2, 10.5, 7.9, 8.8, 10.8</td>
</tr>
<tr>
<td>Column</td>
<td>9.4, 9.6, 10.2, 10.4, 8.2</td>
</tr>
</tbody>
</table>

### Table 5: Characteristic strengths from universal testing machine

<table>
<thead>
<tr>
<th>Formulae</th>
<th>Universal testing machine (N/mm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varepsilon$</td>
<td>9.53</td>
</tr>
<tr>
<td>$\Sigma(x - \varepsilon)^2$</td>
<td>9.47</td>
</tr>
<tr>
<td>$\sigma = \sqrt{\Sigma(x - \varepsilon)^2/(n - 1)}$</td>
<td>0.82</td>
</tr>
<tr>
<td>$F_k = \varepsilon - 1.64\sigma$</td>
<td>8.20</td>
</tr>
</tbody>
</table>

### Table 6: Compressive strengths of concrete from sand samples A to E

<table>
<thead>
<tr>
<th>Compressive strength (N/mm$^2$)</th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample C</th>
<th>Sample D</th>
<th>Sample E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>$f_{cu}$</td>
<td>$f_{cu}$</td>
<td>$f_{cu}$</td>
<td>$f_{cu}$</td>
<td>$f_{cu}$</td>
</tr>
<tr>
<td>1</td>
<td>20.0</td>
<td>18.0</td>
<td>15.6</td>
<td>20.7</td>
<td>13.5</td>
</tr>
<tr>
<td>2</td>
<td>21.0</td>
<td>18.2</td>
<td>15.0</td>
<td>21.4</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>20.5</td>
<td>16.4</td>
<td>18.0</td>
<td>20.2</td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>19.7</td>
<td>19.0</td>
<td>13.7</td>
<td>18.7</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>20.4</td>
<td>16.8</td>
<td>14.8</td>
<td>19.6</td>
<td>5.0</td>
</tr>
<tr>
<td>6</td>
<td>19.0</td>
<td>18.6</td>
<td>14.0</td>
<td>20.0</td>
<td>6.0</td>
</tr>
<tr>
<td>7</td>
<td>20.0</td>
<td>17.4</td>
<td>17.0</td>
<td>21.0</td>
<td>7.0</td>
</tr>
<tr>
<td>8</td>
<td>19.0</td>
<td>17.8</td>
<td>16.8</td>
<td>19.4</td>
<td>8.0</td>
</tr>
<tr>
<td>9</td>
<td>18.0</td>
<td>19.3</td>
<td>16.5</td>
<td>18.5</td>
<td>9.0</td>
</tr>
<tr>
<td>10</td>
<td>19.5</td>
<td>18.4</td>
<td>17.5</td>
<td>19.8</td>
<td>11.0</td>
</tr>
</tbody>
</table>
**Table 7:** Variation of Average Compressive Strength against Percentage Content of Clay/silt

<table>
<thead>
<tr>
<th>Sample</th>
<th>% clay/silt content of sand</th>
<th>Average Compressive Strength (N/mm²)</th>
<th>Characteristic strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>4.0</td>
<td>19.93</td>
<td>18.54</td>
</tr>
<tr>
<td>A</td>
<td>4.2</td>
<td>19.71</td>
<td>18.28</td>
</tr>
<tr>
<td>B</td>
<td>4.5</td>
<td>17.99</td>
<td>16.6</td>
</tr>
<tr>
<td>C</td>
<td>6.8</td>
<td>15.89</td>
<td>12.31</td>
</tr>
<tr>
<td>E</td>
<td>7.8</td>
<td>12.23</td>
<td>11.23</td>
</tr>
</tbody>
</table>

**Figure 1:** Variation of Average Compressive and characteristic Strengths against Percentage Content of Clay/silt

**CONCLUSION**

From the discussion of results above, the collapse of the building which was still under construction then, could not have occurred due to design error, because design for tension and compression reinforcements for slabs, beams and columns were satisfactory. The provision of shear reinforcement at 300mm center to center, instead of the required spacing of 250mm and the lack of provision of adequate anchorage length could not have been the major cause, of collapse of the building, because at the time of collapse, the building was subjected only to its self weight, which is about 31% of the ultimate load. The characteristic strength of the concrete from which the building was constructed is about 8N/mm². This is 40% of the required concrete strength. Such a massive reduction in concrete strength, which is 60%, will be a major cause of the collapse of the building.
Also from the discussion of results above, concrete produced using the same mix ratio, but with sand from different borrowed pits, will have different characteristic strengths. Hence the quality of sand used in concrete production is of great importance. The higher the percentage of clay/silt content of any sand the lower the characteristic strength of concrete produced from it.

Inspite of the fact that CP114 has been withdrawn, Nigerian Engineers still refer to it in their concrete specification, and this is having damaging effect on the Nigerian construction industry. Standards such as BS 5328 – 1 and BS 5328 – 2 emphasized the need to carry out research on the locally available aggregates, before prescribed method of concrete can be used.

**RECOMMENDATIONS**

The quality of concrete used to construct a building greatly affects its durability. Also, method of mix specification directly affects the quality of concrete produced, and hence the durability of structure built with such a concrete. Therefore in order to improve on our mix specification methods, with the corresponding improvement in the quality of concrete produced, and the durability of our buildings in Nigeria, the following recommendations are made.

The Federal Government of Nigeria should mandate the Nigerian Institute of Civil Engineers (NICE), which is under the Nigerian Society of Engineers to produce the Nigerian Standards within a stipulated time.

Adequate fund should be provided for the project.

NICE in turn should select one or two universities in each of the six geopolitical zones of the country, through the department of civil engineering to among other things, collect reliable data on the aggregates available in their respective geopolitical zones, and formulate indigenous standards based on field data collected.

**REFERENCES**


CONCEPTUAL MODEL FOR INTEGRATING HEALTH AND SAFETY INTO CONSTRUCTION PROCUREMENT IN GHANA

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The purpose of this work is to develop a framework for integrating health and safety (H&S) into the procurement process of construction projects in Ghana at multiple levels. Procurement is the process through which the contracts for construction work are created, managed and fulfilled. The procurement process in construction comprises of specification, selection and award of a contract. The stage at which procurement occurs suggests that procurement can be used as a tool for incentivising H&S in construction contracts. Invariably the success of construction contracts is judged on the basis of cost, quality, and time performance. However, the overriding importance of human life and health suggests that any project which is completed in accordance to its cost, quality, and time objectives, but fails to fully ensure the health and safety of the people associated with it, should probably be regarded as a failure. Clearly, the health and safety of people working on construction sites should be of value and this should be fully embedded at multiple levels. Appropriate legislation, professional institutions, trade associations, procurement approaches need to be mobilised to minimise accidents on construction sites. However, this is not always the case in most parts of Africa where legislation and the institutional framework of the construction industry does not seem to uphold health and safety of workers as a paramount importance in construction projects and contracts. This research focuses on Ghana. The purpose of this work is to develop a framework for integrating health and safety into the procurement process of construction projects in Ghana at multiple levels. The research will provide a basis for improving the culture of health and safety on construction contracts in Ghana.

Keywords: Ghana, health and safety, procurement.

INTRODUCTION

Procurement is an important vehicle in the construction process that can be used to achieve various objectives because of the early stage at which it occurs and also because of the involvement of multiple participants at this stage where the specification, selection and award of a construction project take place. One of the most important objectives to ensure in construction projects, and indeed all human endeavours, is the health and safety of the people involved in an enterprise and the

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processes and operations used to accomplish the aims of an enterprise. This is a challenging task that requires the involvement of various stakeholders in the construction industry, construction firms, and construction projects. Too often the main objectives of a construction project are stated in terms of cost, quality, and time without much emphasis on the health and safety aspects of the people involve. A study by Ika (2009) which highlights the characteristics of articles on project success published between 1986 and 2004 in the Project Management Journal (PMJ) and the International Journal of Project Management (IJPM), suggests that parameters for project success are most often centred around concepts such as project management success, project success, success criteria, and success factors without any reference to H&S. Cost, quality and time have traditionally been seen as the important benchmarks for measuring project success. It will be argued in this paper that a project that achieves success in the three aspects but fails to deliver comprehensively on health and safety aspects relating to people, the environment, and product of the construction process should perhaps not be regarded as a success as has traditionally been done. In 2005, a global meeting was held in Benin to review the state of construction health and safety practices in Africa (Puplampu and Quartey, 2012). The discussions at that meeting concluded that most African countries have inadequate occupational health and safety (OH&S) review mechanisms, the majority have inadequate OH&S policy frameworks, especially Ghana, and inadequate infrastructure for supporting achievement of OH&S at all levels. This is one of the developments that lead to the need for comprehensive research with respect to construction health and safety in Ghana. Furthermore, limited, if any, research has been carried out on the topic from the specific perspective of investigating and attempting to integrate the roles of various stakeholders at the procurement stage to facilitate construction health and safety. The study is relevant to the improvement of construction health and safety performance as it aims to development a model applicable for effective integration of roles of stakeholders in the implementation of H&S on construction projects. Good H&S practices not only provide a safer working environment, but also improve morale and productivity of human resources (Australian Safety and Compensation Council, 2006). This can contribute towards ensuring fewer workplace injuries, higher employment retention rates, and enhancement of an organisation’s corporate image.

LITERATURE REVIEW
The literature review addresses four main sections, namely the socio-economic context of the construction industry in Ghana, health and safety in construction, procurement in the construction industry, and the intersection of procurement and health and safety in construction. This provides a background for identification of the major stakeholders, their roles in construction procurement, and how this can be integrated at the procurement stage to deliver H&S throughout construction supply chains in Ghana.

SOCIO-ECONOMIC CONTEXT OF THE CONSTRUCTION SECTOR IN GHANA
Ghana has an estimated population of 24.65 million as indicated by the 2010 Population and Housing Census conducted by the Ghana Statistical Service. A major driver of the economy is the recently established oil and gas industry. This seems to have contributed significantly towards Ghana becoming one of the top-ten fastest growing economies in the world, and one of the fastest growing economies in sub-Saharan Africa according to World Bank estimates.
Statistics released by the Ghana Statistical Service indicate that the three main economic sectors contributing to Ghana’s gross domestic product (GDP) are Services (51.4%), Agriculture (29.9%), and Industry (18.6%). The industrial sector’s contribution to Ghana’s overall GDP is estimated to have remained virtually the same for the past 20 years. While the share of other industrial sub-sectors has remained fairly constant or declined, the share of the construction sub-sector has steadily increased from around 30% to close to 40%, overtaking manufacturing as the largest sub-sector in the past ten years. This growth has been primarily driven by an increasing demand for urban housing and infrastructure development. Research conducted by Anaman and Osei-Amponsah (2007) relative to the causality links between the growth of the construction industry and the growth of the macro-economy in Ghana indicates that construction is clearly one of the major drivers of economic growth in Ghana.

The African Economic Outlook (2012) report notes that the construction sector contributes 8.6% to the total GDP of Ghana and employs over 1.4% of the country’s labour force. The GDP growth for Ghana has increased sharply in the last few years and future growth prospects remain extremely positive. The GDP growth rates as published by the Ghana Statistical Service indicate that from 2006 until 2012, Ghana’s GDP growth rate averaged 2.1% reaching an all-time high of 16.8% in June 2011.

The construction industry in Ghana which is noted as one of the fast growing industry sectors can be seen as the vehicle that provides the infrastructure that enables the operations and development of other sectors of the economy. Due to the discovery and exploration of oil and prospects of more oil deposits in Ghana, economic activities have begun to improve upwards resulting in an increased demand for real estate and commercial development, and the necessary infrastructure development to support Ghana’s fast growing economy.

PROCUREMENT

In construction, procurement can be defined as the strategic process of creating, managing and fulfilling contracts (ISO 10845: 2010). This involves all the steps from the establishment of the project or products to be procured, to soliciting and evaluating tender offers, to awarding and administering contracts and confirming compliance with requirements. The procurement process in construction covers the stages where the details of a project are specified, a contractor is selected, and a contract awarded (as explained in the EU 2004 rules on public procurement). In broad terms, procurement can be explained as the method used for the acquisition of goods, services, works, and utilities. Procurement is often associated with terms and activities such as purchasing, acquisition, and buying.

The key steps involved in developing a construction procurement strategy include specification of scope, risk allocation, calculation of price, selection of supplier, and the procedure of award (Watermeyer, 2012). The principles and mechanisms for dealing with these steps need to be carefully understood and applied by procurers in order to achieve the right objectives for a project. A framework should be developed to guide the decision-maker through the various stages of the process for deciding on a procurement policy, including sources of funds, management of design, management of construction, integration of supply chain, calculation of price, and method for selecting contracting parties including consultants. Risk allocation is particularly important as its significance is in the fact that risk allocation forms the basis of procurement and contract strategy (Laryea, 2012).
Some of the major procurement methods in construction include general contracting, design and build, develop and construct, construction management, public private partnerships, partnering, and performance-based contracting (Hackett et al., 2007). These should be viewed in terms of organisational models of project delivery. The British Standard on Construction Procurement (BS8534: 2011) articulates six main variables of construction procurement. With a number of options and possibilities available within each of the variables, there are permutations of more than 15,000 procurement methods that can be applied in theory from a functional perspective (see also explained in Hughes et al., 2006). According to Murdoch and Hughes (2008: 88-93), the most important criteria for choosing suitable procurement methods in construction are: involvement of the client in the construction process; separation of design from management; reserving the client’s right to alter the specification; of client’s contractual remedies; complexity of the project; speed from inception to completion, and certainty of price.

The procurement process in construction should ideally commence from the point where the need for goods, services, utilities or works is identified and complete at the stage of sustainable disposal of the asset or infrastructure. However, there are six principal activities associated with the construction procurement process, namely: 1) establish what is to be procured; 2) decide on procurement strategies in terms of contract, pricing and targeting strategy and procurement procedure; 3) solicit tender offers; 4) evaluate tender offers; 5) award contract, and 6) administer contracts and confirm compliance with requirements. The impact of these activities on construction outcomes suggests that procurement can be applied as a major tool to promoting health and safety in construction.

HEALTH AND SAFETY

The objective of improving health and safety in all sectors of the economy is supported by international organisations. It is a key component of the World Bank’s agenda (see, for example, World Bank Group Environmental, Health, and Safety Guidelines). H&S is also a core component of the ILO’s Decent Work agenda which is now incorporated into the United Nations’ Millennium Development Goals. The ILO has for many years been encouraging the introduction of measures to improve OHS including improved policies and legislation, wider availability of occupational health services, improved training and certification of skills, better recording and notification of accidents and the introduction of H&S management systems. However the use of procurement as an instrument to promote improved OHS practices among suppliers has received little attention to date. While several guidelines on labour issues have recently been produced by Millennium Development Boards (MDB), most offer only limited guidance on how to improve standards through procurement.

In a recent paper published in the International Journal of Business and Social Sciences, Puplampu and Quartey (2012) highlighted the key issues and challenges with respect to general H&S practices in Ghana. The paper identified inadequate, limited and narrow research attention as the first key issues on H&S practice in Ghana. The study recognised the existence of occupational health and safety hazards, risks and diseases in Ghana (Ghana News Agency, 2012; Labour Department Report, 2000) and these are prevalent in the construction, mining, agricultural, and other commercial sectors. It also identified inadequate, limited and narrow research attention as the first key issues on OH&S practice in Ghana.
The third H&S issue identified was H&S challenges that impede the country’s efforts to mainstream H&S practices in its development agenda. Some of the challenges identified are: the absence of a comprehensive national H&S Policy (Clark, 2005); inadequate H&S infrastructure and measures (Ghana Health Service Report, 2007), and inadequate support from government, employers, and employees (Kheni, 2008).

The paper noted that Ghana cannot boast of any comprehensive national H&S policy. It noted that Clark (2005) indicated that the majority of Ghana’s legal H&S provisions are limited in scope as the vast majority of industries and most of the informal sectors are not specifically covered. The Ministry of Health Report (2007) also identified some H&S challenges in Ghana, which include a weak H&S infrastructure, untrained and inadequate H&S professionals, and lack of proper monitoring and surveillance for H&S diseases and injuries. The paper concluded that Ghana must renew attention to H&S practices, especially OH&S research and promotion. Without this and a comprehensive national OH&S policy, and OH&S investment, it would be difficult for Ghana to effectively achieve the millennium development goals.

Internationally, construction is noted as a hazardous industry whether in developed or developing countries, and contributes significantly to the number of occupational accidents and ill health globally (Takala, 1999). Literature indicates that developed countries are striving to address this industry specific risk profile, however not much is being done by developing countries in this regard. Accident rates in developing economies are unacceptably high, and it is predicted that these numbers will continuously rise with the pace of industrialisation (Hamalainen et al., 2006).

Lingard and Rowlinson (2005) in their textbook ‘occupational health and safety in construction project management’ and various authors argue that the reasons for the hazardous nature of construction lie in the physical environment of the work, nature of construction work operations, construction methods, construction materials, heavy equipment used, and physical properties of the construction project itself as noted by Laryea and Mensah (2010).

In Ghana, the growth of construction has led to the increasing severity of risks at construction sites (Kheni, 2008). Accident statistics in terms of Ghana’s Workmen’s Compensation Law 1987 show that out of a total of 6 064 accidents reported to the Labour Department in 1975, construction accounted for 1 108, second only to manufacturing (1 661). This translates to 18% of accidents in the country’s industries, and over 1 500 accidents per 100 000 workers. In 2000 the Labour Department reported 1 120 construction accidents, of which 56 were fatal, translating to a fatality rate of 77.6 per 100 000 workers which is much higher than the ILO’s estimate for developing countries (Takala 1999), making the construction industry the highest in terms of occupational deaths in comparison to other industrial sectors.

With the expected increase in construction activities in Ghana due to the expected rise in demand for real estate and infrastructure development as a result of the steady economic progression, proactive efforts and urgent attention are required from all major stakeholders in the quest to take control of this endemic trend in the construction industry in Ghana.

In a recent comprehensive research report commissioned by the Construction Industry Development Board (CIDB) (2009) it was recorded that while at the legislative level, South Africa is not lacking in terms of Health and Safety legislation, the enforcement of Construction Regulations is inadequate, and that the OH&S Inspectorate is understaffed and lacks the requisite construction expertise. While it is encouraging
that the report acknowledged the significant efforts and commitment of major role players towards the improvement of health and safety in the construction industry, it is disappointing that construction continues to contribute a disproportionate number of fatalities and injuries relative to other industrial sectors. At the organisational and site level, the report attributed poor construction H&S performance to lack of management commitment, inadequate supervision, and lack of H&S training.

**INTERSECTION BETWEEN PROCUREMENT AND HEALTH AND SAFETY IN CONSTRUCTION**

There are at least four studies identified on the intersection between procurement and health and safety in construction. This is published on behalf of the UK group called Engineers Against Poverty by Wells and Hawkins (2012) in the form of a briefing note for developing countries on promoting construction health and safety through procurement. A handbook for public sector health and safety in construction procurement has also been published. The government of Australia (2006) has published a guide on occupational health and safety in government procurement. The Victorian government (2010, Edition 1) has published a guide on health and safety in construction procurement. The guide includes advice on how to integrate health and safety into the main phases of the construction procurement process and is intended to assist government departments to fulfil their duties under the Occupational Health and Safety Act 2004. While there is a range of different models that can be used for procurement, a generic set of key stages are highlighted for the purposes of this document, including planning, design, tender, contract, construction and evaluation. The Olympic Delivery Authority (ODA) in London published a post games account on health and safety in the procurement process. Health, safety and security is one of the ODA’s six priority themes, alongside design and accessibility, employment and skills, equality and inclusion, sustainability, and legacy. Competence in terms of each of the priority themes was considered during the procurement of all goods and services by the ODA using a balanced scorecard. This included details on the technical questions asked at the pre-qualification questionnaire (PQQ) stage and the evaluation criteria and guidance at both the PQQ and Invitation to Tender (ITT) stages. It also includes an example of the Health Safety and Environment (HS&E) element of the works information included in NEC contracts. These examples demonstrate a close relationship between procurement and health and safety outcomes. This relationship will be explored in the context of the construction industry in Ghana and the empirical findings will be used to develop a framework for integrating health and safety into the procurement process of construction projects in Ghana.

Through the literature review, five major stakeholders and actors have been identified in relation to dealing with the problem and issues of construction health and safety namely:

- The government in taking ownership and providing leadership through legislative, regulatory and enforcement agents, i.e. Ministry of Labour, Ministry of Works and Housing, Factories, Offices and Shops Act (FOSA);
- Fostering client ownership and commitment to OH&S, in design and construction management practices aimed at the creation of a healthy and safe construction environment;
• Professional and educational institutions through training and certification of construction professional including OH&S profession, and the establishment of codes of practices for the various professions;

• Contractor associations and labour unions to play relevant roles in ensuring compliance of good OH&S practices, and

• Procurement and contract policies and strategies geared towards ensuring contractual commitments of OH&S in construction.

While the roles of these five groups are widely known and reported the literature, the main problem is that the way these functions interact in the procurement process to ensure construction health and safety is not clearly articulated particularly in the context of the construction industry in Ghana.

RESEARCH PROBLEM AND APPROACH
Through the survey of the literature, five actors (stakeholders) connected with construction health and safety, have been identified. However, the way that the roles and function of these stakeholders interact during the procurement process to ensure construction health and safety is not clear particularly within the context of the Ghanaian construction industry. The proposed study will attempt to explore the nature of the relationship between the five actors at the procurement stage; and then explore how they interrelate within a co-ordinated model aimed at effective implementation of health and safety in construction procurement.

Government is the biggest procurer of construction work in Ghana and many developing countries. However, Ghana’s fast growing economic implies that the private sector is engaged in a range of major projects that affect construction health and safety significantly. Therefore, the study will encompass elements from both public and private sectors.

MODEL DEVELOPMENT COMPONENTS
This section is intended to provide a justification for the components of the conceptual model. Construction health and safety should be a matter of concern to all stakeholders in the construction industry, the construction firm, and construction projects. Through a detailed literature review, five institutional actors and factors that impact on construction projects were identified.

First, it is necessary to begin from the premise that the governments of each of the 185 countries in the United Nations (UN) are members of the ILO and hence have a major role to play in implementing international and local policies and agreements designed to ensure health and safety in countries. The ILO has a tripartite governing structure – representing governments, employers, and workers, usually with a ratio of 2:1:1. Governments and their relevant institutions in countries are responsible for enacting suitable laws and designing measures for the implementation of ILO and national frameworks for ensuring health and safety generally, and in the construction sector specifically. Therefore, government is a major actor in relation to the research problem and for that reason it is necessary to incorporate government into the anatomy of a proposed framework for designing procurement systems to incentivise construction health and safety in Ghana. The Government of Ghana can provide
leadership through legislative, regulatory and enforcement agents, including the Ministry of Labour (Employment and Social Welfare), Ministry of Works and Housing, Factories, Offices and Shops Act (FOSA). According to the Victorian Government (2010) guide on health and safety in construction procurement, as procurers, governments can promote better health and safety by requiring projects to include a range of H&S measures, such as specifying the H&S budget, building layout or the use of certain construction materials. The inclusion of health and safety principles in the procurement process also has a number of commercial advantages, including: improved productivity, reduced costs, better prediction and management of production and operational costs over the lifecycle of the project, and innovation in design and construction. The Victorian Government’s (2010) health and safety in construction procurement publication provides practical guidance to practitioners in state government, local government, statutory authorities and other agencies who procure, commission, manage and maintain building and civil construction projects.

Second, there is a need to foster client ownership and commitment to health and safety, and design and construction management practices aimed at the creation of a healthy and safe construction environment. Every construction project has an owner. Nearly every published literature on construction projects mentioned the client or owner of a project (see for example, the ISO 10845: 2010 series of standards for construction procurement). The owner of a construction project is responsible for initiating and establishing the major variables relating to the procurement of a construction project including the funding mechanism e.g. owner-financed, public sector-financed, developer-financed, private finance initiatives public-private partnerships, method of contractor selection (e.g. negotiation, partnering, frameworks, selective competition, open competition), price basis (e.g. work and materials as defined by bills of quantity, cost reimbursement, whole building, a fully-maintained facility, performance), responsibility for design (e.g. architect, engineer, contractor, in-house design teams, supplier), responsibility for management (e.g. client, lead designer, principal contractor, joint venture, construction manager) and extent of supply chain integration (BS 8534: 2011 Construction procurement policies, strategies and procedures). These variables will obviously impact on the project delivery and hence some of the factors associated with healthy and safety. The construction owner or client is, therefore, a principal actor to incorporate into the conceptual model. The extent of responsibilities will be explored during the empirical phase of the research.

Third, the construction supply chain encompasses the roles of various built environment professions including project managers, architects, engineers, quantity surveyors, construction managers, and construction health and safety agents. These individuals tend to belong to professional bodies and professional associations that seek to regulate the professions and improve professional practice of its members. As professionals they are expected to possess the required educational qualifications and certain minimum competencies in their various professional disciplines. In Ghana the prominent professional bodies associated with construction and the built environment
are Ghana Institute of Architects, Ghana Institution of Surveyors, Ghana Institution of Engineers, and Ghana Institution of Planners. These institutions are also responsible for continuous professional education of their members and hence an important vehicle for promoting achievement of health and safety through education and regulation of the activities of their members. It is however disappointing to note that the educational curriculums of these professions do not seem to include elements of construction health and safety. The law in Ghana makes it imperative for all buildings to be designed by registered architects and engineers before a building approval or permit can be obtained. This is an important vehicle that needs to be explored. The research by Emuze and Smallwood (2012) and Steven (2010) explain how health and safety can be incorporated into design activity to achieve beneficial outcomes. There is clearly a role for professional institutions and their members in the conceptual model to be developed for construction health and safety in Ghana. These may take the form of regulation of the practice of individual members, setting of standards for incorporation of health and safety into design, certification of construction professionals including OH&S profession, and the establishment of codes of practices for the various professions.

Fourth, the leadership role played by an owner is as important as the management and coordination functions of a contractor or builder on construction sites. The construction site is the place where construction designs are implemented by workers and construction supply chains. Health and safety is one of the basic risks associated with construction projects (Skan and Delia, 2010). A major principle of risk allocation is to apportion risk to the party that is best positioned to control the risk (Murdoch and Hughes, 2008). Clearly, it is the contractor and construction workers on site that are best positioned to control and do something about most of the risks relating to physical activities on the construction site. Even with all the necessary legal framework and policies in place, with the appropriate procurement and contract strategies, and all procedures and processes developed, full implementation of effective H&S for the desired results cannot be achieved without full commitment from the top management of construction companies, their construction workforces and the construction professional who directly engage in construction activities on construction sites. For this reason contractor associations and labour unions are an important stakeholder to incorporate into the conceptual model for construction health and safety in Ghana as they play relevant roles in ensuring compliance of good OH&S practices.

Fifth, there is a procurement process for every project that may be formal or informal depending on the scope and scale of a project. As defined earlier in this paper, procurement is the overall process through which construction contracts are created, managed and fulfilled (ISO 10845: 2010). The early stage at which procurement occurs in the construction process means that it presents a significant opportunity to introduce health and safety measures and influence (or incentivise) expected outcomes. Procurement activities commence once the need for procurement is
identified and end when the transaction is completed. There are six principal activities associated with the procurement process, namely: 1) establish what is to be procured; 2) decide on procurement strategies in terms of contract, pricing and targeting strategy and procurement procedure; 3) solicit tender offers; 4) evaluate tender offers; 5) award contract, and 6) administer contracts and confirm compliance with requirements. The ISO 10845: 2010 international standard for construction procurement indicates that appropriate methods, procedures and operational policies are required to implement these principal activities. The procurement process of projects is therefore an important variable to incorporate into the conceptual framework to be developed for incentivising construction health and safety in Ghana. The selection of procurement as a key variable to incorporate into the conceptual model for health and safety in construction is supported by a study carried out by Wells and Hawkins (2010) on behalf Engineers Against Poverty (EAP) on how procurement can be used to promote construction health and safety in developing countries. Two reasons are argued by Wells and Hawkins (2010) to justify why OHS is a serious issue to consider during the procurement process of construction services and works. First, Health and safety legislation in many countries is increasingly holding clients responsible for the health and safety of the workforce on their construction projects. This responsibility may to some extent be passed on to consultants and to contractors and subcontractors. Hence the terms on which these services are procured are critical in ensuring that the responsibility is taken seriously by all parties and that the interests of the client are safeguarded. Second, while it is often argued that the monitoring and enforcement of health and safety regulations is the responsibility of regulatory authorities, the large number and wide dispersion of construction sites means that it is practically impossible to inspect all. In this context the procurement process and the terms and conditions of the contract can be seen as complementary mechanisms for ensuring compliance with existing legislation and/or the terms and conditions of project finance. There is evidence in the literature to demonstrate that procurement procedures can further or inhibit good OHS practice (Hawkins and Wells, 2007; Manu et al., 2011). Currently the most common procedure for awarding construction contracts in developing countries is open competitive tender with tenders evaluated mainly on the basis of price. In order to win bids, contractors must limit their costs, and labour is a major item of cost. The winning tender is therefore likely to be the one that does not provide H&S equipment, appropriate welfare facilities, and a healthy and safe working environment. In this context a low price for the client is secured at the expense of the health and safety of the workforce. According to Wells and Hawkins (2010) the key stages in construction procurement for consideration of health and safety issues are: first steps before tender; selection of consultants; planning and design; prequalification of contractors; bidding documents; tender evaluation; contract agreement; monitoring and reporting, and post project evaluation. Research on practices in Ghana at each of these procurement stages will be examined and analysed to ascertain the extent to which health and safety considerations are taken into account. Procurement and contract policies and strategies should be designed to
include health and safety contractual commitments and implemented to deliver on such commitments.

**FRAMEWORK FOR DEVELOPING THE MODEL**

The five components of the proposed model for integrating health and safety into procurement process of construction projects in Ghana have been discussed. This framework is summarised in Figure 1.

There are five main research questions will need to be explored in the empirical phase of the study to facilitate the model development. These questions relate to the roles of each of the five actors at the procurement stage of construction projects.

In the first instance a comprehensive review of literature needs to be carried out to ascertain various laws and legislation used by governments in various counties to deal with construction health and safety. A detailed search of legislation and statutory requirements enacted by government and district assemblies (local government) in Ghana for dealing with health and safety related issues will also be carried out. This will help to ascertain the institutional and legislative framework made available at national and local government levels for dealing with the issues and problems relating to construction health and safety. Therefore, the research question (RQ1) relates to the role of government is: How is the role of government in promoting construction health and safety promoted by relevant legislation and institutions at a policy and operational level?

The second research question (RQ2) relates to owners. How do owners incorporate health and safety issues into the procurement process of their projects?

The third research question (RQ3) relates to professional bodies is: How do professional bodies and their members perceive the issues relating to construction health and safety, and what obligations do they carry as professionals to help in dealing with the issues of construction health and safety?
Figure 1: Framework of conceptual model

The fourth research question (RQ4) relates to the role of contractors and construction workers is: how do contractors and workers perceive the issues of health and safety, and how do they deal with the issues of health and safety on construction sites?

The fifth research question (RQ5) relates to the construction procurement processes used in Ghana. How is health and safety integrated into the procurement process specifically in terms of planning, design, tender, contract, construction, and evaluation of projects?

These research questions will be investigated through a comprehensive survey of the stakeholders and also through a detailed study of project documents and other relevant materials in which construction-related information is documented and recorded. The findings will help to develop a co-ordinated model aimed at effective implementation of occupational health and safety in the Ghanaian construction industry.

CONCLUSION AND FURTHER WORK

Ghana like most African countries have inadequate occupational health and safety (OH&S) review mechanisms, the majority have inadequate OH&S policy frameworks, and inadequate infrastructure for supporting achievement of OH&S at all levels. Ghana cannot boast of any comprehensive national H&S policy and the majority of Ghana’s legal H&S provisions are limited in scope as the vast majority of industries and most of the informal sectors are not specifically covered. There is existence of occupational health and safety hazards, risks and diseases in Ghana and these are prevalent in the construction, mining, agricultural, and other commercial sectors. Some of the challenges identified are: the absence of a comprehensive national H&S Policy, inadequate H&S infrastructure and measures, and inadequate support from government, employers, and employees. Some of the H&S challenges identified in Ghana include a weak H&S infrastructure, untrained and inadequate H&S professionals, and lack of proper monitoring and surveillance for H&S diseases and injuries. It can then be concluded that Ghana must renew attention to H&S practices, especially OH&S research and promotion. Without this and a comprehensive national OH&S policy, and OH&S investment, it would be difficult for Ghana to effectively achieve the millennium development goals.

Limited, if any, research has been carried out on the topic from the specific perspective of investigating and attempting to integrate the roles of various stakeholders at the procurement stage to facilitate construction health and safety.

The five research questions pertaining to construction health and safety will be investigated within the context of the Ghanaian construction industry to help develop a model for integrating health and safety into construction procurement. The literature review and model components identified here provide a framework for taking forward the research which will lead to findings that are fundamentally important for improving the culture of construction health and safety in Ghana.

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Evidence exists in developing economies that there are construction supply chain problems and business relationship gaps. The business relationship gaps encourage discords, disputes and conflicts (DDC) and prevent exchange of information for effective and efficient supply chain of information flow (SCIF). These problems together impede the improvement of Design Service Delivery (DSD) activities. There is a quest for robust and reliable methodologies for this kind of built environment (BE) on-going research. This is to increase standard and acceptability of non-collaborative adversarial business relationship assessment results. The purpose of the paper is to justify the methodological issues and their appropriateness in dealing with the research aim, questions and objectives. These methodologies will also provide a valid and credible basis for the research path. Findings from the selected case study of business relationship maturity levels of individual construction firms or respondents can be categorised using the illustrative/indicative improvement assessment conceptual model. The categorization of the business relationship maturity levels will assist in effecting specific improvement in DSD activities.

Key words: business relationship, construction supply chain management, design service delivery, research methodology.

INTRODUCTION

Non-collaborative working and adversarial business relationship situation exist in the Ghanaian construction industry. Evidence has emerged from the study that the traditional procurement system commonly practiced in Ghana shows obvious traces of adversarial business relationships. Furthermore, the construction industry is noted to be of a fragmented culture, which accounts for its poor performance over the years (Latham, 1994; Egan, 1998; Bresnen and Marshall, 2002; Naoum, 2003; Baiden et al. 2006; Bresnen, 2007; Pryke, 2009). The industry is full of mistrust, self-interest and competitive behaviours, apart from the lack of effective communication (Latham, 1994; Chan et al. 2004; Pryke, 2009). These harsh situations generate non-
collaborative working and adversarial business relationships, which leads to discords, disputes and conflicts (DDC). As Ramus and Birchall (2006) indicated, disputes are damaging, both to the industry and to its clients, the cost of resolving them is often high. They also sometimes take a long time to resolve. The total effect of disputes on individual projects can destroy all objectives involved in them (Ramus and Birchall, 2006; Orgen et al., 2012a). Other issues which cause construction discords, disputes and conflicts are location and allocation of leadership, authority and control. As stated in the research of Collins (1975) cited in Orgen et al. (2012a), people dislike being controlled and for that matter they wish to protect their professional autonomy and thus engage in conflict to avoid being controlled. To arrest the situation, many interventional efforts of cooperative procurement methods and working have been introduced. All these efforts are employed to end DDC. In spite of these positive interventional strives, non-collaborative working and adversarial business relationship traces in the construction industry are not in doubt. Therefore, to engender rigorous business relationship transformation in the traditional procurement system for the improvement of DSD activities, there is the need to have an attitudinal behavioural change of the DSD actors. A change of ‘mind-set’ is necessary for attitudinal behavioural change that can lead to the improvement of the DSD activities. It is based on these problems that business relationships management framework development is essential for the improvement of the DSD activities.

This paper seeks to justify the methodological issues appropriate for the development of the research aim, objectives and conceptual model. Finally, justification is given also for the appropriate research approaches, data collection and techniques.

RESEARCH PROBLEM

Available evidence in the Ghanaian construction industry has shown that adversarial business relationships, which cause DDC exists in the DSD activities and indeed, disturbs contractors and other DSD actors (Anvuur et al., 2006; Laryea, 2010; Orgen et al., 2012a). It has been identified in the Ghanaian construction industry that cultural, political, economic and contractual issues contribute greatly to adversarial business relationships (Anvuur et al., 2006; Laryea, 2010). A number of different interventions have been suggested to overcome adversarial business relationships. Such efforts include cooperative procurement procedures (Eriksson and Westerberg, 2011), alliancing (Yeung et al., 2007), partnering (Bresnen and Marshall, 2002; Naoum, 2003; Wong and Cheung, 2004; Bresnen, 2007; Alderman and Ivory, 2007; Kadefors, et al., 2007) and team integration (Baiden et al., 2006). As a way of improving business relationships, it was recommended that there should be change through the right strategies, proper development of professionalism and seeking mergers with firms with similar organizational values (Laryea, 2010). However, there is the need for improvement of efforts in many service endeavours and in DSD activities not in doubt. To arrest the problem in a ‘unique’ project base environment offer a useful gap for thorough research. Indeed, as the issues that cause non-collaborative working relationships among the DSD actors keep reoccurring (Anvuur et al., 2006; Laryea, 2010; Orgen et al., 2012a), DSD activities lack improvement; learning processes are not made to include practice of taking feedback from executed projects and applying it on others. As Loo (2003) points out, taking performance feedback from projects and learning from experience improves the performance of a project. Therefore, there is the need to find a research path to address the argument of non-improvement of DSD activities. Also, it is necessary to search for information
abstractions to develop a framework and models for the improvement of DSD activities which are not in sight.

**RESEARCH QUESTIONS**

1. How are the DSD activities in Ghana improving in collaborative business relationships for *proper* free exchange of construction project information to produce an effective and efficient SCIf – (chain of documentation)?

2. What are business relationship management (BRM) concepts, procedures and processes that are required to produce attitudinal behavioural change in business relationships among DSD actors?

3. What essential attitudinal behavioural reasons, learning and knowledge are required by the DSD actors for the improvements of the DSD activities in the construction industry in Ghana?

4. To what extent can business relationship management (BRM) concepts be used to improve relationships among DSD actors involved in the traditional procurement method in Ghana?

5. What conceptual framework and models can be developed to improve business relationships among DSD actors to achieve free flow of performance feedback and information that would improve construction DSD in Ghana?

**AIMS AND OBJECTIVES**

The broad aim of the research is to develop a framework for an effective and efficient information flow within construction supply chains. In particular the exchange of information (chain of documentation) within the DSD that is involved in the traditional procurement practices in Ghana is examined. To achieve this aim, one should realize that improvement in the DSD activities depends on how effective and efficient the supply chain of information flow is constituted and applied (Edum-Fotwe et al., 2001; Örgen et al., 2011, 2012b). The aim is further reinforced with the following objectives:

1. To find out the business relationship information and strategies required among the DSD actors in the traditional procurement practices for the improvement of the DSD activities

2. To find out what attitudinal behavioural reasons, learning and knowledge are required for changes among the DSD actors in developing SCIF for the improvement of the DSD activities in Ghana

3. To investigate the principles for developing business relationships among the DSD actors in the traditional procurement practices and their effects on the SCIf for the improvement of the DSD activities

4. To examine existing theories, concepts, procedures and processes with a view to develop a business relationship management conceptual framework and models that can be used to assess and improve upon DSD activities

**PRELIMINARY LITERATURE REVIEW**

Relationship management (RM) is observed to be a very broad pragmatic concept. This concept makes use of all important possible traditional and non-traditional (innovative) methods to change individual and organizational attitudes, behaviour,
systems and strategies towards achieving a non-adversarial relationship (Cheung and Rowlinson, 2005). Also, the RM concept is a paradigm shift from adversarial behaviour towards more collaborative practices which have their conceptual origins in relational contracting (Smyth and Fitch, 2009). Moreover, the identified RM concept is seen to have the potential to engender vigorous improvement in Design Service Delivery (DSD) activities through change of attitudinal behavioural culture of DSD actors (Orgen et al., 2011; 2012b). The attitudinal behavioural change can overturn the non-collaborative working and adversarial business relationship argument parading for years in the DSD activities of the construction industry (Latham, 1994; Chan et al., 2004; Pryke, 2009). Cultural changes in the business of DSD actors will produce an effective and efficient supply chain of information flow (SCIf) (Hatmoko and Scott, 2010; Orgen et al, 2011) for the improvement of the DSD activities. Further, DSD actors from different backgrounds of professional autonomy with ‘I-intentions’ or I-goals (Tuomela, 1991; Seebass, 2008) contribute different sub-SCIfs. These are based on separate professional skills constituting a disjoint SCIf – chain of documentation (Edum-Fotwe et al. 2001; Hatmoko and Scott, 2010). The ‘We-intention’ or joint goal have strong improvement potentials instead of the professional autonomy with ‘I-intention” or I-goal (Tuomela, 1991; Seebass, 2008). This improvement potential is heightened and made to involve the use of critical relationship improvement factors such as trust, communication, alignment of objectives, problem solving, etc., causing effectiveness and efficiency in SCIf to improve the DSD activities. The professional DSD practitioners who sustain the SCIf development include Project Managers (PM), Quantity Surveyors (QS), Architects (Arc), Structural Engineers (St Eng), Services Engineers (Ser Eng), Geomatic Engineers (Geo-Eng), Geotechnical Engineers (Geotech Eng), Planners (Pl) and Contractors/organizations (Orgen et al, 2011; 2012a;2012b). However, it is observed that their activities information, completion and sustenance of SCIf are characterized by fragmentation, mistrust, poor communication, non-collaborative working and adversarial business relationship causing discord, disputes and conflicts (DDC) among the DSD actors (Latham, 1994; Egan, 1998; Bresnen and Marshall, 2002; Naoum, 2003; Baiden et al. 2006; Bresnen, 2007; Pryke, 2009; Orgen et al, 2011; 2012a). Besides, some DDC issues involve poorly articulated designs and very late payment for work done without interest (Laryea, 2010). Odusami et al. (2003) also observed that information flows for DSD activities and instructions were uncoordinated due to lack of proper allocation and location of authority amongst the DSD practitioners. As in the research of Collins (1975); Orgen et al, (2012a) people dislike being controlled and thus engage in conflict to avoid it.

Relationship Management is developed from relationship marketing (Gronroos, 2000; Gummesson, 2001; Ford et al. 2003; Smyth, 2008). In this sense, construction marketing involves terms of interaction (Cole and Kelly, 2011) explored for good business (working) relationship among/between individuals or organizations (DSD practitioners and contractors). The objective in studying the (practitioners and contractors) DSD actors business relationship management exploration is to constitute in the DSD construction market a supply chain of information flow (SCIf) – chain of documentation (Gummesson, 2001; Cole and Kelly, 2011) useful for clients’ (customers’) businesses. These interactive business relationship fora among DSD practitioners are on the one hand, to produce and offer SCIf prospects for sale. The DSD practitioners in this sense are sellers of their services to potential customers (clients) (Cole and Kelly, 2011). On the other hand, the contractors complete the supply chain of information flow- chain of documentation by using same in the
Design service delivery

realization of the project delivery. These interactions (exchanges of information) in constituting and using of SCIf in the DSD are therefore between two nodes (DSD practitioners and contractors). These occur in business relationships on the construction supply chains and networks (Pryke, 2009). They are a kind of DSD actors’ business relationship management that should grow through proper research among the DSD practitioners and between them and the contractors. The DSD actors, all in the Design Service Delivery (DSD), are controlled by relationship marketing systems. Indeed, they can contribute through interactions of sharing performance feedback (Mensah, 2007), traditional non adversarial methods/reviews and innovative information as a way of increasing their marketing advantage for effective and efficient SCIf (Titus, 2005; Hatmoko and Scott, 2010) to improve DSD activities. The DSD actors’ business relationship management effort is to develop a framework and models for an effective and efficient SCIf to improve the Design Service Delivery (DSD) activities (Orgen et al., 2011; 2012b). Framework and models that will yield a robust SCIf -chain of documentation, which will produce high quality, prevent cost and time overruns in project Delivery.

It is further observed that a change of ‘mind set’ among the DSD actors (among DSD practitioners and between them and the contractors) is essential (Cheung and Rowlinson, 2005) as it will engender effective concern for other DSD actors or associates. Moreover, it will usher all into win-win-win benefits (PRIkye, 2009). Therefore, in the research it is, evident that in-depth data evolved in each sub system for the SCIf-chain of documentations should follow the common processes and procedures of plan, source, make and deliver ((Yeo and Ning, 2002). This will make standardization of SCIf at various maturity levels easy and assessable. The SCOR model provides indications of the areas essential for DSD actors business relationship management exploration and interaction in the development of the DSD construction market supply chain of information flow (SCIf) for the improvement of the DSD activities. However, the levels of managing and attaining improvement business relationship and continuous improvement in DSD activities depend on maturity growth of the DSD actors. Five maturity levels are identified as traditional adversarial, transitional, short-term, medium-term and long-term maturity periods (Paulk et al., 1993; OGC, 2002; SEI, 2006, 2009; Meng, 2010; Orgen et al., 2012b). These five maturity periods were used in constructing the integrated supply chain relationship framework (Orgen et al., 2012b). To achieve the expected improvement and continuous improvement, apart from developing and maturing in levels, the critical relationship improvement factors are essential part of the attitudinal behaviour of the DSD actors. The factors involved are: Trust (ie confidence) (Kadefors, 2004; Meng, 2010), Communication, Objectives alignment, Development of continuous improvement, Joint problem solving, Procurement, collaboration (Commitment/loyalty/protection) and Risk handling/ allocation (Meng, 2010) Marketing/marketers strategies/skills (Gummesson, 2001; Orgen et al., 2011). No good business relationship can survive without the use of some of the critical relationship improvement factors. For that reason, improvement in the DSD activities is linked to the improvement in business relationships. On the strength of this literature summary, the author is of the view that sufficient evidence is available to show the quest for an effective and efficient chain of documentations in the DSD fragmented businesses. This will then robustly focus on the main aim and objectives of the study which is to improve the DSD activities for the Ghanaian construction market.
CONCEPTUAL MODELS OF DSD ACTIVITIES IMPROVEMENT IN THE RESEARCH

The DSD illustrative improvement assessment model 1 consists of five regions: simple base (baseline), primary, secondary, tertiary and improvement and continuous improvement regions. The simple base region is traditionally non-collaborative, harsh and adversarial in nature with undefined interactive information elements. This region is level 1, where there is little or no exchange or sharing of performance feedback (PFB), traditional non-adversarial methods/review (TM/R) and innovative information (I) to improve SCIf and DSD system, with corresponding rating as in the DSD indicative assessment of model 1. The simple base region seems to be more a closed system than an open system. Also, the illustrative model 1 has four other levels within the remaining four regions. These levels can be used alongside level 1 of the simple base region (traditional adversarial period). These are used to determine in terms of exchange or sharing of performance feedback, traditional non adversarial methods/review and innovative information where a particular construction company or firm or respondent will be placed. The DSD practitioners’ ability in terms of exchange or sharing interactive information elements eg., performance feedback will also be determined. It will then offer useful premises to investigate and assess why there is improvement or no improvement based on the kind of information flowing from (SCIf) cycle of DSD practitioners to contractor/organization and vice versa. Also, the primary region (transitional maturity period) is of three open subsystems making up level 2 in model 1. Each of the open subsystems in level 2 offers one piece of improvement interactive information element only. The secondary region (short-term maturity period) also has three open subsystems making up level 3. Each of the open subsystems in level 3 offers two pieces of improvement interactive information elements only. In addition, the illustrative/indicative model 1 presents a tertiary region (medium-term maturity period) with only one open subsystem making up level 4. The open subsystem in level 4 offers three pieces of improvement interactive information elements only.
Finally, the improvement and continuous improvement region (long-term maturity period) embraces all the open subsystems as level 5. This consists of the primary, secondary and tertiary regions making up level 5 for the finality region of model 1. The five different levels discussed make the DSD system whole and complete. The level 5 is essential in the preservation, stabilization and sustenance of improvement and continuous improvement of the DSD in the long-term maturity period. Also, it is for prevention of DDC through effective use of the critical business relationship improvement factors. In each of these five levels there is at least an exchange and sharing of one of the following information: performance feedback, traditional non-adversarial methods/review and innovative information from SCIf cycle bond of the mechanisms that make the DSD system a system involving the contractor. A strong business relationship cycle is developed using the system theory, thinking and rethinking principles as in the illustrative assessment of model 1.

The effectiveness and efficiency of the SCIf cycle bond is based on voluntary giving up of some professional autonomy by the DSD actors; for a hybrid procurement process of a strong SCIf cycle, through effective use of the critical business relationship improvement factors as shown in the DSD indicative assessment of model 1. The DSD illustrative/indicative model 1 is developed based on the literature, research aim, objectives and key questions to assess improvement performance of the participants.

**RESEARCH APPROACH**

From the understanding gained from relevant literature review, there is the need for interface interaction among the DSD practitioners. Also, it is essential to have regular sustainable interactions between the DSD practitioners and contractors in order to incorporate their previous experiences in developing the SCIf. Furthermore, a multi-theoretical approach which is composed of action oriented system theory, thinking and rethinking offered a lot of different facts and ideas for the development of the model 1. Initially, detail groupings of business relationship issues of similar and dissimilar facts and ideas were gathered. The issues assembled from both the literature and theories mentioned in the multi-theoretical approach that will assist in the assessment were tabulated. Several rearrangements of groupings of the relevant literature facts
and ideas occurred. A critical comparison of the business relationship issues with the action oriented system theory, thinking and rethinking ensued. Further, rearrangement revealed five (5) groupings with linkages that can assist in answering the objectives of the study after data collection as indicated in model 1. The five (5) groupings of the collaborative business relationship issues that will bring effectiveness and efficiency in SCIf were assigned five alphabets: E, D, C, B and A. to rank the levels of collaboration in each region. The alphabet E is the lowest and A the highest of the rankings as shown in the DSD indicative model 1. The main summary in developing the illustrative/indicative model 1, involved the use of the environment, the structure, the components and the mechanism which make the DSD system work as system. From the literature search, it became apparent that the environments for DSD are three: Global, Ghanaian and DSD sub-systems. The structure is identified to be the DSD actors and the components are their respective professions or professional services. It is also realised that the mechanism that will make the DSD system function as a system is the SCIf bond- (chain of documentation). Therefore the model is developed in line with the principles of action oriented system theory, thinking and rethinking (external and internal flow from all other subsystems that make up a particular system whole). There are two parts of model 1; illustrative and indicative. The indicative complements the illustrative by way of offering explanations as to how collaborative business relationship work for improvement of DSD activities would be assessed.

Categorising a particular construction company or firm or respondent will depend on what business relationships maturity it exhibits in an inter-professional working arena in developing the SCIf. This professional maturity level concerns willingness to share information drawn from the Global, Ghanaian and DSD sub-systems environments for the improvement of a particular DSD system. It also includes information sharing among the DSD actors on the non-DDC cycle as in the DSD illustrative model 1. Besides, DSD illustrative model 1 is developed based on system thinking and rethinking for a strong SCIf cycle bond. For proper functioning of the bond among the various DSD practitioners, it is constructed to function as a single chain structure in a DSD system. To achieve the proper function of SCIf bond with all the actors including the contractor requires a mechanism that makes all the DSD actors use and allow free flow or share of all the interactive elements equally among the DSD actors in the DSD system. This involves giving up some amount of professional autonomy in business relationships for inter-professional collaborative work. The focus is on inter-professional collaborative work in strong professional cooperative league with the contractor for his imputes in developing the SCIf and not “classes mate or any other mate.” Where in the collaborative work the critical business relationship improvement factors (CBRIf) in the DSD indicative model 1, are used for the development of the SCIf. Also, one should not overlook business relationships in the procurement used including marketing skills, relationships and strategies of DSD actors. The number of critical business relationship improvement factors shown in the indicative model 1, that are used enhances the openness of the DSD system, depending on the type of procurement and collaborative working in any particular region and corresponding to the maturity period. Therefore, to allow for the use of more interactive elements, a particular region is constructed based on an openness of the DSD system. The three broken arrows pointing upwards to the longest horizontal broken arrow in model 1, is to show that unimaginable few CBRIfs are sometimes used in creating the traditional adversarial period. Contrary to this situation, to move from a lower region where unimaginable few CBRIfs are used; like region 1,
downwards to higher regions like 2, 3, 4 and end in the highest region 5 require continuous openness of the system. In this case, the kind of rankings assigned to a period is based on openness of the region to interactive elements and maturity level of the DSD actors of the DSD system. Also, the number of inflow and outflow of interactive elements for the development’ of the SCIf bond at the interface of DSD practitioners on the non-DDC cycle and the contractor’s position in DSD environment is essential. The contractor’s position in relation to all other circles and intersections from region 1 to 5 as sub-areas in the illustrative model 1, indicates his level of maturity and contributions to DSD practitioners in constituting the SCIf. Therefore, the parts are holistically constructed together for the transformation of the structure (DSD actors) and the components (DSD professions or professional services). In addition, it is to achieve a collaborative business relationship to develop an effective and efficient SCIf bond for the improvement of the DSD system as a whole.

A case study involving the study of a few cases of the different actors on the supply chain of information flow will be purposively targeted for an in-depth study of their business relationships in the fieldwork. Efforts will be made to uncover more variables of interest. As Yin (2003) puts forward that research approach used should show appropriateness to the research purpose and research questions under consideration will be the major focus in the study.

DATA COLLECTION

Selection of appropriate research approaches or strategies for the study

The action plan to follow for the data collection is a mixed method or a combination of quantitative and qualitative approaches. As regards aim of the study and the nature of research questions posed, there is no single research approach that can answer all the questions effectively. A combination of strategies – data triangulation will be useful for some of the research questions posed. This will, in a way, compensate for the weaknesses and strengths of each of the strategies (Vulliamy et al, 1990). Also as the research approaches to be chosen are dependent on the aim or purpose of the study, the type and availability of the information required (Naoum, 2004) call for an understanding of the information to be collected for the research in question. Considering the research questions, which deal with ‘how and what’, qualitative-descriptive nature of data as well as proportional quantification of some variables are necessary. These involve complex interactions and attitudinal behaviour among DSD actors (DSD practitioners/associates and contractors/staff), a systematic study of the topic is important. On the question of seeking proportional quantification and extent (degree) as in the case of the nature and degree which to business relationships affect improvement of DSD is to be devoid of influence or bias. This requires survey approach- questionnaires and interviews strategy as they are objective and epistemological of positivism and ontological realism undertaking, which are value neutral or free in nature (Pathirage et al, 2005). In contrast, looking for the nature, appropriate business relationship and reasons for knowledge, learning and change of mind set would require an in-depth study of small samples producing rich and non-interference research.

A non-probability sample selected through purposive quota non proportional sample will be used for the research. The case study approach will be a most useful strategy in these research circumstances as it is value laden and occupy social constructivism of the epistemological and idealism of the ontological stance (Pathirage et al, 2005).
Finally, the supply chain relationship management framework and models need interventional adjustments after field research in order to realize improvement solutions that will be justifiable. This research approach comes under the domain of social constructivism of the epistemological and idealism of ontological stance (Pathirage et al, 2005). An exploratory research with a problem-solving focus will be helpful for the conceptual DSD improvement framework and model. The research techniques will follow a mixed research approach of using different strategies: case study and survey research. The two strategies are chosen, based on the research aim, questions and objectives.

**PROPOSED CASE STUDY PROCESS**

Case study is considered as a research strategy when a researcher wants to back arguments with an in-depth real life study and analysis. The case study is largely a qualitative research. Three principles have been put forward for data collection which includes multiple sources of evidence, creating a case study database and maintaining a chain of evidence (Yin, 2003). Multiple sources of evidence in case study research basically enables the researcher to consider several relevant data source options such as DSD documents, archival records, interviewing experienced participants, electronically recording data, and direct observation of participants. Several data sources are considered in the research for the improvement of DSD activities in order to achieve data triangulation. This will remove or eliminate problems associated with construct validity (Yin, 2003). Besides, this will be carried out to keep an identifiable research path for the improvement of DSD activities. The method is used to achieve a dependable data collection, database and maintenance of research evidence will be relevant hallmarks of the case history/study approach. In the research in question, the multiple sources of evidence that will predominantly be used include DSD documents in the form of improvement policy documents of the construction firms and companies, interviewing of DSD actors with electronic recording, and visual data collection. Also, there will be direct general observation of DSD activities as well as participants or respondents’ observations in carrying out DSD activities. The case history will seek solutions to the first research objective the ‘nature’ of business relationship culture among EDSD actors. In addition, the data collection for this the first objective will be conducted as historical research. This emanated from research questions which started with ‘What?’ There will be no intervention and so the instrument used is selected to achieve data of no influenced characteristics. The second research objective of finding out principles for developing business relationships among the DSD actors in the traditional procurement practices and the effects on the SCIf for the improvement of the DSD activities arises from ‘what are the effects on SCIf in the improvement of the DSD activities.’ The objective which seeks to look for ‘effects’ can benefit from the use of case study which consider database and more importantly seek chain of evidence for the ‘effects’ of issues relevant to the research.

**CONCLUSION**

There is clear evidence of non-collaborative and adversarial business relationships among DSD actors in the construction industry in Ghana. These construction business relationship problems have negative effects on the improvement of the supply chain of information flow (SCIf) - chain of documentation The seriousness of the situation has drawn back the improvement of the DSD activities as a whole. Under these circumstance, the major focus of the research is to develop a framework for an
effective and efficient information flow within construction supply chains for the improvement of the DSD activities in particular, the exchange of information which will produce effective and efficient SCIf - (chain of documentation) within the DSD that is involved in the traditional procurement practices in Ghana. The literature search and findings have been used to develop a framework which has DSD illustrative/indicative improvement assessment model 1. The model is developed using a multi-theoretical approach, which involves principles of an action oriented system theory, thinking and rethinking. This kind of illustrative/indicative model will assist the assessment of collaborative business relationship and maturity levels of the DSD actors in producing SCIf documents. Methodological efforts put forward in this paper are to provide a path that will aid the field study to gather a reliable data for effective and efficient supply chain of information flow (SCIf) – chain of documentations. This will also help to obtain empirical data that can be depended upon for the improvement of the Design Service Design (DSD) activities. The research methods, approaches and techniques are dependent on the aim, objectives and key questions. The research strategies and the conceptual improvement assessment models are not constant for all Build Environment Research. Efforts made in the construction of the assessment model 1 can be fully determined after the data collection inputs have been keyed in the model for classification and rating. Finally, DSD activities improvement or otherwise can then be determined.

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CONTRACTOR-SUBCONTRACTOR WORKING RELATIONSHIPS: A REVIEW OF TRANSACTION COST ECONOMICS AND RESOURCE-BASED THEORY

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One prominent characteristic of the construction industry is the increased dependence on subcontracting in projects delivery. Different reasons have been assigned to this dramatic rise and the decisions to subcontract. However, current theories offer at least two main explanations for subcontracting: the transaction cost economics and the resource-based view of the firm. Whilst there has been increased utilisation of transaction cost economics in construction literature, little or no use has been made with resource-based theory regarding decisions to subcontract. Through comprehensive review of current literature, this paper identifies key variables of the two theories affecting subcontracting decisions and combines them to propose an integrated conceptual framework to enhance our understanding of subcontracting decisions. It also serves as the basis for empirical study to be carried out.

Keywords: resource-based theory, subcontracting decision, transaction cost economics.

INTRODUCTION

Close working relationships developments have been advocated as central to successful delivery of construction projects and improved performance across organisations in this fast changing environment (Egan, 2002; 1998; Latham, 1994). One prominent characteristic of the construction industry is the increased dependence on subcontracting (Hartmann and Caerteling, 2010; Errasti et al., 2007; Wang and Liu, 2005). The dramatic increase in importance of subcontracting to the industry has been attributed to the strategic responses to the fundamental features of the industry – unpredictable demand, fragmentation, and site-based production coupled with the historical nature of the industry has resulted in difficulty in predicting future work and input requirements (Bankvall et al., 2010). The site-based production has meant that there are uncertainties in the availability of resources in the local environment in which the project is carried out. Significant technological advances in the actual construction processes have added to the problem. Reflecting on these circumstances, the system of subcontracting emerges as response and main contracting organisations establish various forms of relationships with their subcontractors (Ross, 2011; Briscoe and Dainty, 2005).

Main contracting organisations opt for subcontracting for various reasons, and the decision to outsource is one of main research subjects in this field. Current theories offer at least two main explanations for subcontracting; the transaction cost economics

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TCE and the resource-based theory (RBT) (Mclvor, 2009). TCE specifies the conditions under which a firm should manage an economic exchange internally within its boundaries, and the conditions suitable for managing an economic exchange externally (Williamson, 1975, 1985). Conversely, the advocates of the RBT suggest that a firm can be viewed as a bundle of unique resources and relationships (Barney, 1991), and economic exchanges arise when firms need additional resources that cannot be procured through the market transactions. Even though there are other economic theories to account for outsourcing, such as relational contracting theory (Manu et al., 2011), the above two theories are considered the most influential explanations and view subcontracting from two different perspectives (Mclvor, 2009).

To date, research on RBT is generally undertaken in operations management and manufacturing resulting in little or no such research within construction. Nevertheless, there have been many studies on subcontracting using the TCE. Studies using RBT in operation management have shown that superior performances are achieved in organisational activities, which could explain why some activities are carried out in-house within the organisation, and that firms select a strategy that best exploits their capabilities relative to external opportunities (Holcomb and Hitt, 2007). This is a limitation of previous works in construction because they usually consider outsourcing from perspective of TCE (Lee et al., 2009; Eriksson and Laan, 2007; Kale and Arditi, 2001). Although cost minimisation and profit maximisation are still crucial incentives for outsourcing in many contexts, the implications for the long-term capabilities of the firm have to be taken into account. Consequently, there is the need for better understanding of the influence of TCE and the RBT on decisions to subcontract.

The main research question this paper addresses is: how can TCE and RBT combine to better explain the decision whether to outsource or insource and improve performance aspects of the ensued economic relationships? The aim of this paper is to generate new insights into subcontracting decisions through reviewing literature that uses either one or both of the two theoretical perspectives with a view to providing theoretical and practical explanations for decision to subcontract. This could provide the foundation for empirical studies to be carried out and to contribute robust theoretical explanation for decision to subcontract in construction, which can help to improve economic bonds between the main contractors and their subcontractors. The rest of the paper is organised as follows. First, a brief review of prior research in TCE and RBT. Next, forms of contractor-subcontractor working relationships are discussed. This is followed by a discussion of TCE and RBT, their relevance to decisions to subcontract and forms of economic exchange. Integrated TCE and RBT conceptual framework is then proposed. Finally, conclusions are drawn and future work suggested.

PAST STUDIES IN TCE AND RBT

TCE is widely considered to be the most influential attempt to apply an economic theory to the structure of firms (Williamson 1981). It explains firms’ activities in outsourcing. Hennart (1993) shows that the transaction cost framework can provide a unifying paradigm that accounts for the common elements among seemingly unrelated businesses and provide new insights into their complex phenomena. Parker and Hartley (2003) examine the role of transaction costs and the importance of trust in relational contracting in the economics of public private partnerships and private finance initiative and conclude that TCE provides a powerful framework for analysing government procurement policy. Lee et al. (2009) discuss the motivation of
subcontracting and form of relationship from the perspective of TCE, and explain why a particular mode of transaction is chosen over such alternatives as supply contract or spot market relationship. Memili et al. (2011) compare the governance choices of firms regarding their subcontracting tendencies based on TCE framework and argue that firms are less likely to engage in subcontracting if production activities are highly important, and that cost minimisation concerns influence the extent to which firms utilise subcontractors. Ekström et al. (2003) categorise a few key attributes of transaction for subcontracting and relationship developments, which are the specificities of required assets, the degree of uncertainty, the difficulty of performance assessment, and the frequency of transaction. The authors maintain that while outsourcing is closely associated with low-frequency and low-level of uncertainty transactions, close relationships dominate transactions with high asset specificities, and test these explanations with empirical analysis of subcontracting in Architecture Engineering Construction activities.

RBT is used to discuss various elements of outsourcing. It focuses on developing certain capabilities, which in turn has important implications for which activities should be undertaken internally and which should be outsourced (McIvor, 2009). Holcomb and Hitt (2007) analyse rationale for outsourcing and performance aspects of economic exchange with resource characteristics as influencing factors. For example, motivation of subcontracting is affected by mobility, imitability, and substitutability of resources and the form of procurement is selected on based on capabilities. Where internal capabilities are low, the case for outsourcing based on market exchange is high. Whereas, where internal capabilities to carry out an activity efficiently exist, the case for outsourcing is much reduced (Parker and Hartley, 1997). Solesvik and Westhead (2010) observe that a firm may seek to subcontract in order to gain access to the resources and competencies owned by a potential partner. The authors argue that in some cases, a resource deficient firm cannot develop, or is not willing to internally develop required resources and competencies because it may be costly to acquire such resources and competences, and they may be only required for a short period of time. In such instances, outsourcing is the best option. Koza and Lewin (1998) distinguish between motives for outsourcing by firms in a cyclical industry such as construction as both exploitation (reducing the cost of existing resources utilisation) and exploration (innovation resulting in the use of new resources and competences).

There are several studies which examine the above two theories to explain outsourcing in manufacturing and purchasing. In construction literature, however, few or no study comparing the two theories has been uncovered. Therefore, the call to examine the two theories with the view to providing robust theoretical explanations for subcontracting and related working relationships ensued (Ross, 2011).

CONTRACTOR-SUBCONTRACTOR WORKING RELATIONSHIP IN CONSTRUCTION

One prominent characteristic of the construction industry is the increased dependence on subcontracting (Hartmann and Caerteling, 2010; Errasti et al., 2007; Wang and Liu, 2005). As reported by Ng et al. (2009), about 90 per cent of the total value of the actual construction works is carried out by subcontractors whilst the main contractor’s role has been limited to organisational management. Errasti et al. (2007) observe that few firms can claim to have the complete technical expertise, resource base, or investment capital required to fully complete a construction project. As a result, the
decision to sublet work packages or parts of construction process is a vitally important strategic decision for firms in the industry, since virtually no project can be carried out by a single organisation without some degree of subcontracting. The co-existence of subcontracting firms and main contracting organisations therefore suggest that these actors are interdependent (Miller et al., 2002).

In contractor-subcontractor economic exchanges, however, the main contractor usually determines parts of the product or process to be outsourced, select subcontractors, set subcontract agreements, and control the subcontractors during construction. Two main types of exchange can be distinguished: transactional or market-based and the relational or collaborative (Eriksson et al., 2007; Beach et al., 2005). Their theoretical basis originates from TCE (Coase, 1937) and RBT (Penrose, 1959). Errasti et al. (2007) maintain that the increasing complexity of markets makes it difficult for firms to possess all the resources to compete effectively, and economic exchange leads to relational interdependency. Consequently, Parker and Hartley (2003) observe that subcontracting decision with regard to relationship developments becomes either transaction or relation oriented. However, Eriksson et al. (2007) suggest that market-based relationship typically involves non-repeated short-term dealings with a distinct beginning and end. Similarly, Miller et al. (2002) conclude that contractors normally maintain relationship with a variety of different specialists trade contractors and offer sporadic works, matching the skills of the specialist to those required for the successful completion of a construction project. This practice however places very little emphasis on the development of the subcontracting sector in the construction industry. Market-based exchange is the dominant form of working relationship in the construction industry (Dubois and Gadde, 2000). According to Lee et al. (2009), this relationship has been preferred in the construction simply due to the industry’s characteristics including fragmentation and uniqueness of each project (Bankvall et al., 2010). Moreover, the parties, to a large extent, rely on standardised types of contracts that limit the respective responsibilities of the parties (Chiang, 2009). Because contractor-subcontractor relationships are usually formed on a ‘project-to-project’ basis, many uncertainties arise during construction due to seasonality in construction demand, project-specific component activities, and technological advances (Lee et al., 2009).

On the other hand, the primary goal of relational exchange is to improve relationships among parties involved, and to achieve long-term commitment between two or more organisations for the purpose of achieving specific business objectives by maximising the effectiveness of the relationship, either in single project partnerships or in long-term orientation (Beach et al., 2005). In relational exchange, subcontractors undertake more than one construction project or several construction activities at any point in time. In this form of working exchange, the contractor has a degree of certainty of the quality of work. Conversely, the subcontractor gains a degree of certainty concerning job security over a specific time-period. This is especially useful in the planning and optimising the production schedules (Sözen and Kayahan, 2001).

RELEVANCE OF TCE AND RBT ON SUBCONTRACTING

Working exchanges between contractor and subcontractor involve contracting under conditions of imperfect information. The economics of contracting literature is based on transaction costs. Kale and Arditi (2001) suggest the use of “transaction” as a fundamental approach for investigating inter-firm relationships and define the term “transaction” as transferring of resources such as materials or services. The foundation
of TCE is firmly based on bounded rationality and opportunism in human behaviour, the transaction cost approach characterises the transactional environment according to uncertainty, frequency of transactions, and assets-specific (see table 1).

TCE attempts to explain contractor-subcontractor relationship and subcontracting decision through profits maximisation as well as contractors’ strategies to reduce transaction costs and improve construction performance. TCE suggests that firms pursue the minimisation of transaction costs and the maximisation of economic efficiency while organising production activities in the market. According Lee et al. (2009) main contractors’ profits are determined by the price of contracts with subcontractors and project owners. It also includes management efforts to guarantee the quality of work package subcontracted and to finish the project on time and within budget. The motivations for a firm to enter into relationship include solving market failure problems caused by asset specificity (Williamson, 1985).

<table>
<thead>
<tr>
<th>Table 1. TCE assumptions and variables</th>
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<tbody>
<tr>
<td><strong>Factor</strong></td>
</tr>
<tr>
<td>Assumption</td>
</tr>
<tr>
<td>Opportunism</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Uncertainty</td>
</tr>
<tr>
<td>Assets-specific</td>
</tr>
</tbody>
</table>

Adapted from Lee et al. (2009)

The primary transaction cost element that affects the potential for opportunism and, hence, governance decisions is asset specificity. In TCE it is argued that when asset specificity becomes substantial, the terms of relationship will convert from conventional market exchange into small numbers exchange (Williamson, 1975). The hybrid mode (e.g., subcontracting) or internal organisation (hierarchy) is then assumed to replace market governance to safeguard asset specificity (Williamson, 1985), and to handle bilateral dependence (Williamson, 1991). This is determined by the extent to which an organisation finds it more efficient to make or buy a product or service and engage in any form relationship (Williamson, 1981). Six types of asset-specificity have been identified (Williamson, 1985). These include:

- site or location specificity;
- physical asset-specificity;
- human asset-specificity;
brand name capital
dedicated discrete investments asset-specificity; and
temporal specificity.

As observed by Ekström et al. (2003), however, brand name capital and discrete investments are less applicable in construction, while the remaining four types of asset-specificity are common. Asset specificity is particularly relevant to the governance decisions of contracting firms. It is dependent upon both the extent to which work related skills and expertise are specific to a particular firm and the easiness of measuring individual productivity (Williamson, 1981). When asset-specificity is high, one or both parties is “locked into” the transaction. For instance, a typical project in construction comprises layers of subcontractor, and thus, a large number of transactions that involve assets of differing specificities. Where the procurement of a facility (work package) involves little or no asset-specificity, relationship between the buyer and the seller is at an arm’s length basis where the buyer, for each transaction, chooses the supplier with the best trade-off between product, price and availability (Ekström et al., 2003). Conversely, where construction project requires specialised skills, the transaction gives rise to human asset-specificity. In such situation, the buyer and supplier can leverage the lessons learned from working together on one project to the next project. Hence, the main contractor almost invariably employs the same subcontractor repeatedly resulting in what Eccles (1981) refers to as “quasi-firm” or hybrid structure. Furthermore, high asset specificity can determine the importance of business activities. Williamson (1981) maintains that in cases of high asset specificity, both the buyer and the seller prefer exchanges with continuity features. Indeed, close working relationship has empirically been shown to be a very important source for enhancing the quality of products or services (Poppo and Zenger, 2002). Due to the potential impact of these trades on overall project profitability, some main contractors have formed long term relationships as a possible way of reducing the threat of hold-up (Ekström et al., 2003).

Moreover, the decisions to either internalise production or outsource work package are contingent upon behavioural uncertainty regarding opportunism (Williamson, 1985; 1991). In construction, however, each project is unique and construction process has to be adjusted to meet the needs of clients. Related to the above, is the unstable demand which presents the main contractor with uncertainty not only about the amount of future work, but also resources to be employed (Eccles, 1981). According to Arditi and Chotibhongs (2005), the common solution to this problem is to use the system of subcontracting, as it allows flexibility and reduces costs of maintaining fixed assets (Chiang, 2009; Winch, 2001). Thus, main contractors are able to utilise resources at less risks and continue in unpredictable business by means of subcontracting (Hartmann and Caerteling, 2010; Dainty et al., 2001). Additionally, through subcontractors’ quotes, main contractors are able to produce “tailor-made” cost estimates for facility yet to be constructed and hence lower the uncertainties associated with costs not being covered in a bid (Hartmann and Caerteling, 2010).

The contract agreement between the main contractor and subcontractor is usually set by the former. However, these agreements are signed before services provided, which gives rise to contractors having to depend on the “temporally bounded and interdependent services” of subcontractors for their projects delivery success (Hartmann and Caerteling, 2010). Due to contractors’ inability resulting from bounded rationality, they are limited in predicting or assessing precisely before-hand whether
time, cost, and quality targets could be met as well as the quality of subcontractors’ resources, assets and capabilities would meet required standards (Ngowi and Pienaar, 2005). In order to reduce the potential for opportunism and depending on asset-specificity, contractors may adopt the market approach with low asset-specificity trade contractors and assume that they will deliver the utmost performance and abstain from opportunistic behaviour, since displeasing attitude could lead to the loss of future business. Conversely, with high asset-specificity trade contractors the cost of governing transaction through market mechanisms may outweigh the potential flexibility and production cost benefits of subcontracting (Tam et al., 2011; Chiang, 2009).

Although TCE offers a powerful framework for analysing contractor procurement decision, it is not necessarily a sufficient explanation of procurement arrangements (Parker and Hartley, 2003; Dietrich, 1994). Subcontracting decisions may be influenced by internal resource capabilities or competences as well transaction cost (Walker and Weber, 1984). According to Parker and Vaidya (2000) the objective of capability is to reduced production cost whilst trying to maximise relational benefits. Stated differently, outsourcing decisions should be seen not as the result of some “deterministic relationship” based on costs of transaction only, but rather the product of strategic choices taking into consideration both costs and organisations’ internal capabilities and strategic goals (Parker and Hartley, 2003).

Table 2. Assumptions and variables of RBT

<table>
<thead>
<tr>
<th>Factor</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumption</td>
<td>valuable</td>
</tr>
<tr>
<td></td>
<td>Resources and capabilities permit a firm to exploit opportunities and counter</td>
</tr>
<tr>
<td></td>
<td>threats in the business environment</td>
</tr>
<tr>
<td>Variable</td>
<td>rare</td>
</tr>
<tr>
<td></td>
<td>Only when others cannot have access to the resources, can the resources</td>
</tr>
<tr>
<td></td>
<td>bring economic competitive advantages</td>
</tr>
<tr>
<td></td>
<td>Imperfectly imitable</td>
</tr>
<tr>
<td></td>
<td>The other competitors or contractors cannot replicate the resource due to</td>
</tr>
<tr>
<td></td>
<td>complexity of the know-how</td>
</tr>
<tr>
<td></td>
<td>Non-substitutability</td>
</tr>
<tr>
<td></td>
<td>The subcontractor’s skills and capabilities cannot be substituted by others.</td>
</tr>
</tbody>
</table>

Penrose (1959) proposes that the firm organises the use of its own resources together with other resources acquired from outside the firm for the production of goods and services at a profit, and assumes that firms try to increase total long-run profits and want to expand whenever profitable opportunities exist. One immediate opportunity of such is to put resources into use. According to Barney (1991), a resource with the potential to create competitive advantage must meet a number of criteria (see table 2). Resources can be assets, capabilities, and organisational processes that enable a firm to conceive of and implement strategies to improve its efficiency and effectiveness (Watjatrakul, 2005). RBT suggests competencies represent a bundle of tangible and intangible assets and resources that work together to create competitive capabilities. Resources and capabilities are considered valuable if they offer a firm the chance to
exploit its business environment by balancing opportunities with threats (for example, uncertainty and opportunism) (Watjatrakul, 2005).

Based on the assumptions of the RBT, Langlois and Robertson (1995) claim that firm boundaries can be determined by comparing capabilities it’s possess with the external providers’ capabilities. As a result, the decision to subcontract can be affected by the ability of a firm to invest in developing a capability and sustaining an improved performance. Activities in which the organisation has internal capabilities to supply efficiently, the case for outsourcing is much reduced as it gains more advantage from carrying out such activities in-house, rather than sourcing complementary capabilities from external providers.

In line with the preceding discussions, TCE views firms as institutions for organising economic activity and that subcontracting decision centres on costs minimisation. On the other hand, RBT considers firms outsourcing decisions as strategies employ to access external resources in order to maximise long run profit. In other words, TCE assumes that key motivation for working exchange or subcontracting is to economise transaction cost and the inherent source of threat is the opportunistic behaviour of exchange parties, whilst RBT focuses primarily on the long run profit maximisation and production skills with the inherent source of threat is the imitation of resources by parties involved.

INTERACTION BETWEEN TCE AND RBT AND SUBCONTRACTING DECISIONS

In construction, organisations employ subcontracting for various reasons such as achieving performance improvements in the areas of cost, quality and flexibility (Dainty et al., 2001; Ofori and Debrah, 1998). However, Mclvor (2009) contends that the prospect for performance improvements has to be balanced against the prevailing conditions in the supply market. TCE provides a sound theoretical lens to augment this analysis. Apart from being useful in evaluating supplier performance, TCE can increase our understanding of whether it is more efficient for an activity to be undertaken in-house or subcontract (Parker and Hartley, 2003; Kale and Arditi, 2001). With regard to supplier conditions, employing both TCE and the RBT can extend the potential exchange strategies available to an organisation when subcontracting is considered the optimal option. TCE provides an influential theoretical framework for analysing market versus hierarchical mechanisms in the decision to subcontract. Conversely, from the viewpoint of the RBT, inter-firms relationships are the result of strategic resource so as to enable them to access and develop complementary resources (Barney, 1991).

Figure 1 illustrates the argument for combing the two theories when deciding whether it is more appropriate for an activity to be undertaken in-house or outsource. It shows four cases where the main contractor has to decide whether to “make or buy”, with transaction costs/asset specificity on the vertical axis and strategic resources on the horizontal axis.

Where transaction cost/asset-specificity and strategic resources are low, there is potential for outsourcing, since the prevailing conditions in the supply market provide more appropriate resources for the activity production. On the other hand, high transaction cost/asset-specificity and strategic resources suggest that retaining an activity inside the organisation is more appropriate. Under such circumstances, the high transaction cost maybe attributed to the strategic importance of the activity.
involved or because of the instability of ‘lock-in’ resulting from power asymmetries in the supply chain, whilst internal resources to carry out the activity efficiently are available, thus reducing the case for outsourcing (Parker and Hartley, 2003). In other words, main contracting organisations may face high transaction cost in attempting to outsource in such situation. In the other two cases, the decision to either make or buy is not straightforward as transaction costs and strategic resources are not in agreement. Decision will therefore base on relative importance of transaction costs and strategic resources with regard to the activity involved.

<table>
<thead>
<tr>
<th>Strategic Resources</th>
<th>High</th>
<th>Low</th>
</tr>
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<tbody>
<tr>
<td>High-specificity/cost, low-strategic resource</td>
<td>(?)</td>
<td>High-specificity/cost, High-strategic resources (Insourcing)</td>
</tr>
<tr>
<td>Low-specificity/cost, Low-strategic resources (Subcontracting)</td>
<td>(?)</td>
<td>Low-specificity/cost, High-strategic resources</td>
</tr>
</tbody>
</table>

Figure 1: Interaction between transaction cost/asset-specificity and strategic resource in the insource or subcontracting decision (adapted from Parker and Hartley, 2003)

Nevertheless, under some circumstances, the best subcontracting decision on the basis of cost/specificity-strategic resource may be to enter into some form of collaborative working relationships. According to Parker and Hartley (1997) collaborative working exchanges such as partnerships are the middle ground between market-based relationship and vertical integration and act as deterrent to opportunistic behaviour and lock-in situations.

CONCLUSIONS

The rationale of this paper was to critically review literature on TCE and RBT in subcontracting and relationship development context. Especially, it sought to explore how these two theories can be employed to enhance our understanding of subcontracting decisions. First, the main characteristics of type of relationships in construction were examined in the supply relationship context. The diverse relationship and/or subcontracting strategies have essential differences. A distinctive feature among the strategies is their emphasis on cost minimisation, efficiency or maximising the effectiveness of the relationship. Next, literature on both theories was reviewed to establish the key assumptions and variables that may influence subcontracting decision. The interaction between primary variables within the two theories and their effects was demonstrated. Based on this conceptual framework practitioners can identify and categorise their supplier relationships, and thus decide which activities should be insourced or outsourced. Whilst strategic activities should
be internalised using collaborative arrangements, the more straightforward activities can be subcontracted through market-based relationships.

**LIMITATIONS AND FUTURE WORK**

The conceptual framework proposed in this paper describing the key circumstances for deciding whether to subcontract or insource was purely derived from past literature, which has not been empirically tested in the construction industry. As a result, it is acknowledged that industry characteristics may influence it. Subsequently, based on integrating the variables of TCE and the RBT, there is the need to carry out empirical research in a number of organisations that employ subcontracting system.

**REFERENCES**


CORRELATES BETWEEN CONSTRUCTION COMPANY SIZE AND CORPORATE PERFORMANCE: AN EXPLORATORY STUDY

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This paper investigates the correlates between Construction Company’s size in terms of net asset, technical and management skills, human resource, finance, innovation and experience and their corporate performance. The main objective of this paper is to establish among the variables the most significant factors that have greater impact on the corporate performance of firms. The rational for the study is based on the fact that the size of construction companies that enhances their corporate performance is unknown. A descriptive survey method was used with quantitative data gathering using structured questionnaires. A combination of convenience and snowball sampling techniques was used in identifying 35 building and civil engineering construction companies based in three provinces of South Africa and registered in grades 2-6 of the Construction Industry Development Board (cidb) contractor grading register. Multi-attribute methods and rank correlation tests were used in the data analyses. The findings of this exploratory study indicate that there is a negative significant relationship between staff size a key indicator of company size and corporate performance (Return on Total Assets- ROTA) and a positive significant relationship between technical and management skills and corporate performance turnover. Based on these significant findings, it can be concluded that it is not the size of staff that determines the corporate performance but their productivity. Effective and efficient staff as well as good technical management skills of the company will make the construction company more competitive and influence its corporate performance. The findings of this research however will inform construction companies of the requisite construction company size that enhances their competitiveness in the market place which in turns impacts on their corporate performance.

Keywords: capacity, company size, competitiveness, construction company, corporate performance.

INTRODUCTION

The global nature of markets and economic activities has resulted in the increasing complexities of competition among construction companies (Ibrahim, Ibrahim and Kabir, 2009; Korkmaz and Messner, 2008), which has made construction companies to be continuously challenged to meet the needs of society and clients (Sexton and Barrett, 2003). The rational for the examination of the correlates between construction company size and corporate performance is based on the high failure rate of small and

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medium sized construction companies in South Africa on the construction industry development board (CIDB) contractor grading register (Windapo and Cattell, 2011) and on the premise that the impact and extent of construction companies’ size in terms of total asset, technical and management skills, human resource, experience, finance and innovation on overall corporate performance is not known (Coviello, 2005). This paper explores how construction company size may be related to corporate performance within the construction industry. In this paper, Company size can be linked to the capacity of construction companies which is being described by (Zahra and George, 2002), as the acquisition and understanding of new knowledge and the transformation and application of these new ideas in implementation processes (innovation), having adequate human resource team (Russell, 1991), level of technical and managerial skill (Cannon and Hillebrandt 1991), ability to recognize the value of technological innovation and apply it to gain competitive advantage (Cohen and Levinthal 1990), having financial capital (Bakar, 1993), and as an underlying knowledge and experienced based of the firm that enhances technological capabilities (Rush et al., 2007). Company size can therefore be said to include, net asset, technical and managerial skills, human resource (staff size), finance, experience and ability to innovate. Armstrong (2006) described company size in terms of capacity from an operational point of view as a basic measure of performance.

OVERVIEW OF THE RELATIONSHIP BETWEEN CONSTRUCTION COMPANY’S SIZE AND CORPORATE PERFORMANCE

The relationship between construction company’s size and performance has been reported few decades ago to be of significant interest not only to industrial organisational experts, but also to researchers. This has generated a lot of debate on nature of firm structure and its impact on performance (Gooding and Wagner III, 1985). Gooding and Wagner III (1985) posit further that out of all the different organisational structural variables, size is considered the most persistence in terms of the number of studies that suggested relationships with other organizational features. Within construction management research, relationship between construction company size and corporate performance has been extensively documented by several researchers. Company size has been reported in many ways, for example Penman (2001) refers to assets as resources possessed by firms for use in business operations for an economic benefit which resulted from some current or past transactions. Construction company size as noted by Cascio and Ferris et al. (1999) is a function of adequate human resource which impact on organizational performance, including higher productivity, greater cost effectiveness and greater overall efficiency. Companies therefore fail to deliver better or perform because of lack of adequate human resource Morrison et al. (2003). In addition, Hatush and Skitmore (1997), Tam and Harris (1996) refer to technical capacity of firms in terms of buildings, land, plant and equipment for contracting business. Teece et al. (1997) however argued that plant and equipment can be easily bought by any firm and so does not improves its capacity or make it competitive. Dlungwana et al. (2002) however describes technical and management skills as the ability of a firm to release the full potential of its employees through the transfer of knowledge across projects embedded in the capability to enhance continuous growth. Hillebrandt and Cannon (1990) identify technical and management skills as the most significant factor that determine the capacity of construction companies as well as their capability.
Bonaccorsi and Giannangeli (2008) posit that firms’ size can be measured in terms of total number of employees, founders and contract workers in the firm. Knowledge and intellectual capital are also company size variables which are being argued by Lubit (2001) as fundamental bases of competencies and key factor of performance. This implies that the size and age of any business organization have a positive relationship with its survival rates and performance of the firm (Malinen, 2001; Bubshalt and Al-Goball 1996; and Bakar et al., 2011).

Finance in this paper refers to the working capital of the firm which is described by Armstrong (2006) as the amount by which the readily convertible liquid or current asset exceeds its current liabilities which represents the working capital of the company. Financial availability and adequate cash flow of firms enhances their performance (Hillebrandt and Cannon, 1991; and Bakar, 1993) whilst its lack causes companies go to out of business not because they are not profitable but because they are not solvent (Calvert et al., 2003).

(Rush et al., 2007) described innovation as organizational, financial, marketing and technological capacity of a firm as well as to implement significantly new processes, products or management approaches in order to increase its efficiency and skills (Saeden et al., 2003) or successful implementation of creative ideas within an organization (Amabile et al., 1996). Sexton and Barret (2003) perceived innovation to be a significant factor that enhances a firm’s competitive advantage in the changing market and hence impact greatly on their corporate performance. Eaton et al. (2006) and Egbu (2004) noted that technological innovations of firms reduce cost and time which would enhance performance. Firms that invest more resources in innovative capabilities are likely to perform better than less innovative ones (Hitt et al., 1997). Bakar et al. (2011) view corporate performance in terms of the annual turnover of firms as a basis to measure development and growth of the firm. Therefore, the corporate performance of construction companies in this paper is measured using the company size variables such as assets, technical and management skills, human resource, experience, finance and innovation.

COrporate performance is acknowledged as a function of a firm’s competitiveness and capability (De Haan, Voordijk and Joosten, 2002); financial, operational and organizational effectiveness (Man et al., 2002), technical capacity (Hatush and Skitmore, 1997; and Man et al., 2002), profitability or financial gain (Beatham, Anumba, Thorpe and Hedges, 2004; and Norris, 1990), which is the basic goal for running a business (Tam, 2002; Naoum, 2003) and a function of timely delivery (Soetanto, Proverbs and Holt, 2001). Bakar et al. (2011) opined that growth and performance can be measured by the dependent variables of turnover and number of permanent employees of the firm.

Although previous research has validated several factors that influence the corporate performance of firms, however, Man et al. (2002) opined that managerial skills and technical ability are influential factors of performance. Man et al. (2002) further argued that construction company size has a strong relationship with competitiveness, organizational capabilities, entrepreneurial competences and performance. This implies that company size has a very strong link with performance of the firm. Based on the extant literature, a framework of the relationship between company size and corporate performance is conceptualized as shown Figure 1 and equation 1.
research adopts the constructs identified and validated in the literature by previous researchers (Shen et al., 2003; Tan et al., 2007).

**CONCEPTUAL FRAME WORK FOR CONSTRUCTION COMPANY SIZE AND CORPORATE PERFORMANCE**

Figure 1 shows the conceptual framework between company size variables and corporate performance

![Conceptual Framework](image)

**Figure 1**: Conceptual framework for relationship between Company size and corporate performance variables

The relationship between company size and corporate performance variables can be modeled mathematically as: Company Size \( fn \{ TA, TECMAS, STAFFSZ, AGE, CAPSTR, INN \} = \) Corporate Performance \( fn \{ ROTA; ROCE; PM, PBIT, TURNOVER \} \) - where \( fn = \) function – Equation 1

**RESEARCH HYPOTHESIS**

The research hypothesis is proposed to guide the direction of the study.

\( H_A: \) There are significant company size variables that are related to the corporate performance of construction companies in South Africa.

**METHODOLOGY**

The study employs the use of quantitative approach for data gathering through structured and self-administered questionnaires. The complete questionnaire was divided into two sections; work category and designation of respondents and the overall perception of the respondents regarding the elements of Construction Company size that impact corporate performance. Firstly, the respondents were asked to indicate their work category and to rate the factors of construction company size on
a five point Likert-type scale from excellent to very poor (where 1 is Excellent to 5 is very poor).

A purposive but convenient and snowball sampling technique was used for ease of data collection, time and economic purposes (Adams, 1997; Silverman, 2010; Lund Research, 2010 Sampling in this research effort describes a specimen or part of a whole of the population under survey which would reflect the characteristic of the remaining population (Naoum, 2007). The sample size of the study was limited to grade two to six building and civil engineering contractors because these grades of contractors are often used in contractor training and development programmes on government housing projects in South Africa and also form the major contributors to infrastructure delivery in the construction industry. All potential participants were contacted by telephone to invite them to take part in the study. The survey questionnaire was emailed to one hundred (100) participants who agreed to participate in the study. The study was carried out between July and September 2012 (a ten week period) at the end of which 35 valid responses were collected. This represents an overall response rate of 35%. A descriptive and multi-attribute methods and rank correlation was used in analysing the data collected (Chang and Ive, 2002), which is deemed by Mbachu and Nkado (2007) as appropriate for quantitative and qualitative research data and questions. In order to rate the variables of the construction company size; a relative important index was computed with a minimum value of 1, and a maximum value of 5. The perceptions of the respondents interviewed were validated using the Pearson Moment Correlation Coefficient (r). The study scope was limited to the identification of the key variables of construction company size that enhances the corporate performance of companies in the South African construction industry.

RATING OF CONSTRUCTION COMPANIES’ SIZE THAT ENHANCES THEIR CORPORATE PERFORMANCE.

In order to rate the indicators of construction companies’ size that enhances their corporate performance, a relative importance index was computed with a minimum value of 1, and a maximum value of 5 from data obtained on a five point Likert-type scale from respondents perceptions (Table 1). The relative importance index was calculated using the formula (Cheung et al., 2004; Iyer and Jha 2005; Ugwu and Haupt, 2007):

Relative Importance Index (RII) = \frac{5n1+4n2+3n3+2n4+n5}{n1+n2+n3+n4+n5}

Where: n1, n2, n3, n4 and n5 = Excellent, Good, Average, Poor and Very Poor respectively.

Corporate Performance Measurement

This study employs the following variables as measures of corporate performance:

Return on Total Assets (ROTA, %) - This is measured in terms of profit before tax which is expressed as a percentage of the total asset. It is an indicator of both profitability and growth. Calculated as: (Pre Tax Profit/Total asset)*100. (Armstrong, 2006; and Ibrahim et al., 2005).

Return on Capital Employed (ROCE, %) - This is a measure of the profitability and growth of the firm as it measures the effectiveness of the management of the firm. It is defined as the ratio of profit before interest and tax to the total assets less current liabilities. It is calculated as: Profit before Interest (PBIT) and Tax/(Shareholders
Funds + Long Term Loans + Other Long Term Liabilities)*100% or PBIT/TA-CL (Armstrong, 2006).

Profit Margin (PM, %) - According to Ibrahim et.al. (2005), profit margin is referred to as net profit on sales and reflects the degree of competitiveness in the market, the ability to differentiate products, the economic situation and ability to control expenses. It is calculated as: (Profit before interest and Tax/Turnover)*100%.

Profit before interest and tax (PBIT): This is described as the profit inclusive of interest and tax. It is calculated as [(Return on Capital Employed, ROCE)* (Shareholders Funds + Long Term Loans + Other Long Term Liabilities)]/100 or (Profit Margin, PM * Turnover)/100 (Armstrong, 2006).

Turnover (TURN): This is the volume of contract performed by construction companies, usually rated per year of its operation (Armstrong, 2006).

MEASURES OF COMPANY SIZE VARIABLES

Total Asset (TA): This is the fixed Asset plus the Current Asset.

Net Asset (NA): This is the asset excluding liabilities. It is calculated as the Fixed Asset – the Current Asset.

Technical and Management skill (TECMAS): Technical and Management skills is described as the ability of a firm to release the full potential of its employees through the transfer of knowledge across projects embedded in the capability to enhance continuous growth of firms (Dlungwana et al., 2000).

Staff Size: This refers to the permanent employees of the firm within a certain period of time. It is measured by the number of employee on its payroll.

Experience (Age of the firm): This is the number of years the company has operated since its inception in the construction industry.

Finance - Capital Structure (CAPSTRU): refers to the combination of funds, in the form of debt and equity, a firm uses to finance its asset investments of the firm (Muzir, 2011: pg. 87). This is usually controlled by cash position which simply means the amount in cash held by company in its bank account to finance projects. In other words, it’s the company standing capital

Innovation (INN): successful implementation of creative ideas within an organization or the generation, acceptance and implementation of new ideas, processes, products or services (Sexton and Barrett, 2003).

METHOD OF DATA ANALYSIS

The Pearson product moment correlation (r) was used to test the proposed research hypothesis. According to Naoum, (2007) and Oyewobi, et al. (2011), the relationship can be either positive or negative and the strength of it is measured on a scale that varies from +1 through 0 to -1. If the critical value obtained is equal or more than the critical value tabulated, then the null hypothesis proposed will be rejected and vice versa (Naoum, 2007).

FINDINGS AND DISCUSSION OF RESULTS

The data collected in the study are presented in the following sub-sections:
BACKGROUND OF THE RESPONDENTS

The study sought to find out the work category and designation of the respondents used in the study and data collected in this respect were distributed as 62.86% civil engineering contractors, 20% civil engineering and general building contractors, 11.43% general building contractors and 5.71% civil building and mechanical contractors. 57.14% of the respondents were owners, 22.86% directors, 14.29% management staff and 5.71% technical staff.

The respondents are highly placed in the organisations in which they work. This implies that the information provided by this cohort of respondents will be reliable and valid.

Quantitative measures of elements of Construction Company Size and Corporate Performance

This section shows the quantitative measures of construction company size and corporate performance figure 2 and 3

Figure 2: Indicators of Construction companies’ size

Figure 2 shows the cross section of quantitative measures of construction company size variables used in the study. Figure 2 reveals that Firm 13 has the highest technical and management skill of 1500%, whilst Firm 31 has the highest total asset and innovative skills of 436% and 338% respectively.

Figure 3 shows the cross section of quantitative measures of corporate performance used in the study and reveals that Firm 22 has a ROTA of 529%, Firm 18 had the highest ROCE of 1428%; Firm 15 had the highest profit (PM) of 1076% and firm 35 had the highest turnover of 689%.

RESPONDENTS’ PERCEPTION REGARDING CONSTRUCTION COMPANY’S SIZES THAT IMPACT CORPORATE PERFORMANCE.

This study aims at understanding the perception of respondents regarding the elements of Construction Company’s size that impacts on corporate performance. Data collected in this regard is presented in Table 1.
Figure 3: Indicators of corporate performance

Table 1: Respondent’s perception regarding elements of Construction Company size that impacts on corporate performance.

<table>
<thead>
<tr>
<th>Elements of Construction Company Size</th>
<th>Rating of Frequency</th>
<th>Respondents’ Perception</th>
<th>-RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent</td>
<td>Very Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>10 20 5 0 0</td>
<td>4.14 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance</td>
<td>8 20 7 0 0</td>
<td>4.03 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>5 20 9 0 1</td>
<td>3.80 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical and Management skills</td>
<td>8 14 9 4 0</td>
<td>3.74 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Asset</td>
<td>7 17 6 4 1</td>
<td>3.71 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff Size</td>
<td>3 16 7 7 2</td>
<td>3.31 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 indicates that from a ranking perspective, the experience (in terms of age) of the construction firm was ranked first with an RII of 4.14, followed by capital structure/finance of the company with RII of 4.03. It reveals that construction firms long term corporate experience is perceived to impact on corporate performance, followed by the company’s standing capital or money available for running the business.

**RELATIONSHIP BETWEEN CONSTRUCTION COMPANIES’ SIZE AND CORPORATE PERFORMANCE**

Results of the Pearson Product Moment Correlation Analysis computed between the indicators of company size and corporate performance of the responding companies are presented in Table 2.

Pearson Product Moment Correlation analysis was used to validate the perceptions of respondents regarding elements of Construction Company size that impacts on corporate performance and to test the hypothesis of the study that there are significant company size variables that are related to corporate performance of construction companies in South Africa. It emerged from the analyses presented in Table 2 that there is a significant negative relationship between the staff size and corporate
performance (ROTA), with a critical value -0.291* and a significant positive relationship between technical and management skill and corporate performance turnover with a critical value of 0.451**. There are no significant relationships between other indicators of company size in terms of total asset, age, capital structure, net asset, innovation, with corporate performance.

Table 2: Correlates between the factors of construction companies’ size and corporate Performance

<table>
<thead>
<tr>
<th>Corporate Performance Indicators</th>
<th>ROYA</th>
<th>ROCE</th>
<th>PBIT</th>
<th>PM</th>
<th>Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Asset (TA)</td>
<td>-0.235</td>
<td>-0.227</td>
<td>0.264</td>
<td>-0.009</td>
<td>0.239</td>
</tr>
<tr>
<td>technical and management skills</td>
<td>-0.168</td>
<td>-0.158</td>
<td>0.188</td>
<td>-0.111</td>
<td>0.451**</td>
</tr>
<tr>
<td>staff size (STSZ)</td>
<td>-0.291*</td>
<td>-0.218</td>
<td>0.031</td>
<td>0.093</td>
<td>0.132</td>
</tr>
<tr>
<td>Experience (AGE)</td>
<td>-0.049</td>
<td>-0.031</td>
<td>0.099</td>
<td>-0.029</td>
<td>-0.022</td>
</tr>
<tr>
<td>Capital structure (CAPSTRU)</td>
<td>-0.217</td>
<td>-0.240</td>
<td>0.145</td>
<td>-0.001</td>
<td>0.134</td>
</tr>
<tr>
<td>Innovation (INNO)</td>
<td>-0.001</td>
<td>-0.11</td>
<td>-0.100</td>
<td>-0.033</td>
<td>-0.200</td>
</tr>
</tbody>
</table>

** Correlation is Significant at the 0.01 level (1-tailed)
*Correlation is Significant at the 0.05 level (1-tailed)

VALIDITY OF RESEARCH FINDINGS

The perception of respondents regarding the elements of company size that impacts corporate performance were tested by the Pearson Product Moment Correlation Analysis for validity. The respondents ranked experience (age of the company) as first with a relative importance index 4.14 followed by Finance/Capital Structure with a relative important index of 4.03 but this could not be matched by the results from the Pearson Product Moment Correlation. However, the findings of the research conforms to the research done by Cascio and Ferris et al. (1999) which states that Construction company size is a function of adequate and efficient human resource (staff size) which impact on organizational performance, including higher productivity, greater cost effectiveness and greater overall efficiency. Companies therefore fail to deliver better or perform because of lack of adequate or efficient human resource Morrison et al. (2003).

CONCLUSIONS AND FURTHER RESEARCH

This exploratory study provides insights into significant company size variable that impacts on corporate performance of South African construction companies in terms of total assets, technical and management skills, staff size, finance, experience and innovation. The findings suggest that the staff size of the construction companies is negatively correlated with corporate performance (ROTA) as well as the technical and management skill of the company with corporate performance – Turnover. No other
significant relationship was seen between other indicators of company size and corporate performance. The finding of this research effort however reveals that the respondents’ perception regarding the elements of construction company size that impacts corporate performance does not match with the Pearson Product Moment Correlation Analysis computed. The respondents perceived experience (age of the company) followed by finance (standing capital of the company) to be the most significant elements that impacts corporate performance. It can be concluded therefore that the company size variables that impacts corporate performance of most small and medium sized construction companies is unknown. The result of the Pearson Product Moment Correlation shows that corporate performance of construction companies in South Africa lay in well managed, efficient and effective staff and the overall turnover of the company. It follows that no matter a company’s corporate existence and finance based structure, the smaller the staff size and efficient and effective technical and management skills, the more will be its corporate performance.

This research effort reports the pilot study of an on-going research into the impact of construction company size of small and medium sized contractors on their corporate performance. Further research to validate the results obtained in this study using a larger sample size across more provinces of South Africa, will form the basis of future studies.

LIMITATION OF THE RESEARCH

The finding of this research was focussed only on building and civil engineering contractors listed in Grade 2 to 6 on the cidb Contractor Register. The findings of the research will therefore not be generalizable to the total population of small and medium sized contracting companies in South Africa due to the smallness of the sample size and the limited number of provinces surveyed. The findings and conclusions are also limited to the quality of the responses on the salient information relating to the research questions given by the respondents in the study.

ACKNOWLEDGEMENT

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REFERENCES


Tucker et al.


innovations in the construction industry: an examination of critical success factors.


COST OF TENDERING IN GHANA- CLIENT’S PERSPECTIVE

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Tendering can be described as a process by which a contractor is selected in an objective and transparent manner leading to the award of contract. This process comes with a lot of cost to the tenderers and the client. The purpose of this study was to assess the cost of tendering in Ghana focusing on the cost incurred by the clients. A case study approach was adopted in investigating the cost of tender for three entities. Historical records of awarded contracts in three public institutions (tertiary education, local government and tertiary health institutions) were collected in terms of cost of advertisement, tender opening, tender evaluation and approval from relevant tender review boards. The study established that, the clients in these three institution from 2009 to 2012 spent an average of Three Thousand, Six Hundred and Forty-Seven Ghana cedis, One Pesewa (GH¢ 3,647.01) equivalent to $1,879.90 per project which is averagely 0.70% of contract sum.

Keywords: tendering cost, public institutions, tendering stages, Ghana, clients

INTRODUCTION

The selection of contractors to carry out a construction project has been described by many as the most important decision every prospective building owner would take. The success or failure of the project is largely influenced by the level of diligence that is taken to arrive at the decision. This decision is even more important especially where the public funds are used to procure the project. Transparency, non-discrimination and fairness are therefore demanded from public officials entrusted with the responsibility of making this decision for the public at large. In view of the significance of this decision, several steps have evolved over the years, aimed at ensuring that the end product will give the client value for his/her investment. These steps include among other things: solicitation (advertisement), preparation of tender documents, tender opening, evaluation of tenders, seeking approval from relevant agencies and finally awarding the contract to the recommended tenderer. Though the process helps the client to select a tenderer with competitive price and the capacity to perform the contract, it comes with cost to the client. It has been estimated in other jurisdictions especially in the United Kingdom that the expenditure of contractors in tendering for the jobs is 3% of their turnover and consultants spend 20% of their turnover on winning work (Hughes, 2004).

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In Ghana however, though public procurement bill was enacted into law in 2003, procurement researchers have neglected this area and clients are therefore left in the dark as to how much they spend in the selection of contractors to execute their works. Throughout the world construction industry tendering is acknowledged to be complicated, adding considerable cost to construction. The purpose of this study is therefore to ascertain the cost clients incur in Ghana in the selection of contractors.

**LITERATURE REVIEW**

Tendering is defined by Brett (1997) as ‘the production and submission of a tender price for carrying out certain stated building works based on a study of the contract documents’. CIOB (2009) also defined tendering as ‘the process of preparing and submitting for acceptance a conforming offer to carry out work for a price, thus converting the estimate to a bid’. Tendering may also be defined as the common basis for selecting a contractor to execute a construction project.

According to Connaughton (1994) and Hoxley (2000), tendering is a means to an end: usually a means for a contractor to win the right to deliver a construction project. However, tendering could also happen between the interface of contractor and sub-contractor; contractor and supplier, client and consultant, etc. A tender is treated as an offer to do the work for a certain amount of money (firm price), or a certain amount of profit (cost reimbursement or cost plus). The tender which is submitted by the competing firms is generally based on a bill of quantities, a bill of approximate quantities or other specifications which enable the tenderers attain higher levels of accuracy. The above definition suggests that every tendering process should be carried out in an objective and transparent manner leading to the selection of capable contractor who will meet the aspirations of the client.

**Tendering Costs**

Tendering involves a lot of activities and time. The process can be rigorous. Meanwhile, resources are utilized by organizations when tendering and this contributes to the transaction cost. Hughes et al (2001) opined that the costs associated with tendering are observed to be significant, which is estimated as $\frac{1}{2} - 1\%$ of turnover, and $2 - 3\%$ of bid price. Building services contractor’s reported that about $15\%$ of their turnover could not be accounted for due to “unnecessary” tendering processes (Masden et al., 1991). A survey of the cost of tender of a consultancy firm in UK in 1997 revealed that, an amount of £589,600.00 was spent in the processing of 1,802 tender invitations. Further, a total of these costs during the year was £1.085m, but only 10% of the tender responses were successful. This result reinforces the need to monitor the cost of tender both by the client and also the tenderer. In view of the foregoing reports, researchers have decried the wasteful expense of competitive bidding (Pearson 1985, Dawood 1994, Pasquire and Collins 1997) and are therefore looking for a means to curtail the cost spent in the tendering process. Chinyio (2011) argued that the more organizations are involved in bidding exercise the more this cost gets higher. It is therefore important that the goods/services which are procured are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality, quantity, time, and location (Weele, 2010).

There are many time consuming tasks that contribute to the long lead-time of tendering including: internal collaboration among a multi-disciplinary group of people within a single organization (but often geographically distributed), obtaining approvals, preparing the tender specifications and documents, interfacing between
customers and suppliers, interfacing with other companies, third party consultants, partners in a consortium and sub-contractors, assembling accurate bidding documents and calculating prices and time estimations (Brozowski, 2001). Available literature indicates that the cost spent in the selection of contractors still remains unexplored.

The Tendering Process in Ghana.

The public procurement Act, 2003 (Act 663) was enacted into law in 2003. The object of the law as stated in section (2) of the law is to “harmonise the processes of public procurement in the public service to secure a judicious, economic and efficient use of state resources and ensure that it is carried out in a fair, transparent and non-discriminatory manner. To facilitate the attainment of the goals of the law, the Act has established and outlined various structures and processes in line with best international practices. Though the ultimate goal is to safeguard the public purse, some amount of money is required to ensure that the goal of the law is achieved. The various procedures outlined by the law in tendering for a goods, works or consultancy services include solicitation for qualified tenderer, tender opening and evaluation of the tenders. Also the law requires in schedules 2 and 3 that concurrent approval is sought from some review boards depending on the value of the procurement. These boards include; district review boards, regional review boards and the central or ministerial review board.

Clause 47 of the law requires that when procuring through National competitive tendering, the invitation for tenders must be published in two newspapers of wide national circulation. The case of ‘international Competitive Tendering’ requires publication in at least two newspapers of wide international circulation among others. These obviously will require some amount of money to execute. One of the pillars of the law is transparency. In view of this the law outlines in section 56 that tenders are opened in public and in the presence of contractors who chose to attend. Some of the entities have developed a culture of providing some form of snacks for all who attend the tender opening to encourage maximum participation and which will not be done without a cost. After the tender opening, at least three member panel (Manual 4.14) with requisite expertise is constituted by the head of the organization to evaluate the tenders (Section 59) and make recommendation for award by the tender committee. The technical nature of the evaluation sometimes demands that expertise is hired outside the organization or the procurement unit with it accompanying cost of remuneration and refreshment. The appropriate review authority (District, Regional, Ministry or Central Tender Review Board) would review the evaluation report and approve or reject the report with reasons.

This is usually the final stage of the tendering process and most competing firms may be waiting anxiously to know the outcome. The entity usually writes to the firm with the successful tender and requests for confirmation of the accepted offer and provision of performance security.

These processes as outlined in the law would require some money to carry out which could be high if the client is fond of canceling tendering process.

RESEARCH METHODS

Case study approach was adopted in the investigation of the major research question i.e. how much does the client in Ghana spend in the selection of contractors for the execution of construction project? Three public institutions were purposively selected for this study. These are; Tertiary education institution, Health institution and Local
Government institution (District Assembly) all in the Ashanti Region of Ghana. For the purposes of anonymity, the names of the entities have been withheld. The selection of the three institutions was based on the fact that, these entities are within the three sectors where Government invest heavily in infrastructure i.e. education, health and local government. Data on the various cost required were obtained from procurement officers, director of finance and works superintendents in these institutions. The respondents were required to provide a historical data on awarded works contracts which were procured through the competitive bidding procedure from 2009 to 2012 in order to ensure that the data is current. The data collected include: date of tender, whether tender was advertised or not, the cost of advertisement, amount spent on tender opening, tender evaluation, tender committee and seeking for approval from appropriate authorities.

The data was analysed using descriptive statistics. The means, standard deviations and coefficient of variation (COV) were also determined to aid in measuring the variability of the data collected in the three institutions.

The standard deviation is the most common measure of variability, measuring the spread of the data set and the relationship of the mean to the rest of the data. However, the standard deviation alone is not particularly useful without a context within which one can determine meaning. By calculating how the standard deviation relates to the mean, otherwise known as the coefficient of variation (COV), this will have a more uniform method of determining the relevance of the standard deviation and what it indicates about the responses of the sample. The closer the COV is to 0, the greater the uniformity of data. The closer the COV is to 100%, the greater the variability of the data. The coefficient of variation (COV) expresses the standard deviation as a percentage of the mean, and it is useful in comparing relative variability of different responses (Elhag and Boussabaine, 1998). Its value is computed using equation 1.

\[
\text{COV} = \frac{S}{M} \times 100\% \quad \text{----- Eqn. (1)}
\]

Where COV stands for coefficient of variation, \(S\) the standard deviation and \(M\) the weighted mean of sample.

**DISCUSSIONS OF RESULTS**

Data set of thirty-nine (39) projects were collected from the three case study organizations. Data on 25 projects were collected from the local government institution (case study area A), 8 projects from the tertiary education institution (case study area B) and 6 projects from the health institution (case study area C).

**Determination of Cost of Tender**

In determining the cost of tender, the costs at various stages of the tendering process were aggregated. The following equations (2 – 5) were used for the computation of the cost of tender:

\[
\begin{align*}
\text{CT}_1 &= AC_1 + TOC_1 + TEC_1 + ETCC_1 + SCAC_1 + \text{CT}_1 \\
\text{CT}_2 &= AC_2 + TOC_2 + TEC_2 + ETCC_2 + SCAC_2 \\
\text{CT}_3 &= AC_3 + TOC_3 + TEC_3 + ETCC_3 + SCAC_3
\end{align*}
\]

Where,

CT = Cost of Tender of individual projects
The results revealed that the cost at tender evaluation stage represented an average of 29% of the tender for the 39 projects surveyed. Advertisement cost was the second highest stage representing 27%; Cost of seeking concurrent approval from the appropriate tender review board contributed about 22%; Tender Entity committee,
22% and the least being tender opening, 5%. The contribution of various stages to the Tender Cost is represented in figure 1.

![Figure 1: Average tendering cost at each stage](image)

Table 2: Cost of tendering at each stage of the tendering process for case study area 'B'

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>ADVERT. COST (GH₵) (AC₂)</th>
<th>TENDER OPENING COST (GH₵) (TOC₂)</th>
<th>EVALUATION COST (GH₵) (TEC₂)</th>
<th>ENTITY TENDER COMMITTEE COST (GH₵) (ETCC₂)</th>
<th>SEEKING CONCURRENT APPROVAL COST (GH₵) (SCAC₂)</th>
<th>TOTAL COST (CT₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>1,300.00</td>
<td>200.00</td>
<td>1,750.00</td>
<td>1,100.00</td>
<td>1,450.00</td>
<td>5,800.00</td>
</tr>
<tr>
<td>Project 2</td>
<td>1,300.00</td>
<td>200.00</td>
<td>1,750.00</td>
<td>1,100.00</td>
<td>1,450.00</td>
<td>5,800.00</td>
</tr>
<tr>
<td>Project 3</td>
<td>1,200.00</td>
<td>100.00</td>
<td>480.00</td>
<td>900.00</td>
<td>500.00</td>
<td>3,240.00</td>
</tr>
<tr>
<td>Project 4</td>
<td>570.00*</td>
<td>175.00</td>
<td>1,400.00</td>
<td>1,100.00</td>
<td>1,400.00</td>
<td>4,295.00</td>
</tr>
<tr>
<td>Project 5</td>
<td>1,200.00</td>
<td>150.00</td>
<td>1,200.00</td>
<td>1,100.00</td>
<td>600.00</td>
<td>3,950.00</td>
</tr>
<tr>
<td>Project 6</td>
<td>1,200.00</td>
<td>150.00</td>
<td>1,200.00</td>
<td>1,100.00</td>
<td>1,400.00</td>
<td>4,750.00</td>
</tr>
<tr>
<td>Project 7</td>
<td>1,200.00</td>
<td>150.00</td>
<td>1,200.00</td>
<td>1,100.00</td>
<td>1,400.00</td>
<td>4,750.00</td>
</tr>
<tr>
<td>Project 8</td>
<td>1,300.00</td>
<td>200.00</td>
<td>400.00</td>
<td>1,100.00</td>
<td>1,450.00</td>
<td>5,250</td>
</tr>
<tr>
<td>AVERAGE COST</td>
<td>1,158.75</td>
<td>168.75</td>
<td>1,235.00</td>
<td>1,075.00</td>
<td>1,206.25</td>
<td>4,732.50</td>
</tr>
</tbody>
</table>

(Source: authors field survey 2013) * the cost of advertising in one newspaper as against advertising in two newspapers

Table 3: Cost of tendering at each stage of the tendering process for case study area 'C'

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>ADVERT. COST (GH₵) (AC₃)</th>
<th>TENDER OPENING COST (GH₵) (TOC₃)</th>
<th>EVALUATION COST (GH₵) (TEC₃)</th>
<th>ENTITY TENDER COMMITTEE COST (GH₵) (ETCC₃)</th>
<th>SEEKING CONCURRENT APPROVAL COST (GH₵) (SCAC₃)</th>
<th>TOTAL COST (CT₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>1,200.00</td>
<td>200.00</td>
<td>400.00</td>
<td>200.00</td>
<td>400.00</td>
<td>2,400.00</td>
</tr>
<tr>
<td>Project 2</td>
<td>1,400.00</td>
<td>200.00</td>
<td>240.00</td>
<td>500.00</td>
<td>400.00</td>
<td>2,740.00</td>
</tr>
<tr>
<td>Project 3</td>
<td>1,600.00</td>
<td>288.00</td>
<td>252.00</td>
<td>360.00</td>
<td>1,100.00</td>
<td>3,600.00</td>
</tr>
<tr>
<td>Project 4</td>
<td>1,200.00</td>
<td>288.00</td>
<td>200.00</td>
<td>500.00</td>
<td>1,100.00</td>
<td>3,288.00</td>
</tr>
<tr>
<td>Project 5</td>
<td>1,000.00</td>
<td>200.00</td>
<td>200.00</td>
<td>500.00</td>
<td>400.00</td>
<td>2,300.00</td>
</tr>
<tr>
<td>Project 6</td>
<td>1,200.00</td>
<td>250.00</td>
<td>216.00</td>
<td>500.00</td>
<td>400.00</td>
<td>2,566.00</td>
</tr>
<tr>
<td>AVERAGE COST</td>
<td>1,266.67</td>
<td>237.67</td>
<td>251.33</td>
<td>426.67</td>
<td>633.33</td>
<td>2,657.33</td>
</tr>
</tbody>
</table>
Computing the aggregated cost of tender using equation 5 \[ (CT_a = \frac{CT_1 + CT_2 + CT_3}{3}) \] gave an amount of Three Thousand, Six Hundred and Forty-Seven Ghana cedis, One Pesewa (GH¢ 3,647.01) equivalent to US$ $1,879.90 per every tender a client undertook. This figure translates to 0.70% of the average recommended tender figure of GH¢ 528,216.96.

Table 4: Results of cost of tendering

<table>
<thead>
<tr>
<th>Item</th>
<th>Stages of tendering process</th>
<th>Local government (ct₁)</th>
<th>Tertiary institution (ct₂)</th>
<th>Health institution (ct₃)</th>
<th>Average cost at each stage (ctₐ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost of advertisement</td>
<td>506.20</td>
<td>1158.75</td>
<td>1,266.67</td>
<td>977.21</td>
</tr>
<tr>
<td>2</td>
<td>Cost at tender opening</td>
<td>186.20</td>
<td>168.75</td>
<td>237.67</td>
<td>197.54</td>
</tr>
<tr>
<td>3</td>
<td>Cost of evaluation</td>
<td>1,702.00</td>
<td>1,235.00</td>
<td>251.33</td>
<td>1062.78</td>
</tr>
<tr>
<td>4</td>
<td>Cost on entity tender committee</td>
<td>349.20</td>
<td>1075.00</td>
<td>426.67</td>
<td>616.96</td>
</tr>
<tr>
<td>5</td>
<td>Tender review board</td>
<td>538.00</td>
<td>1206.25</td>
<td>633.33</td>
<td>792.53</td>
</tr>
<tr>
<td></td>
<td>Cost of tendering at entities (ct₁₋₃)</td>
<td>3,281.60</td>
<td>4,843.75</td>
<td>2815.67</td>
<td>3647.01</td>
</tr>
<tr>
<td></td>
<td>Cost of tendering to the client per project (GH¢) (ctₐ)</td>
<td>3,647.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical results shown in tables 5 and 6 indicate that variation of responses regarding the amount spent at each stage of the tendering process within each organization and across organizations is relatively high, as indicated by the coefficient of variation. This is an indication that there is generally no uniformity between the organizations as to how much is spent at each stage of the procurement process. The allowances paid to evaluation panel, tender committee and review boards are not standardized in most public institutions in the country.

The results from the analysis shown in table 5 reveals that the cost at tender opening had the greatest uniformity across the three case study areas recording COV of 18%. This was followed by Cost of Advertisement, Tender Review Board, Cost on Entity Tender Committee and cost of Evaluation with 42.11%, 45.61%, 64.60% and 69.68% COV respectively.

CONCLUSION

The cost of tendering for works contracts in Ghana was determined using three case study areas in the Ashanti Region of Ghana. The study presented and discussed costs at various stages of the tendering process. It was found that, evaluation stage is the most costly stage of the tendering process. Also, the cost of tender for works contracts will cost client an amount of approximately 0.7% of the successful tenderer’s bid.

(Source: authors field survey 2013)
price. The study further established that the costs at various stages of the process is not uniform and need to be standardized.

Table 5: Results on coefficient of variation (COV) from three case study areas

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Stages of tendering process</th>
<th>Local government (a)</th>
<th>Tertiary institution (b)</th>
<th>Health institution (c)</th>
<th>Mean of mean</th>
<th>Sd of mean</th>
<th>Cov (sd/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost of advertisement</td>
<td>506.2</td>
<td>248.5</td>
<td>1158.8</td>
<td>243.0</td>
<td>1,266.7</td>
<td>206.6</td>
</tr>
<tr>
<td>2</td>
<td>Cost at tender opening</td>
<td>186.2</td>
<td>99.4</td>
<td>168.8</td>
<td>34.7</td>
<td>237.7</td>
<td>43.5</td>
</tr>
<tr>
<td>3</td>
<td>Cost of evaluation</td>
<td>1,702.0</td>
<td>273.3</td>
<td>1,235.0</td>
<td>428.7</td>
<td>251.3</td>
<td>75.8</td>
</tr>
<tr>
<td>4</td>
<td>Cost on entity tender committee</td>
<td>349.2</td>
<td>82.9</td>
<td>1,075.0</td>
<td>70.7</td>
<td>426.7</td>
<td>124.5</td>
</tr>
<tr>
<td>5</td>
<td>Tender review board</td>
<td>538.0</td>
<td>200.2</td>
<td>1,206.3</td>
<td>406.6</td>
<td>633.3</td>
<td>361.5</td>
</tr>
</tbody>
</table>

Table 6: Coefficient of variation (CV) within organizations

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Stages of tendering process</th>
<th>Local government (a)</th>
<th>Tertiary institution (b)</th>
<th>Health institution (c)</th>
<th>Mean of mean</th>
<th>Sd of mean</th>
<th>Cov (sd/m)</th>
</tr>
</thead>
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<tr>
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<td>1,235.0</td>
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<td>Cost on entity tender committee</td>
<td>349.2</td>
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<td>70.7</td>
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<tr>
<td>5</td>
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<td>406.6</td>
<td>633.3</td>
<td>361.5</td>
</tr>
</tbody>
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CULTURAL EXPRESSION AND SUSTAINABLE DESIGN OF RESORTS IN NIGERIA

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Culture is one of the pillars of sustainable design and plays a major role in resort design at many locations. It stands as an interface between the tourists who are its consumers, and the locals, to whom it is a way of life. Many resort designers in Nigeria have at the least attempted to interpret and reflect local culture in a symbolic manner. It is in this light that this paper examines various attempts at reflecting local culture in resort design in Nigeria. This was based on purposive and illustrative selection of cases, visual surveys/ descriptive analysis and interviews. The result shows the existence of some common features in attempts at expressing culture. These include; cylindrical buildings with conical roofs, use or representation of local materials, and the use of art and crafts, ornaments and decorations. In most cases however, these were sparingly applied and limited to a number of buildings within the resort. One of the key limitations raised by respondents was that local building traditions could not offer tourists the required level of comfort. This calls for more research, innovation and creativity in harnessing rich local cultural heritage of host communities in order to offer tourists richer experience in resorts.

Keywords: culture, expression, identity, resorts, sustainable design, tourism.

INTRODUCTION

The importance of culture to sustainable resort design cannot be overemphasized. Sustainable design aims at harmony with community, local culture and place. This is of greater importance to destinations such as Nigeria with high level of cultural diversity, and which offers predominantly cultural tourism products. In line with this, Government of the Federal Republic of Nigeria et al (2006) identified cultural heritage as strategic elements in the Nigerian tourism product, and recommended the development of distinctive facilities for the promotion of tourism. A number of studies have drawn attention to the need to preserve the cultural heritage of tourism destinations (Fleming and Campbell, 2005; Akagawa and Tiamsoon, 2005). These studies were mostly rooted in the level of degradation and loss of cultural identity which resulted from the uncontrolled or poorly planned activities of the tourism industry. This confrontation has led to the disappearance of many tangible and intangible cultural characteristics and has placed others on the endangered list (Akagawa and Tiamsoon, 2005). Maintenance and conservation of cultural identity is essential in sustainable design of resorts. In many instances however, cultural sustainability is in not given adequate consideration in tourism facilities design. The result of this is multiplicity in identities (Nguyen, 2007). In order to avert this, Beyer et al (2005)

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advocated that the development of resorts be based on a cross-cultural participatory design process that embraces indigenous cultural interests in the site and surrounding country and aims to ensure cultural security, sensitivity and integrity in a process of partnership. It is in this light that this paper examines various attempts at reflecting local culture in resort design in Nigeria. The objectives of the paper are:

To conduct a review of the concept of culture and its relationship to resort design;

To conduct a descriptive analysis of reflections of local culture in selected resorts in Nigeria.

THE CONCEPT AND DIMENSIONS OF CULTURE

Culture consists of shared and enduring meaning, values, and beliefs that characterize certain groups and orient their behaviour (Mulholland, 1991). A number of authors classified culture into two dimensions. These include: Material and non-material culture (Woodward, 2007); tangible and intangible culture (Denver Service Centre, 2009); culture as a product of society and culture as a force that steers society (Smith & Riley, 2011); and, Subjective and objective culture (The Concept of Culture, 2013).

Subjective culture is viewed as something intangible or non-material. This includes: family life, myth, folklore, ideology, folk song, and folk dance are renewable and transmitted from generation to generation among others (Denver Service Centre, 2009; The Concept of Culture, 2013). Objective culture on the other hand is created by individuals and consists of the man-made environment and can include everything that people have created (The Concept of Culture, 2013). This includes: Sites, structures, districts, landscapes, objects, and historic documents, and also plants, animals, and other natural resources culturally defined as food, manufacturing, and ceremonial items; and naturally occurring or designated physical features, such as caves, mountain peaks, forest clearings, dance grounds, village sites, and trails, regarded as the sacred homes of deities, spirits, ancestors, and/or places of worship and ceremony (Denver Service Centre, 2009).

CULTURE, IDENTITY AND ARCHITECTURAL DESIGN

The built environment is at the very heart of the identity of a community. It reflects the lifestyle, social organisation, artistic practices, and the architectural adaptation to cultural and religious factors (WTO, 2005). Architecture is part of the built environment and serves as a means of communicating information, and encoding value systems, therefore, architectural design must respond to culture and cultural identity (Rapoport, 2005).

Mahgroub (2007) listed the three dimensions of identity to be: time, place and culture. Tomlimson (2003) described cultural identity as an inheritance, a benefit of traditional long dwelling of continuity, a collective treasure of local communities. Castells (2004) provided a basis for the understanding the reflections of cultural identity in architecture. The study noted that identities may be generated for cultural survival, to withstand social, religious, territorial and linguistic domination. This feeling of encroachment of domination may lead local ethnic people to seek reference points for identity in their physical surroundings (Howard, 2006). In such cases, architects may attempt to resist the invasion of the modern style by ordering visual impression using elements of local culture in their design.
CULTURE AND RESORT DESIGN

Culture is one of the key tourism resources and a core element of the tourist product offered by many destinations. It is also a key motivation for travel (Robinson & Picard, 2006), with the desire being to experiences both relics from the past and the contemporary life and society of others. Mai (2007) submitted that tourism facilities should take into account and enhance the cultural resources of their host community, hence accomplishing a vital part of sustainability in tourism. Similarly, Rashed and Kamal (2005) advocated that tourist facilities should express the local environment with its physical, urban, environmental and moral values in order to enhance the tourist’s experience of local culture and comply with the principles of sustainability. In line with this, Jimoh (2005) recommended the promulgation of regulations that will ensure the adoption of traditional architectural elements and motifs in the design of tourism facilities. Huffadine (2000) recommended the assimilation of local customs and heritage with the function of resorts. Sothern Australia Tourism Commission (SATC, 2000) called for the reflection of community values in tourism developments and recommended that architectural style, landscape design, and construction materials of new developments should reflect the cultural heritage of the locality or region. This includes the encouragement of the use of local knowledge, skills and traditions, and the promotion of tourist activities and behaviours which are respectful of cultural activities, sites and values, designs which are compatible with national and local heritage and character and should foster the community’s identity (ibid).

METHODOLOGY

The International Committee on Monuments and Sites (ICOMOS), 2010) listed the means of understanding cultural heritage to include; consultation with connected people, and physical investigation. This study was therefore based on two methods of data collection – visual (physical) survey and interviews.

Field studies were conducted at Suntan beach resort, Lagos state, Saminaka resort, Kaduna state, Trappco ranch and resort, Kaduna state, and La Champagne Tropicana beach resort, Lagos state, and Argungu fishing village, Kebbi state, all in Nigeria. These cases were selected purposively and illustratively based on reconnaissance and archival surveys. The reconnaissance and archival surveys provided an overview of resorts in Nigeria and a sampling frame which aided the selection of resorts which exhibit some elements of Nigerian cultural heritage. One managerial staff was interviewed at each resort on the background and significance of identified cultural elements. The result from this study is not meant for generalisation but to describe and illustrate. The collected data was subjected to descriptive and content analysis. The study focused on the following aspects:

Interpretation and expression of local architectural heritage;
Use of indigenous building materials;
Use of local arts, crafts, ornaments and decorations;
Use of indigenous skills and construction techniques; and,
Reflection of local lifestyle and cultural activities.

RESULT

Interpretation and Expression of Local Architectural Heritage

One of the key methods used to express culture in the surveyed resorts is through building form. This is reflected, in most cases in the introduction of curvilinear hut-like buildings with conical roofs. This was predominantly used for accommodation units and gazebos as can be seen in the chalets at Suntan beach resort, Badagry,
Lagos, La Champagne Tropicana beach resort, Lagos, Saminaka resort, Kaduna, and, Argungu fishing village, Kebbi state among others (Plates 1 to 4). At Suntan beach resort, La Champagne Tropicana, and Argungu fishing village, accommodation units were grouped into clusters to express a village setting. In the case of La Champagne Tropicana, the buildings were in clusters of five, with some of the huts raised on silts.

![Plate 1: Chalet at Suntan beach resort, Lagos.](image1)

![Plate 2: Relaxation space at Saminaka resort, Kaduna state.](image2)

![Plate 3: Reception hall at La Champagne Tropicana fishing village, beach resort, Lagos.](image3)

![Plate 4: Chalets at Argungu Kebbi state.](image4)

**Use of Indigenous Building Materials**

Mud bricks, and thatch produced from various types of plant materials was used in most of the surveyed resorts. The chalets at La Champagne Tropicana beach resort, Lagos are made up of a combination of red mud bricks used for walls, wood and glass used for the window sills (Plate 5). Bamboo was used for walls and columns in some structures such as the massage room and open stages. Some of the roofs are made of well treated thatch. At Sun tan beach resort, thatch was used for beach-front pagodas (Plate 6). At Trappco ranch and resort, earthen bricks were used for walls and arches in the restaurant (Plate 7), and for arches and facing of some walls of the chalets. In the same resort, thatch was used for the gate house (Plate 8) and also laid over corrugated zinc roofing sheets in most of the other buildings.

**Use of Local Arts, Crafts, Ornaments and Decorations**

At La Champagne Tropicana, one of the accommodation types ‘Labalaba’- meaning butterfly - was furnished in Yoruba style, the ‘Obieze’ was furnished in Igbo style while the ‘Kodi’ – meaning shell- shows the traditional Hausa decoration of Northern Nigeria. Local arts, crafts and ornaments used in the studied resorts include cane furniture, pottery products, mats, murals, wall decorations and artworks. These were
Sustainable design

clearly evident at Trappco ranch and resort where decorations on steel beds were symbolic to Northern Nigeria. Also, half clay pots were used as lamp holders, cane furniture and wall decorations were widely used. At Saminaka resort, murals were painted on the fence walls reflecting local cultural activities (Plate 11), while at Argungu, these were painted in the cultural and dancing arena among others.

Plate 5: Thatch and mud at La Champagne
Tropicana Beach Resort, Lagos.

Plate 6: Pagodas at suntan beach resort, Lagos.

Plate 7: Mud bricks at Trappco ranch and resort, Kaduna.

Plate 8: Thatched structure as gate at Trappco, ranch and resort, Kaduna.

Plate 9: Symbolic Northern Nigerian decoration, At Trappco ranch and resort, Kaduna.

Plate 10: Cane furniture at Trappco, ranch and resort, Kaduna
Use of Indigenous Skills and Construction Techniques

Skills and techniques for construction of mud walls and thatch roofs are common in most cultures of Nigeria. This was applied in some elements in the surveyed resorts. (See plates 2, 5, 6, 7, 8 and 12). These show timber roof structures tied with bush ropes, with thatch roofs, and mud brick masonry of walls and arches.

Plate 11: Murals at Saminaka resort, Kaduna. Plate 12: Mud bricks and timber roof at Trappco ranch and resort, Kaduna.

Reflection of Local Lifestyle and Cultural Activities

Most of the surveyed resorts provided for one or more activity based on local culture. The design of La Champagne Tropicana made provision for open stages used for cultural dances and other live performances. There was also the incorporation of canoeing as part of the recreational activities since fishing was a major occupation of the local community. At Argungu fishing village most of the activities were based on local culture. An example of this can be seen in the provision of an arena for traditional wrestling and cultural dances. At Trappco ranch and resort provision was made for polo which was a sport for elites in Northern Nigeria.


Interview Result

Interviews conducted at the resorts provided insights on the cultural significance of elements used in their design. Interview responses at Suntan beach resort revealed that the use of round huts was meant to reflect the indigenous architecture of many regions of Nigeria. In the case of Saminaka resort, the environment was largely based on Western culture. However, open sheds (relaxation spaces) with thatch roofs were
introduced to reflect local culture. In the case of Trappco ranch and resort, the design was described by the respondent as a combination of various Nigerian cultural elements with western culture. The Hausa culture was reflected in the recreational activities and the use of mud facing and arches on the building envelope. Other Nigerian cultures were reflected in the interior through the use of cane furniture, Aso-oke and tie and dye (popular Nigerian fabric) for curtains and bed sheets. In the case of La Champagne Tropicana resort, Provision of accommodation in clusters was meant to reflect village settings. Some of the huts were raised on silts in line with the architectural characteristics of many waterfront communities in Lagos state of Nigeria. Also, the use of round mud huts with conical and thatch roofs were all attempts at reflecting local culture. Local activities such as canoeing was introduced since a sizable proportion of the local population were fishermen. At Argungu fishing village the respondent submitted that the key tourism attraction of the destination was local culture, and should be reinforced through creation of appropriate setting for fullness of experience. Furthermore, the respondent emphasised the fact that the destination was endowed with rich architectural heritage which should be showcased to the visitors - "tourist expects to see traditional architecture when they come to the site". Some of the buildings such as the round huts for accommodation were designed to reflect a village setting in Northern Nigeria. Also, adequate spaces were provided for local cultural activities. Most of the respondents however noted that resorts could not be fully based on local culture since the indigenous architecture will not provide adequate comfort for tourists. Table 1 below gives a summary or findings from the interviews.

<table>
<thead>
<tr>
<th>Resort</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suntan beach</td>
<td>- Use of round huts was meant to reflect the indigenous architecture of many regions of Nigeria.</td>
</tr>
<tr>
<td>Saminaka resort</td>
<td>- Round huts with thatch roofs to reflect local building.</td>
</tr>
<tr>
<td>Trappco ranch and resort</td>
<td>- Combination of various Nigerian cultural elements with western culture;</td>
</tr>
<tr>
<td></td>
<td>- Local culture was reflected in recreational activities and building materials;</td>
</tr>
<tr>
<td></td>
<td>- Various Nigerian cultures were reflected in the interior furnishing.</td>
</tr>
<tr>
<td>La Champagne Tropicana</td>
<td>- Accommodation clusters to reflect village setting;</td>
</tr>
<tr>
<td></td>
<td>- Round huts to reflect local buildings;</td>
</tr>
<tr>
<td></td>
<td>- Huts raised on silts in line with the architectural characteristics of waterfront communities in Lagos state of Nigeria;</td>
</tr>
<tr>
<td></td>
<td>- Rooms were furnished bas on the three predominant cultures in Nigeria;</td>
</tr>
<tr>
<td></td>
<td>- Canoeing was introduced since fishing was a local occupation.</td>
</tr>
<tr>
<td>Argungu</td>
<td>- Spaces were provided for local cultural activities;</td>
</tr>
<tr>
<td></td>
<td>- Tourists want to see indigenous design;</td>
</tr>
<tr>
<td></td>
<td>- Round huts for accommodation was designed to reflect a village setting in Northern Nigeria.</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Attempts at reflecting indigenous culture in the surveyed tourism facilities in Nigeria can be classified into four. These are:

- The reflection of local building forms;
- The use of local materials and skills;
- The use of local furnishing and ornaments;
- The introduction of local cultural activities.
Perhaps the most common is the use of round-huts with conical roofs. This is attributed to the fact that round huts are a common feature of many Nigerian cultures. In terms of building materials, mud bricks are a common material for walls while the conical roofs were either of thatch, corrugated roofing sheets or a combination of both. However, these features were reflected in only a few buildings within the resorts, usually relaxation spaces or pagodas and some accommodation units and eating spaces. Provision of a number of recreational activities based on local culture was also prevalent. Other reflections such as the use of art and crafts, ornaments and decorations were sparingly applied. All these reflections are however limited to sparingly applying elements of local culture on contemporarily styled buildings, and the selection of a few buildings within resort complexes for the expression of local culture. It is also pertinent to note that some of the cultural elements applied in the resorts are no longer predominant or practiced around the location of the resort. This may be described as identities of resistance, generated for cultural survival as stated by Castells (2004), to counter the evident domination of Western culture in the built environment. One of the key limitations raised by respondents was that local building traditions could not offer tourists the required level of comfort.

CONCLUSIONS

This paper examined various attempts at reflecting local culture in resort design in Nigeria through visual survey and interviews. The study concludes that attempts have been made in the surveyed resorts to express local culture. These attempts were however limited to sparingly applying elements of local culture on contemporary buildings, and the selection of a few buildings within resort complexes for the expression of local culture. Based on these findings the study recommends the following:

More research, innovation and creativity in harnessing indigenous renewable building materials for resort design;

Use of local cultural resources as themes and source of concepts for resort design in Nigeria;

Promotion of cultural expression in resort design by tourism regulatory bodies in Nigeria.

REFERENCES


Sustainable design


DELAYS TO LARGE CONSTRUCTION PROJECTS IN GHANA: A RISK OVERVIEW

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Delay to large scale projects, which is as a result of actions or inactions of some project stakeholders, is becoming a global phenomena and Ghana is no exception. The objective of the research is to identify, rate and rank the most significant risk factors that causes delay on projects and examine the social impact of these delays to recommend modalities to help mitigate these risk factors. The study adopted quantitative methods with the distribution of 144 questionnaires to built environment professionals receiving a response rate of 75.7%. The instrument listed 58 common factors under 8 category that contribute to the causes of delay for respondents to rate. Analysis of data non-parametric test revealed that client, contractor, material and finance category factors significantly resulted in the schedule delay of large infrastructural projects. The survey analysis revealed that micro-factors that result in delays to large construction projects are time constraint, cost overrun, payment problems, dispute and litigation. The research recommended the following modalities to minimize such delays: availability of resources, improved communication and coordination, proper scope definition and feasibilities, utilization of modern technology, appropriate application of technologically based systems and competent project management’s structures.

Key words: cost overruns, delayed payment, disputes, risk and social impact.

INTRODUCTION

The construction industry is largely plaqued by project delays. The above assertion was confirmed by Buertey (2011) who reveal that about 95% of projects executed in Ghana suffer from schedule delays. Danso et al. (2009) after a review of holds key indicators for the success of construction projects revealed that at least 25% of projects executed under the local government set up fails due to schedule overruns. To confirm the above assertion, Baiden-Amissah (2000), at 5% level of significance, using 95% confident limit, revealed that all projects executed in the certain parts of Ghana fails to achieve the key project objective. According to Young et al. (2008) the most common tool for measuring the performance of various governments in developing countries such as Ghana has been economic growth and infrastructure development. The prudent management of the construction industry is a key performance indicator for measuring the performance of governments in developing countries.

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countries due to the huge money which is normally allocated for in their annual budgets. Buertey et al. (2011) reiterated that the economic reason for the failure of developmental project has detrimental effect on the schedule completion time.

In line with the above challenges, the main drivers behind this research are to identify, rate and rank specific causes of delay on projects and recommend modalities to ensure that delays on construction projects are minimized. Buertey et al (2012) revealed that the challenge of time overrun results in schedule delay, possible cost overruns as the project continues to delay, a delay in the use of the project downstream and social benefit.

The prudent management of the construction industry is a key performance indicator for measuring the performance of governments in developing countries due to the huge money which is normally allocated for in their annual budgets. Buertey et al. (2011) reiterated that the economic reason for the failure of developmental project has detrimental effect on the schedule completion time.

Kerzner (2009) postulates that project success is ‘a continuous stream of successfully managed project’, when it achieves all the project goals and objectives while honouring the preconceived project constraint; otherwise it is a challenged or failed project. The definition of project success today embodies the completion of project: with a minimum or mutual agreed scope changes, without disturbing the main work flow of the organisation and without changing the corporate culture. In our quest to complete projects within the original scope without disturbing the work flow and maintaining the culture or standards of the organisation one is bound to face the challenge of schedule changes. Along the project execution trajectory, variations in scope of work are inevitable, with these changes in design, construction technology or specifications normally lead to schedule overruns. Tom (2003) holds that many contracts are ambiguous when it comes to defining delay and who bears the financial burden of the added costs associated with added contract performance time. Although delays in project are becoming a global phenomenon, the causes of this phenomenon may differ from one country to another due to different cultures, political, economical, and geographical factors among others.

Like any human undertaking, projects need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as "scope," "time," and "cost" These are called Triple Constraint also referred to as the “project management triangle” where each side represents a constraint. One side of the triangle cannot be changed without affecting the others. A further refinement of the constraints separates product "quality" or "performance" from scope, and turns quality into a fourth constraint (PMI, 2008).

The time constraint refers to the limited amount of time available to complete a project, in relation to unexecuted works and available resources. This constraint governs the basic requirement of project management that is, the project should be completed on or before the time scheduled. All projects are developed in order to adhere to some initial determined technical specification. The scope constraint refers to what must be done to produce the project’s end result. Naturally, clients, expects that the project being developed on their behalf will work as expected. Applying this criterion is often referred as conducting “quality” check (Pinto, 2007). These three constraints are often competing constraints. Their relations are as shown in the table below:
Delay in projects

Table 1 Project Constraints and Implication

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Implication/Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased scope</td>
<td>Increased time and increased cost</td>
</tr>
<tr>
<td>Tight time</td>
<td>Increased costs and reduced scope</td>
</tr>
<tr>
<td>Tight budget</td>
<td>Increased time and reduced scope</td>
</tr>
</tbody>
</table>

Adapted from Robertson (2007)

CONCEPTUAL FRAMEWORK

Project schedule delay is a situation when the contractor and or the client jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. Delays can result in disruption of work and loss of productivity, late completion of project, increased time, related costs and third party claims and abandonment or termination of contract. When projects are delayed, they are either accelerated which may result in poor performance or have their duration extended beyond the scheduled completion date, resulting in the delay in the use of the facility by stakeholders. “Many contracts are ambiguous when it comes to defining delay and who bears the financial burden of the added costs associated with added contract performance time” (Tom, 2011).

The classification of delays are critically determined by the terms and conditions specified in the contract. In the absence of a contractual definition, generally the construction industry recognizes three types of delay. Jamil (2011) in his study on construction delay analysis classified delays into three basic categories as follows:

Excusable delays with compensation;

Excusable delays without compensation

Non-excusable delays.

Jamil (2011) describes excusable delays as simply delays at no fault to the contractor; these are delays that are not attributable to the contractor’s actions or inactions. These delays are caused by unforeseen events and the events are beyond the control of the contractor. Examples of excusable delays are design problems, owner-initiated changes, unusually severe weather, fire, natural disasters and other force majeure conditions. Excusable delays justify an extension of a contract's deadline, and mostly classified as compensation events.

In the event of excusable delays, time extension is owed to the contractor where time extension is required as a result of affected scheduled time and an owner cannot recover liquidated or actual damages that may have been sustained because of a delay (Phillips, 2004). Excusable delays are further classified into compensable and non-compensable delays.

According to the standard for of contract, compensable delays are delays where the contractor is owed money to compensate for the loss due to the delay. Excusable delays with compensation are caused by the client’s actions or inactions. Examples of excusable delays with compensation are as directed changes, changed conditions, failure to fulfil contractual responsibilities or conditions constituting constructive changes by the client. Non-compensable delays are delays where a time extension is owed but no compensation is owed to the contractor. In non-compensable delays neither the client nor the contractor is deemed responsible. Some examples of excusable without compensation delays are any ‘act of God’ or unprovoked strikes (Majid and McCaffer, 1998)
Majid and McCaffer, (1998) describes non-excusable delays as delays due to the contractor or sub-contractor’s fault. Examples of non-excusable delays are underestimates of productivity, equipment breakdowns, improper project planning and scheduling, poor site management and supervision, wrong construction methods, unreliable subcontractors or suppliers.

Concurrent delay typically becomes a much contested issue on those projects that experience more than one of these types of delays. The vast majority of projects that are finished late fall into this category. Concurrent delay is experienced on a project when two or more separate delay events occur during the same time period and each independently affects the completion date. In analyzing concurrent delays, each delay is assessed separately and its impact on other activities and the project duration is calculated. The following are guidelines for classifying these kinds of concurrent delays:

In the event of excusable and non-excusable delays occurring concurrently, a time extension is granted to the contractor;

If excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to time extension, but not to damages;

If two excusable with compensation delays occur concurrently, the contractor is entitled to both time extension and damages (Majid and McCaffer, 1998)

If these basic delay guidelines are not addressed in the contract documents, it is certain that discussions regarding concurrent combinations of these guidelines will be both heated and protracted.

In relation to the causes of delay, Abdalla et al. (2002), identified the causes of construction delays construction delays are due to owner interference, inadequate contractor experience, financing and payments, labour productivity, slow decision making, improper planning, and subcontractor defaults.

Wong et al. (2006) revealed that the principal contributors to project delay were improper site co-ordination and management of the electrical and mechanical installations, lack of timely decision making of the client, and defects identified during the fire services inspection by local authorities, site management and supervision, workload of the project staff, the procedures for equipment approval, and working experience of the parties. Sweis et al. (2008) studied delays in the construction industry in the residential projects and held that financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Severe weather conditions and changes in government regulations and laws ranked among the least important causes.

Based on the forgoing, numerous risk factors affecting project schedule are identified these could be categorized as contractor, client, consultant, materials, financial, labour, equipment and external related

**RESEARCH METHODOLOGY**

**Population**

This paper is based on a mix methodological approach of data collection: quantitative and qualitative procedures. With the application of the quantitative data collection, a survey questionnaire was designed and administered to stakeholders and professionals
in the built environment working on developmental projects in Ghana to gather data to determine the risk impact of scope changes in the various work sections and its eventual effect on the contingency margins of the project. The sample size for this work was determined using the statistical relation by Kumar (1999); Clarke and Cook (1998). In all, 144 questionnaires were distributed and 144 (75.7%) were retrieved as depicted in table 2 below. All questionnaires were administered personally to the respondent during which advantage was taken to interview some top and middle level management staff. Respondents were given three weeks to fill the questionnaires after which the questionnaires were personally collected for analysis.

**Questionnaire Design and Data Collection**

The survey instrument had two categories of questions: factors causing the delay to the construction projects and the impact of the risk factors. Fifty eight (58) risk factors identified were grouped under eight categorized: client, contractor, consultant, financial, material, equipment, labour and external related delays. These were tabulated for respondent to rate on a 10 point scale as displayed in tabled 2 to 10.

<table>
<thead>
<tr>
<th>Type of Respondent</th>
<th>Total Out</th>
<th>No. Of Responses</th>
<th>Proportion of total Sample Size (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants</td>
<td>48</td>
<td>40</td>
<td>83.3%</td>
</tr>
<tr>
<td>Client’s firms</td>
<td>48</td>
<td>34</td>
<td>70.3%</td>
</tr>
<tr>
<td>Contractors</td>
<td>48</td>
<td>35</td>
<td>72.9%</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>109</td>
<td>75.7%</td>
</tr>
</tbody>
</table>

Field survey, 2011

**Data Analysis**

In each group, the factors were ranked based on frequency index, severity index and importance index. The importance index was derived from frequency index and severity index as generated from the three principal parties of construction, thus clients, consultants and contractors.

Basing on the fifty eight factors of leading causes of delays in large scale construction projects identified, the factors were categorized into eight major groups as. In each group, the factors were ranked based on importance index. The average index ranked by the three respondents, thus clients, consultants and contractors were tabulated. The average importance indices of the three respondents were calculated for the final ranking of the categorized groups. These average importance indices were ranked from the viewpoint of consultants and contractors while ignoring the ranking of the third respondent. Equation (1) was used for this calculation and the Spearman’s rank correlation coefficient \( r_s \) as shown in table 3- 15 in appendix 2.

The Spearman’s rank correlation coefficient was calculated as a relationship measure among different parties or factors and the strength and direction of the relationship. In this research analysis the Spearman’s rank correlation coefficient is used to show the degree of agreement between the different respondents. The Spearman’s rank correlation is a non-parametric test. Non-parametric tests are also referred to as distribution-free tests.
These tests have the obvious advantage of not requiring the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than means and, as a result, if the data have one or two outliers, their influence is negated. The correlation coefficient varies between +1 and −1, where +1 implies a perfect positive relationship (agreement), while −1 results from a perfect negative relationship (disagreement). It might be said then that sample estimates of correlation close to unity in magnitude imply good correlation, while values near zero indicate little or no correlation.

The Spearman’s rank correlation coefficient ($r_s$) is used to measure and compare the association between the rankings of two respondents for a single cause of delay, while ignoring the ranking of the third respondent. Spearman’s Rank Coefficient ($r_s$) is calculated by the following formula:

$$r_s = 1 - \frac{6 \sum d^2}{N(N^2 - 1)}$$

Where:

- $r_s$ = Spearman’s rank correlation coefficient;
- $d$ = the difference in ranking between contractor and consultant or contractor and client, or consultant and client, ie between any two respondents.
- $N$ = the number of variables, respectively.

The importance index were further used to calculate the Spearman’s rank correlation coefficient and the null hypothesis to analyze and establish the level of agreement of correlation in the ranking between paired groups of the respondents.

**FINDINGS AND DISCUSSION**

With respect to **client related delays**, the sample estimates a correlation close to unity in magnitude ($r_s = 0.976$). This result implies a good correlation between respondent of consultant and contractor. As a result of the good correlation of the client related delays it was also observed that the high ranked factors in this group such as lack of communication and coordination, improper project feasibility study were among the top five ranked factors of the study.

The study shows the data of factors of **contractor related delays**. This is the group with the highest number of factors. This implies there are many associated factors relating to the contractor which may lead to delays in large scale construction projects. It therefore calls for attention, coordination and communication between the client and the contractor as has been identified from the importance index ranking earlier as the number one factor in this study. A Spearman’s rank correlation coefficient $r_s = 0.539$ shows an agreement between the respondents.

For **consultant related delays**; this group of factors saw the respondents rating the cause of inaccurate site investigation being rated the highest in each case. This is a clear manifestation that if a site is not well investigated there is a risk of underground and construction problems which can to extent lead to abandonment of construction projects. The low ranking by the client indicates technical knowhow of site investigation; with a positive correlation of 0.768 Spearman’s rank correlation coefficient $r_s$. 

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### Table 3: Result of Major Delay Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Client Index</th>
<th>Consultant Index</th>
<th>Contractor Index</th>
<th>Overall Mean</th>
<th>Spearman Rank Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rank</td>
<td>Rank</td>
<td>Rank</td>
<td>Rank</td>
<td></td>
</tr>
<tr>
<td>Client</td>
<td>0.456</td>
<td>4</td>
<td>0.589</td>
<td>2</td>
<td>0.523</td>
</tr>
<tr>
<td>Contractor</td>
<td>0.447</td>
<td>5</td>
<td>0.594</td>
<td>1</td>
<td>0.524</td>
</tr>
<tr>
<td>Material</td>
<td>0.509</td>
<td>2</td>
<td>0.544</td>
<td>4</td>
<td>0.509</td>
</tr>
<tr>
<td>Finance</td>
<td>0.513</td>
<td>1</td>
<td>0.544</td>
<td>4</td>
<td>0.502</td>
</tr>
<tr>
<td>Equipment</td>
<td>0.462</td>
<td>3</td>
<td>0.557</td>
<td>3</td>
<td>0.502</td>
</tr>
<tr>
<td>External</td>
<td>0.442</td>
<td>7</td>
<td>0.523</td>
<td>6</td>
<td>0.481</td>
</tr>
<tr>
<td>Consultant</td>
<td>0.444</td>
<td>6</td>
<td>0.497</td>
<td>8</td>
<td>0.455</td>
</tr>
<tr>
<td>Labour</td>
<td>0.406</td>
<td>8</td>
<td>0.511</td>
<td>7</td>
<td>0.467</td>
</tr>
</tbody>
</table>

In relation to finance related delays, there was a $r_s$ of -0.321, which indicates a disagreement between the respondents. There was however a positive correlation between client and contractor, the $r_s$ was 0.357. These differences in agreement between these pair of parties explain how the three respondents are associated with finance when it comes to project execution. In project management, the major contract which involves the greater percentage of finance is between the client and the contractor. As such the two parties have a strong relationship in finance than any other stakeholder hence the reflection in the ranking of factors of financial related delays.

With respect to material related delays, a similar scenario just as in financial related delay was demonstrated in the correlation among the respondents. There was a disagreement between consultant and contractor from the calculated Spearman’s rank correlation coefficient $r_s$ (-0.595). The correlation between client and contractor was positive with Spearman’s rank correlation coefficient $r_s$ =0.417. The agreement and disagreement among the respondents show the working relationships in project management.

For equipment related delays, A Spearman’s rank correlation coefficient $r_s$ of 0.7 indicates strong agreement in the correlation among the respondents for these factors. The ranking high of lack of high-technology equipment and equipment mobilization problem in this group suggests an investment to be made by contractors in Ghana.

For labour related delays, the experiences of frequent strike action was rated high whilst slow mobilization of labour was rated the least out of the seven factors. Strike actions may be caused by lack of communication and coordination as was earlier indicated. The reason could be a misunderstanding of the principle of vertical and horizontal communication in project management. On the part of external related factors, it was observed that delay in obtaining permits from authorities and inflation/prices fluctuation are the factors which highly influences the delay of projects externally. These are caused by unnecessary bottlenecks created in obtaining permits for lack of knowledge in the time constraint in project management. On the other hand inflation/price fluctuation is a problems associated with projects in developing countries which are some of the consequences of delays in project execution.

According to table 2, the respondent i.e., clients, consultants and contractors ranked the major delay groups in terms of importance as client related, contractor related,
material related, finance related, external related, equipment related, consultant related and labour related groups respectively. It was observed that the first four groups were rated closely in terms of magnitude of importance to delays in projects.

Beginning from client related groups, it was observed that out of the seven factors of delays in the group, four were listed in the top eighteen factors of the study. These factors are lack of communication and coordination, improper feasibility studies, client interference and slow decision making. It could be seen from the table that consultants rated improper feasibility higher than the other respondents. This could mean that there is a lack of communication and coordination as rated high by all respondents to the detail of scope of work for the consultant to perform his/her duty in the feasibility studies.

The Contractor related group was rated second by the respondents. This group has ten related factors with four in the top eighteen factors. A significant observation in this group is that whilst contractors view and rank improper planning and scheduling as a high cause of delay, the other respondents ranked it low. The reason being that as discussed earlier the contractor requires a sufficient feasibility studies communicated well for him/her to have effective planning and scheduling. The conditions in third, fourth and fifth ranked groups are similar to the first two groups. The labour related group was rated least. This group has none of the factors that cause delay ranked in the top eighteen factors. From the importance index rating in table 4, it was observed that all respondents rated the factors of labour related delays. The above findings reveals how skilful and available Ghanaians professionals are in relation to industry practice.

Considering the above ratings and rankings, the effect of time constraint was ranked high followed by cost overrun and dispute at the same level. It is obvious from the constraint of project that delays in any phase of project will lead to time overrun according to the work schedule. The cause of time overrun is associated with cost in attempt to meet schedule. In some cases the project team does work for extra hours and in some cases additional workers are hired. There are usually disputes when attempt is made to verify the cause of delay between client and contractor if the delay is compensable or non compensable delay. Therefore the result is a true reflection of practice in project execution in Ghana.

The research confirms the finding by Al-Momani (2000) which revealed in an earlier research conducted in Jordan which concluded that the main drivers of delays in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions, and increase in quantities.

In the Ghanaian front, Frimpong et al. (2003) after studying the delays and cost overrun in groundwater construction projects in Ghana, revealed that the main causes of delay and cost overruns in construction of groundwater projects included: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performances and escalation of material prices. The research concluded that effective project planning, controlling and monitoring should be established to enhance project performance in order to minimise or avoid delay and cost problems in groundwater construction projects.

Nguyen et al., (2004) identified availability of resources; multidisciplinary/competent project team; competent project manager; accurate initial cost estimates and accurate initial time estimates as the main causes of schedule delay. Wiguna and Scott (2005) during their study of risks factors affecting construction delay and cost overruns in
building projects revealed high inflation/increased material price; design change by owner; defective design; weather conditions; delayed payments on contract; and defective construction work were the main drivers.

CONCLUSION

The research revealed that lack of project coordination; communication and poor scope definition are the major causes of these delays were the key attribute to the client related delays. In the same vein, poor site investigations and delay in supply of design information and change orders were ranked as the highest cause consultant delays.

In conclusion, it has been discovered that the client, contractor, material and finance were the major delay groups when it comes to delivery of major infrastructural projects. In general, the major factors that cause delays are time constraints, financial issues/changes in micro economic indicators, delayed payment problems, availability of resources, poor project management structures and lack of technologically based systems. In order to significantly prevent and control delays in the future refining construction projects, it would be appropriate to underscore proactive guidelines for consideration. The result from the real situations showed that delays could be prevented and controlled by carrying out several important strategies during the implementation of the project. Making good use of planning and control for the project taking cognisance of scope definition and scope control. Though the management of escalation in material prices is practically impossible, the contractor’s cost management practices of advance ordering goods, defining the work breakdown structure and finance controlling management is imperative.

The above notwithstanding, to manage project configuration effectively, the contractor must endeavour to establish an effective communication system between all stake holders and partners of the building standard system for every process, surveying, collecting and deal with all of the information about weather and geological conditions of the site and other problem relating the site to make good decisions for constructions of the project. With respect to the client, large scale projects require a well planned cash flow and proactive cash outlay for the project. As the main stakeholder and financier for the delivery of key infrastructural projects, the government must ensure the availability of adequate funds before commencing projects in order to ensure prompt payment to contractors at various phases of the project. Again, project delivery would be much enhanced if the selection of contractors for the procurement of infrastructural projects are politicized but based on competency, capability and financial muscle of the contractors and their power to deliver. The contractor must have adequate experience, technical capability, financial capability, and adequate manpower to execute the project in time. To enhance a smooth project execution, it is noteworthy for client to appoint professional and competent project managers to manage large scale projects and decision making process must be reduced and quick decision made to solve problems that arise during project execution.

On the part of the consultant’s, the success of every project is hinged on the monitoring and control during the executing phase of the project to ensure that all key deliverables are met according to the project scope statement and quality standard. The consultants must at all times and provide quick response to change orders raised by clients and contractors and the necessary details to prevent bottlenecks along the project execution phase. The contractor must also endeavour to provide competent and
disciplinary workmen must be employed at site to reduce rework as this time and cost overrun to projects. Contractors must use high technology equipment to facilitate speedy completion of work. Contractors must provide detailed work schedule, and followed closely to reduce delay in projects.

REFERENCES


## APPENDIX 2- DATA ANALYSIS TABLES

### Table 4: Result of Client Related Delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient ($r_s$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Change orders during construction</td>
<td>0.554</td>
<td>6</td>
<td>0.517</td>
</tr>
<tr>
<td>Improper project feasibility study</td>
<td>0.684</td>
<td>1</td>
<td>0.538</td>
</tr>
<tr>
<td>Delay to furnish and delivery of site to the contractor</td>
<td>0.567</td>
<td>4</td>
<td>0.526</td>
</tr>
<tr>
<td>Lack of communication and coordination</td>
<td>0.654</td>
<td>2</td>
<td>0.596</td>
</tr>
<tr>
<td>Slow decision making process</td>
<td>0.567</td>
<td>4</td>
<td>0.540</td>
</tr>
<tr>
<td>Client interference</td>
<td>0.582</td>
<td>3</td>
<td>0.542</td>
</tr>
<tr>
<td>Lack of capable representative</td>
<td>0.515</td>
<td>7</td>
<td>0.405</td>
</tr>
</tbody>
</table>

$r_s = 0.995$

### Table 5: Result of Contractor related delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contractor related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Improper project planning and scheduling</td>
<td>0.609</td>
<td>4</td>
<td>0.611</td>
</tr>
<tr>
<td>Poor site management and supervision</td>
<td>0.597</td>
<td>5</td>
<td>0.501</td>
</tr>
<tr>
<td>Inaccurate time estimate</td>
<td>0.584</td>
<td>6</td>
<td>0.528</td>
</tr>
<tr>
<td>Obsolete construction methods</td>
<td>0.563</td>
<td>9</td>
<td>0.502</td>
</tr>
<tr>
<td>Inaccurate cost estimate</td>
<td>0.584</td>
<td>6</td>
<td>0.542</td>
</tr>
<tr>
<td>Incompetent project team</td>
<td>0.623</td>
<td>2</td>
<td>0.503</td>
</tr>
<tr>
<td>Rework due to errors during construction</td>
<td>0.624</td>
<td>3</td>
<td>0.528</td>
</tr>
<tr>
<td>Obsolete technology</td>
<td>0.571</td>
<td>7</td>
<td>0.490</td>
</tr>
<tr>
<td>Unreliable subcontractor</td>
<td>0.542</td>
<td>10</td>
<td>0.501</td>
</tr>
<tr>
<td>Inadequate contractor experience</td>
<td>0.640</td>
<td>1</td>
<td>0.529</td>
</tr>
</tbody>
</table>

$r_s = 0.539$

### Table 6: Result of Consultant Related Delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consultant related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Inadequate project management assistance</td>
<td>0.370</td>
<td>7</td>
<td>0.441</td>
</tr>
<tr>
<td>Inadequate consultant experience</td>
<td>0.524</td>
<td>3</td>
<td>0.465</td>
</tr>
<tr>
<td>Inaccurate site investigation</td>
<td>0.609</td>
<td>1</td>
<td>0.542</td>
</tr>
<tr>
<td>Slow response and poor inspection</td>
<td>0.502</td>
<td>4</td>
<td>0.449</td>
</tr>
<tr>
<td>Unclear and inadequate details in drawings</td>
<td>0.428</td>
<td>6</td>
<td>0.453</td>
</tr>
<tr>
<td>Poor design and delays in design</td>
<td>0.542</td>
<td>2</td>
<td>0.360</td>
</tr>
<tr>
<td>Delay in approving changes in the scope of work</td>
<td>0.502</td>
<td>4</td>
<td>0.476</td>
</tr>
</tbody>
</table>

$r_s = 0.768$
Table 7: Result of Finance related delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient ( r_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Finance related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Inadequate fund allocation</td>
<td>0.453</td>
<td>6</td>
<td>0.472</td>
</tr>
<tr>
<td>Contractor’s financial difficulties</td>
<td>0.415</td>
<td>7</td>
<td>0.515</td>
</tr>
<tr>
<td>Client’s financial difficulties</td>
<td>0.626</td>
<td>1</td>
<td>0.503</td>
</tr>
<tr>
<td>Delay in payment of suppliers and subcontractors</td>
<td>0.611</td>
<td></td>
<td>0.476</td>
</tr>
<tr>
<td>Poor cash flow management</td>
<td>0.580</td>
<td>4</td>
<td>0.528</td>
</tr>
<tr>
<td>High interest rate</td>
<td>0.622</td>
<td>2</td>
<td>0.464</td>
</tr>
<tr>
<td>Bureaucracy in procurement system</td>
<td>0.501</td>
<td></td>
<td>0.555</td>
</tr>
</tbody>
</table>

Table 8: Result of Finance related delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Client</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient ( r_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Finance related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Inadequate fund allocation</td>
<td>0.468</td>
<td>7</td>
<td>0.472</td>
</tr>
<tr>
<td>Contractor’s financial difficulties</td>
<td>0.556</td>
<td>1</td>
<td>0.515</td>
</tr>
<tr>
<td>Client’s financial difficulties</td>
<td>0.479</td>
<td>6</td>
<td>0.503</td>
</tr>
<tr>
<td>Delay in payment of suppliers and subcontractors</td>
<td>0.510</td>
<td></td>
<td>0.476</td>
</tr>
<tr>
<td>Poor cash flow management</td>
<td>0.489</td>
<td>5</td>
<td>0.528</td>
</tr>
<tr>
<td>High interest rate</td>
<td>0.534</td>
<td>3</td>
<td>0.464</td>
</tr>
<tr>
<td>Bureaucracy in procurement system</td>
<td>0.554</td>
<td></td>
<td>0.555</td>
</tr>
</tbody>
</table>

Table 9 Result of Material related delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient ( r_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material related delays</strong></td>
<td>Index</td>
<td>Rank</td>
<td>Index</td>
</tr>
<tr>
<td>Shortage of materials in market</td>
<td>0.529</td>
<td>7</td>
<td>0.555</td>
</tr>
<tr>
<td>Changes in types and specifications of materials</td>
<td>0.490</td>
<td>8</td>
<td>0.569</td>
</tr>
<tr>
<td>Escalation of material prices</td>
<td>0.567</td>
<td>4</td>
<td>0.554</td>
</tr>
<tr>
<td>Unreliable suppliers</td>
<td>0.608</td>
<td>1</td>
<td>0.515</td>
</tr>
<tr>
<td>Late delivery of materials</td>
<td>0.567</td>
<td>3</td>
<td>0.476</td>
</tr>
<tr>
<td>Unrealistic procurement strategy</td>
<td>0.584</td>
<td>2</td>
<td>0.438</td>
</tr>
<tr>
<td>Poor quality of materials</td>
<td>0.542</td>
<td>5</td>
<td>0.449</td>
</tr>
<tr>
<td>Underestimation of materials</td>
<td>0.542</td>
<td>5</td>
<td>0.515</td>
</tr>
</tbody>
</table>
Table 10: Result of Material Related Delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Client</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material related delays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortage of materials in market</td>
<td>0.543</td>
<td>0.555</td>
<td>$r_s = 0.417$</td>
</tr>
<tr>
<td>Changes in types and specifications of materials</td>
<td>0.500</td>
<td>0.569</td>
<td></td>
</tr>
<tr>
<td>Escalation of material prices</td>
<td>0.512</td>
<td>0.554</td>
<td></td>
</tr>
<tr>
<td>Unreliable suppliers</td>
<td>0.469</td>
<td>0.515</td>
<td></td>
</tr>
<tr>
<td>Late delivery of materials</td>
<td>0.522</td>
<td>0.476</td>
<td></td>
</tr>
<tr>
<td>Unrealistic procurement strategy</td>
<td>0.489</td>
<td>0.438</td>
<td></td>
</tr>
<tr>
<td>Poor quality of materials</td>
<td>0.423</td>
<td>0.449</td>
<td></td>
</tr>
<tr>
<td>Underestimation of materials</td>
<td>0.613</td>
<td>0.515</td>
<td></td>
</tr>
</tbody>
</table>

Table 11: Result of Equipment Related Delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment related delays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent breakdown of equipment</td>
<td>0.515</td>
<td>0.477</td>
<td>$r_s = 0.771$</td>
</tr>
<tr>
<td>Inadequate number of equipment</td>
<td>0.515</td>
<td>0.490</td>
<td></td>
</tr>
<tr>
<td>Lack of high-technology equipment</td>
<td>0.684</td>
<td>0.524</td>
<td></td>
</tr>
<tr>
<td>Lack of equipment parts for replacement</td>
<td>0.542</td>
<td>0.477</td>
<td></td>
</tr>
<tr>
<td>Equipment mobilization problem</td>
<td>0.555</td>
<td>0.528</td>
<td></td>
</tr>
<tr>
<td>Equipment allocation problem</td>
<td>0.529</td>
<td>0.515</td>
<td></td>
</tr>
</tbody>
</table>

Table 12 Result of Labour Related Delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labour related delays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low motivation and morale</td>
<td>0.582</td>
<td>0.462</td>
<td>$r_s = 0.214$</td>
</tr>
<tr>
<td>Slow mobilization of labour</td>
<td>0.477</td>
<td>0.453</td>
<td></td>
</tr>
<tr>
<td>Low labour productivity</td>
<td>0.515</td>
<td>0.490</td>
<td></td>
</tr>
<tr>
<td>Scarcity of skilled labour</td>
<td>0.425</td>
<td>0.371</td>
<td></td>
</tr>
<tr>
<td>Absenteeism</td>
<td>0.515</td>
<td>0.515</td>
<td></td>
</tr>
<tr>
<td>Misunderstanding among workforce</td>
<td>0.453</td>
<td>0.465</td>
<td></td>
</tr>
<tr>
<td>Frequent strike action</td>
<td>0.609</td>
<td>0.515</td>
<td></td>
</tr>
</tbody>
</table>
Table 13 Result of External related delays

<table>
<thead>
<tr>
<th>Delay Factors</th>
<th>Consultant</th>
<th>Contractor</th>
<th>Spearman Rank Coefficient $r_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External related delays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unforeseen ground condition</td>
<td>0.503</td>
<td>0.451</td>
<td></td>
</tr>
<tr>
<td>Delay in obtaining permits from</td>
<td>0.555</td>
<td>0.542</td>
<td>$r_s = 0.571$</td>
</tr>
<tr>
<td>authorities</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Inflation/Prices fluctuation</td>
<td>0.584</td>
<td>0.486</td>
<td></td>
</tr>
<tr>
<td>Weather condition</td>
<td>0.464</td>
<td>0.453</td>
<td></td>
</tr>
<tr>
<td>Conflict or war in community</td>
<td>0.542</td>
<td>0.489</td>
<td></td>
</tr>
<tr>
<td>Unavailability of utilities at site</td>
<td>0.489</td>
<td>0.453</td>
<td></td>
</tr>
</tbody>
</table>
DETERMINING THE UNIQUE FEATURES OF MASS HOUSING PROJECTS (MHPS)

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¹,³Department of Building Technology, KNUST-Kumasi, Ghana
²Centre for Settlement Studies, KNUST-Kumasi, Ghana

It is argued that, in order to successfully manage and deliver large complex projects, one has to gain a precise understanding of the characteristics and particularities of that project. Mass Housing Projects (MHPs) differ significantly from the 'one-off' traditional projects often encountered in the construction industry and thus require unique management skills and approach in its implementation. MHPs are characterised by managerial and communication ineffectiveness inherent from their nature, features and particularities. Understanding the unique characteristics of MHPs are aimed at improving its organisation, planning, communication and managerial effectiveness to improve delivery. Through comparing ‘one-off’ traditional projects and Mass Housing projects from literature, focus group discussion and questionnaire survey, 10- unique features of Mass Housing Projects were established from management perspective. Mean scores and Kruskal-Wallis were used to test the level of agreements to the variable by the respondents. Also through Kruskal-Wallis test, 9-unique features had p-values greater than 0.05 (p>0.05) showing that there were no significant variations in the means and respondents gave consistent responses, interpretations and low variability to the variables. The study is a preliminary stage of exploring the unique features of MHPs and its impact on communication performance among the project team.

Keywords: mass housing projects, project feature, project management

INTRODUCTION

Projects are unique and share distinguishing characteristics from one project to the other. The features of any project has significant impact on its initiation, organisation and management and contributes hugely to its success or failure. Mass Housing Projects (MHPs) are characterised by inefficient communication among project teams that often result in considerable amount of unproductive time and managerial ineffectiveness on mass housing projects in developing countries (Enhassi & Burges, 2007; Enhassi, 1997). These ineffective communication and managerial inefficiencies among project teams are inherent from the unique nature of MHPs whiles there has been no attempt to clearly define and determine these unique features of MHPs.

It is said that mass housing projects differ significantly from 'one-off' projects and thus requires unique managerial skills and efforts to deliver them successfully (Ahadzie et

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al., 2007; Adinyira et al., 2012). Clearly known and established project features or characteristics of any type of project will be a significant tool towards evolving and enabling frameworks for effective project management. From managerial perspective, organisation and operations are key component of management practice. Projects have definite and unique distinguishing physical attributes, organisational and operational features (Manu et al., 2010). These unique groups of features of projects influence greatly on communication, health and safety, managerial effectiveness, project performance etc. The understanding of the unique features of MHPs and their implications for both management and research is still very limited. This study thus attempts to establish the unique features of Mass Housing projects that makes them different from 'one-off' traditional project by exploring it 'unique physical, organisational and operational features'. This is a preliminary stage of an on-going investigation into the unique features of Mass Housing projects (MHPs) to predict its impact on communication performance among the project team in developing countries. To effectively study MHPs, a clear definition of mass housing project (MHPs) is required to differentiate it from other traditional types of construction projects.

DEFINITION OF MASS HOUSING PROJECTS (MHPs)

Typically, the term MHPs was imbibed into the Construction Industry from the manufacturing sector to describe mass production techniques of housing development projects (Ahadzie, 2007). But from literature, all attempted definitions use the physical attributes of the project such as size, nature of designs, extent of resources involved etc (Ahadzie et al., 2007; Yüksel and Gökmen, 2010; Urban, 2012; Folaranmi, 2012; Turk and Guven, 2008). The main underlining themes in most MHPs definition is, 'in large unit production', 'multiple site location' and 'repeated schemes'. These definitions however fail to incorporate the managerial and contractual connotations of the project. In the context of this study, Mass Housing project is defined as: 'the construction of standardised multiple domestic house-units usually in the same or several geographical locations executed within the same project scheme and under the same management and contract' (Ahadzie, 2007).

Based on the theoretical and the practical understanding of the situation in Ghana, the definition is still relevant for the study. From the above definition it is worth to note that, the designs and schemes may be speculative or specific customer defined as oppose to the main assumption of speculative development by Ahadzie (2007). The underlining fact is that the designs remain standardized, repetitive, managed by same defined team, under uniform contractual arrangement and mass-scale delivery of house-units. Dwelling on the United Nations Economic Commission’s recommendation of an annual production rate of 10 house-units per 1000 population for developing countries to meet their present and future housing needs (Edmonds and Miles, 1984). This study adopts a minimum delivery of 10-units per scheme as a precondition for the scheme to be accepted a mass housing scheme.

MASS HOUSING PROJECT FEATURES

The features of projects are major parameters and inputs for the right choice of procurement method, risk analysis, communication strategy and technology as well as dictating the resource requirements for the delivery of the project (Favie and Maas, 2008). It is emphasized that every project has its own features and these features require specific competences from teams, organisations and companies to effectively manage and execute the project (Favie and Maas, 2008). Clear understanding of
project features and how each affects the decisions and actions will thus allow for thorough planning and delivery option decisions to ensure its successful delivery (Kipp et al., 2008)

Project features (PFs) has been viewed and classified through several methods. Massive construction projects, Multi projects, Super Mega, Mass project, Mega projects have been used to describe the enormity of the project, cost outlay and it managerial and construction challenges (Hernández, 2008; Kipp et al., 2008; Thorpe et al., 1999; Haynes, 2002; Kumaraswamy, 1997). Huge mega projects have gained significant attention due to cases of budget overrun, management problems or outright failure inherent from their exhibited features and characteristics (Kipp et al., 2008). The physical, organisational and operational features of construction projects are critical component in the management of the project (Manu et al., 2010). Mass Housing projects (MHPs) share features that are unique from 'one-off' projects thus making their management inherently more difficult (Henderson, 2009; Ahadzie, 2007; Vanita and Yang, 2006; Adinyira et al, 2012). These unique features of MHPs impact on the operational, organisational and managerial actions during the construction process. This justifiably makes certain practices and managerial interventions on 'one-off' traditional projects non applicable to MHPs. Though mass housing projects show a number of common characteristics, such as size, technological and institutional complexity, political involvement and public awareness with other mega traditional 'one-off' projects, they also exhibit unique features that require different unique managerial approach in its delivery (Ahadzie, 2007; Kipp et al., 2008; Adinyira et al, 2012). This study therefore seeks to reveal the unique features of MHPs. Through literature review and focus group discussion MHPs were compared to 'one-off' traditional project to evolve its uniqueness based on its physical, organisational and operational attributes as presented in Table 1.0.

**METHOD OF STUDY**

In order to determine the ‘unique features’ of Mass Housing projects (MHPs), a literature review was done by comparing MHPs with 'one-off' traditional projects from
management perspective. This was done to establish from literature the features of MHPs that most likely make them different from the traditional ‘one-off’ projects. Through a focus group discussion by three expert in MHPs, the identified unique features based on their physical, organisational and operational particularities were subjected to intense scrutiny and discussion and was thus pruned. The findings (As shown in Table 1.0) were then modelled into questionnaire survey for persons with experience and involvement in MHPs and also have knowledge in project management practice to determine their level of agreement to the features on a five (5) point likert scale.

The respondents drawn largely from Ghanaian House Construction industry were persons who have been associated with housing development through Research, Construction, Education and Policy and/or Management. These domain respondents remain critical stakeholders in MHPs implementation. The study being a critically specialized area, the experience and knowledge of the respondents are critical to ensure right interpretations of the variables and also make correct contribution. Mean scores were used to measure the level of agreement to the various variables by respondents whilst Kruskal-Wallis was used to assess the level of agreement between the various groups of respondents on the variables.

RESULTS AND DISCUSSIONS

Background of Respondents

In all, a total of 58 questionnaires were distributed to persons in MHPs with considerable experience from construction perspective from the Ghana Real Estate Development Association (GREDA), Policy and Management from the Ministry of Water Resources, Works and Housing in Ghana. Persons in Research and Education were drawn from Building and Road Research Institute (BRRI) in Ghana and private practitioners. These groups of respondents were considered for the study because they remain key stakeholders and participants in MHPs and are critical to decision making on mass housing development in Ghana. Out of this, 36 responses were received giving a response rate of 62%. The summary of respondents is represented in Table 2.0 and Figure 1.0.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Involvement in MHPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 years</td>
<td>6</td>
<td>16.7%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>10</td>
<td>27.8%</td>
</tr>
<tr>
<td>11-15 years</td>
<td>12</td>
<td>33.2%</td>
</tr>
<tr>
<td>16 years and above</td>
<td>8</td>
<td>22.2%</td>
</tr>
<tr>
<td>Nature of Involvement in MHPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td>15</td>
<td>41.7%</td>
</tr>
<tr>
<td>RESEARCH</td>
<td>10</td>
<td>27.8%</td>
</tr>
<tr>
<td>EDUCATIONAL</td>
<td>4</td>
<td>11.1%</td>
</tr>
<tr>
<td>POLICY AND MANAGEMENT</td>
<td>7</td>
<td>19.4%</td>
</tr>
</tbody>
</table>

From the data, about 83% of the respondents had above 5 years of experience. This suggests they are more likely to understand the subject matter and give right and accurate interpretations to the variables. Also, 42% of the responses were from people in housing construction whilst persons in research and education constituted 39% as in Figure 1.0. Also 19.4% were in policy and management. This gives a fairly balanced spectrum of responses from the main domain of MHPs stakeholders and participants.
UNIQUE FEATURES OF MHPS

The mean scores of respondents to each of the variables were used to measure their extent of agreement or otherwise on the variables. On a likert scale from 1 to 5 (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4 Agree and 5=Strongly Agree), where 3.0 is pegged as neutral, the mean score of responses on each variable must be more than 3.0 to accept the variable as a unique feature to MHPs. A mean score less than this is thus rejected since it represent a disagreement to the variable as represented in Table 3.0

Source: Field Data

Figure 1.0: Nature of Involvement in Housing Development

TABLE 3.0: MEAN SCORES OF VARIABLES

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Features</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple Site For Various Units</td>
<td>4.42</td>
<td>.554</td>
<td>Accepted</td>
</tr>
<tr>
<td>2</td>
<td>Multiple Standardized Design-Units In Scheme</td>
<td>4.28</td>
<td>.615</td>
<td>Accepted</td>
</tr>
<tr>
<td>3</td>
<td>Multiple Environmental Impact</td>
<td>1.83*</td>
<td>.811</td>
<td>Rejected</td>
</tr>
<tr>
<td>4</td>
<td>Multiple Geographical Location For Schemes</td>
<td>4.06</td>
<td>.715</td>
<td>Accepted</td>
</tr>
<tr>
<td>5</td>
<td>Multiple Interdependent Sub-Contracting Under Scheme</td>
<td>4.22</td>
<td>.637</td>
<td>Accepted</td>
</tr>
<tr>
<td>6</td>
<td>Multiple One-Off Infrastructure</td>
<td>1.64*</td>
<td>.961</td>
<td>Rejected</td>
</tr>
<tr>
<td>7</td>
<td>Complex Network Of Procurement Systems</td>
<td>3.78</td>
<td>.681</td>
<td>Accepted</td>
</tr>
<tr>
<td>8</td>
<td>Multi-Collinear Repeated Preliminary Activities On Units</td>
<td>4.39</td>
<td>.549</td>
<td>Accepted</td>
</tr>
<tr>
<td>9</td>
<td>Repetitive Tasks On Standardized Units</td>
<td>4.14</td>
<td>.639</td>
<td>Accepted</td>
</tr>
<tr>
<td>10</td>
<td>Virtual Team Participants</td>
<td>4.17</td>
<td>.655</td>
<td>Accepted</td>
</tr>
<tr>
<td>11</td>
<td>Complex Construction Method</td>
<td>1.67*</td>
<td>.894</td>
<td>Rejected</td>
</tr>
<tr>
<td>12</td>
<td>Complex Network Of Risk From Various Units</td>
<td>1.72*</td>
<td>.815</td>
<td>Rejected</td>
</tr>
<tr>
<td>13</td>
<td>Complex Network Of Team Relationship</td>
<td>4.44</td>
<td>.558</td>
<td>Accepted</td>
</tr>
<tr>
<td>14</td>
<td>Multiple Duration For Units Under Schemes</td>
<td>4.03</td>
<td>.654</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

From Table 3.0 above, variables 3, 6, 11, and 12 had means scores less than 3.0 which was the cut off point. This suggests that respondents strongly disagree with these variables as being unique features of MHPs and were thus rejected. Again these variables had the highest standard deviations above 0.8 which is close to 1.0. This
suggests that there is low level of consistency and high variability or diversity in the interpretations and responses offered by the respondents on these variables. Thus even though these variables were rejected, one can have a sense of descent from some quarters on the rejection of these as not being unique features of mass housing projects.

**LEVEL OF AGREEMENT OF UNIQUE FEATURES OF MHPS**

The Kruskal-Wallis test is a non parametric of ANOVA and is essentially useful to compare means of more than two groups of an independent variable with relatively small sample size and to avoid the violations of assumptions under ANOVA (Coates, 2001; Field, 2005a). Following the mean score analysis, the 10-accepted variables (see table 3.0) were subjected to the Kruskal-Wallis test. From the respondents as indicated in Figure 1.0, four main groups were identified namely persons involved in housing development from Research, Construction, Education and Policy and/or Management perspectives. The Kruskal-Wallis test was performed at a 95% confidence level to determine the extent of agreement on the variables among the various groups as presented in Table 4.0.

In order to determine whether there is significant variations in the responses among the groups, the Sig.-value (p) and the chi-square values are critically examined (Coates, 2001). When the 'p'-value is less than 0.05 (p<0.05), it suggests that there is significant variations in the means being compared from the samples and that there is inconsistencies in the interpretations given to the variables by the various groups. Dwelling on the results from Table 4.0, the p-values were more than 0.05 (p>0.05)except for variable 1. The chi-square values suggests no significant variations among the groups as well except for variable 1. A p-value greater than 0.05 means that the variability in the groups is about the same at the given significance level. That is the scores and interpretations in one condition/group do not vary much more than the scores in the other groups. Put scientifically, it means that the variability or diversity in the groups is not significantly different at a 95% confidence level. This suggests that there is high level of consistencies, low variability and strong agreement in the interpretations and responses given between the various groups on the variables at a 95% confidence level. This is an indication that generally the various groups agreed to the listed 10 variables being the unique features of MHPs. It is critically significant to highlight on variable 1 from Table 4.0 which has p-value less than 0.05.
This suggests that there is a statistically significant difference in the interpretations given between the various groups on this two variables. It is an indication that though there is an agreement to this feature as unique feature to MHPs as presented in the mean scores (see table 3.0), there is variability in the interpretations between the groups in their responses.

**CONCLUSION AND RECOMENDATIONS**

Mass Housing Projects (MHPs) differ significantly from 'one-off' traditional projects and thus requires unique management styles and skills in their management approach. In order to improve the communication and managerial inefficiencies among the project team in MHPs implementation, it's clearly defined unique features is critical. Gaining knowledge and a precise understanding of the characteristics and particularities of MHPs is a giant step towards increasing the managerial effectiveness to successfully deliver the housing units at the full benefit of stakeholders and meeting goals. Currently, several managerial styles and efforts to tackle mass housing projects by drawing on existing principles and practices that are more peculiar to traditional projects have yielded more unproductive hours and managerial ineffectiveness (Enhassi & Burges, 2007; Enhassi, 1997). This questionnaire survey has revealed 10-unique features of MHPs drawing from respondents of considerable experience and involvement in housing developing from research, construction, education and policy & management perspectives. Dwelling on their experiences, the respondents agreed at 95% confidence level the following as the unique features of mass housing projects namely:

'Multiple construction sites for various housing units under each schemes', 'Various multiple standardized unit-designs under each schemes', 'Multiple geographical location for various schemes', 'Multiple interdependent sub-contracting under various schemes', 'Multiple-Collinear repeated 'preliminary' activities on each units', 'Complex network of Procurement Systems in material and services', 'Repetitive interrelated skill tasks on standardized housing units', 'High level Virtual Team participants', 'Complex Network of Team relationship on various units and schemes' and 'Multiple duration for various standardized design-units under schemes'.

Knowledge of the 'unique features' of MHPs is an important step that would engender the development of unique management styles and frameworks and developing managerial competency models suitable for these type of projects. This will also help in overcoming the challenges inherent in the management of MHPs especially in developing countries. A very important recommendation from this paper is the need for future research to explore these established features to understand their underlying factors to enable for a more pragmatic management framework for MHPs. Though this studies is intended for the impact of the unique features on communication performance among the project team, based on physical, organisational and operational features, the features could be classified under these domain and the correlation among should be explored as well.

**ACKNOWLEDGEMENTS**

The authors would like to sincerely thank all the professionals who participated and responded to the questionnaire survey, especially managers of the selected GREDA members and staff at BRRI.


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(Accessed; 11/01/2013)


DEVELOPMENT OF A DESIGN-RELATED COMPUTER-BASED MODEL FOR ESTIMATING BUILDING MATERIAL QUANTITIES

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Construction estimating involves the estimating of materials, labour, equipment, overheads and contingencies. Building developers have over the years asked for material estimates with reference to the specific design of their buildings after the designs have been completed. To date, there is no computer based model that takes into account the design of the structure/building with reference to the estimate being prepared. The traditional quantity take-off has to be completed before the materials can be extracted. Many find difficulties with estimating programs which exist today because they are complicated. This research sought to develop a design-related computer based model, for building material estimation where the user could input design data in the interface and generate the requisite quantities of materials required for the building by the click of a button. The design-based material extraction model was validated and evaluated by professionals in the Building Construction Industry in Ghana. In order to test the model, the model estimation process was run for six (6) different projects, three (3) each for residential and educational buildings. Projects that were used for the testing of the model were different from those used in formulating the model. In the testing process, a manual material extraction process was used for the calculating the material quantities of Cost Significant Items (CSI) of the project. The model was then used to estimate the material quantities and the results were compared with the manual approach. The average variances between the model generated and the traditional method of material estimation for the educational and residential buildings together, are -11.24% and +30.02%.

Keywords: cost significant items, model, estimation, take-off, variance.

INTRODUCTION

Efficient building material quantity estimation and extraction from building designs has been the concern of built environment clients and professionals alike. Estimation is the methodology for forecasting and predicting quantities, cost and expenditures of a future project and to produce a budget. Estimating is a fundamental part of construction projects. Effective estimating is one of the main factors of the success of a construction project. The cost estimation is done before the construction begins, after completion of the design. In the construction industry, estimation is done by quantity surveyors or estimators. The higher the skill and experience of the estimator, the higher the accuracy of the estimate produced.

REVIEW OF LITERATURE

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According to Amoa-Mensah, (1995), the purposes of estimating is to inform the client about the extent of his expected commitment in a proposed project. Construction materials constitute a major cost component on any construction project. (Perdomo, 2004). The efficient procurement and handling of materials represent a key role in the successful completion of the work (Perdomo, 2004). Materials account for a big part of products and project cost of every construction project. Onibokum and Agbola (1990) observed that about 60% of the total housing expenditure goes for the purchase of building materials. Mogbo (1999) claims that the cost of building materials constitute about 65% of the construction cost. The efficient management of materials plays a key role in the successful completion of a project. Perdomo, (2004). The control of materials is a very important and vital subject for every contracting company. This should be handled effectively for the successful completion of a project.

Christofferson, in a 1999 survey at the International Builders’ Show, reported that builders take an average of 12.7 hours to complete a detailed estimate. However, the kind of structure (design) was not stated. Computers have taken much of the drudgery out of estimating and whiles increasing the accuracy of estimates, have decreased the time needed to 4.7 hours. Christofferson, added that many find difficulties with the estimating programs which are extremely complicated, take a long time to learn how to use, are too rigid to customize and are very expensive.

Computer software systems are widely used in construction management practice in the developed countries, yet, the use of computer applications is still in its early phase of development in the developing countries. Today, a number of construction companies are using computer-aided software for cost estimation. Literature shows that there are different types of computer-based estimating software on the market like Autodesk quantity take-off, Autodesk Revit, Graphisoft Constructor, Bentley Architecture, Automated Estimator, just to mention but a few. These software have gained and continue to gain a wide acceptance in the construction industry, especially in the area of the Building Information Modelling concept.

In Ghana, QS pro and QS solution estimating applications are available for the estimation of material quantities. Moreover, all the local models and applications available to the researcher do not carry out the material extraction based on the design. The traditional method of taking off has to be completed before the models become useful for material extraction.

The aim of the study is to develop a design-related computer based material extraction model for estimating building material quantities to facilitate quick estimating of building materials during the design stage. The specific objectives of the research are:

To identify the existing computer based models for estimating practices in Ghana.

To develop a framework for extraction of material quantities in building.

To develop a design-related computer based model for estimating quantities of building materials for construction.

Manfredonia, et al, (2010) stated that high-quality estimates should satisfy four characteristics as established by industry best practices: they should be credible, well-documented, accurate and comprehensive. An estimate should be

**Credible:** The assumptions and estimates should be realistic. This implies, it has been cross-checked and reconciled with independent estimates, the level of confidence
associated with the point estimate has been identified, and a sensitivity analysis (i.e., an examination of the effect of changing one variable relative to the cost estimate while all other variables are held constant in order to identify which variable most affects the cost estimate) has been conducted;

**Well-documented:** Supporting documentation including a narrative explaining the process, sources, and methods used to create the estimate as well as identifying the underlying data and assumptions used to develop the estimate;

**Accurate:** The actual values should deviate very little from the estimated costs likely to be incurred; and

**Comprehensive:** The estimate accounts for all possible costs associated with a project so far as the structure is sufficiently detailed to ensure that costs are neither omitted nor duplicated, and has been formulated by an estimating team with composition commensurate with the assignment.

Elzarka and Dorsey, (1999) state, "in recent years, computer-based estimating systems have gained wide acceptance in the construction industry. These systems offer several advantages in all the estimating phases namely take-off, pricing, summarization and reporting". The use of computers in cost estimation offers a number of distinct advantages over manual methods; increased accuracy is ensured by minimizing human-based errors.

**RESEARCH METHODS**

A review of literature was carried out to identify existing computer based models for estimating practices. An assessment of how Microsoft Excel and Visual Basics for Application can be used for the development of the model was also carried out.

A computer based model was developed based on the information/gathered, the review of existing estimating models. The developed estimating model was tested and evaluated by experienced professionals in the industry. A structured questionnaire was used for evaluating the model, to find out the opinions of professionals in the industry. The evaluation process was conducted by a selected number of professionals from the industry who were briefed on the aim, components of the model and its operation. A period was given to the professionals to test and evaluate the model and through the use of structured questionnaires, provide feedback to improve the system.

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**Figure 2:** illustrated process of the modelling process (Ashworth A., 1994)
DATA COLLECTION
Primary data was collected using questionnaire surveys to identify existing computer based model for estimating in Ghana. Primary data is the most accurate source of information as it publishes original research (Naoum, 2008). Secondary data was collected from textbooks, journals, newspapers, magazines and internet to identify existing computer based models/software for estimating practices in Ghana. Two models were identified, being, QS pro and QS solution.

In order to obtain comprehensive data, semi structured questionnaires were developed to elicit information from various professionals in the construction industry who practice estimating in the government agencies. The targeted population included professional in the government agencies and contractors in Ashanti region who use some form of estimating software for material quantity extraction.

The selected government agencies consultancy firms were:
Building and Road Research Institute
Architectural and Engineering Services Limited,
Social Investment Fund,
Kumasi Metropolitan Assembly
Atwima Nwiabiagya District Assembly.

Selected contractors registered with Association of Building and Civil Engineering contractors of Ghana (ABCECG), Ashanti regional branch of members of good standing.

SAMPLE SIZE DETERMINATION
In order to be able to draw general conclusion in this study, for the population, purposive sampling was used. Out of 40 questionnaires distributed, 39 were collected representing 99.75% indicating high rate of response.

![Estimation Software Availability for Materials Extraction](image)

**Figure 3:** Estimation Software availability for material extraction; Source: Field survey, 2013
The results presented in figure 4.1 shows that, 25 respondents representing 64% use only Microsoft excel in the estimation of material quantities. Six (6) respondents representing 15%, use both MS excel & QS Solution, five (5) respondents representing 13% use both MS excel & QS Pro, and 3 respondents representing 8% and MS excel & QS Solution & QS Pro respectively.

Literature revealed that the main categories of buildings that exist are: Agricultural, Commercial, Residential, Educational, Government, Industrial, Military, Religious buildings, Transit stations. Two categories of buildings were chosen for this research due to the rate at which they are developed and the time limitation for the research. Residential buildings represent a major part of the Ghanaian Construction industry products.

The selected categories of buildings were as follows;

**Residential Facilities**
Single storey residential building with the number of bedrooms between two and five, with the buildings having a living area (Hall/lounge), kitchen, store, dining hall, washrooms, garage/ car port, terrace, corridor, etc.

**Educational Facilities**
Single storey educational building consisting of classrooms between three and six units including offices, library, storeroom and washroom.

**Design Information Collected For Model Development**
The following Government institutions were selected to source for approved Architectural drawings on single storey residential buildings; between two to six bedrooms and classroom blocks between three and six unit blocks for this research work. Six different project drawings were selected for both the residential and education facilities for the purpose of the model development; Building Road Research Institute, Architectural and Engineering Services Limited, Development office, Kwame Nkrumah University Science and Technology and Kumasi Metropolitan Assembly

Taking off for the selected elements was performed according to the standard method of measurement, seventh edition (SMM7) and the laid down procedure/principle was adopted from literature. The extraction of material quantities was carried out from first principles, after squaring from the take-off sheets, by referring to the standard quantities per unit of measure. (e.g. 9.87 blocks per m$^2$ of block wall). Formulation of the material extraction model was done based on the factors using combination of Microsoft excel and Microsoft visual basic for Applications.

**Determination of Cost Significant Items**
The research was not able to cover the building elements due to time limitation. For this reason, the Pareto principle was adopted for the determination of cost significant items. The cost significant items may be simply defined as the items whose value is greater than the mean bill value. Cost significant estimating is suggested to overcome the problem of pricing bulk numbers of small work items (Horner and Zakieh, 1993; Munns and Al-Haimus, 2000). Cost significant estimating is based on Pareto's principle. The principle established by an Italian Economist, Vilfredo Pareto, holds that 80 percentage of the effect is caused by 20 per cent of the causes. Pareto's
principle, now commonly called the 80:20 rule in everyday business, refers to the fact that 80 per cent is often achieved by the 20 percentage. As we concern construction business we can say “20 percentage of the work items contribute to 80 percentage of the total building cost.”

The mean value is calculated as the total bill value of the project divided by the number of items contributing to total bill value. As the standard method of work item analysis is used and the same project type is studied, it is expected that similar work items will be determined as cost significant with only minor differences (Tas and Yaman, 2005).

In order to determine the Cost Significant Items (CSI) for the development of the model, four projects were selected from Kumasi Polytechnic; all the selected projects had been completed as at the time of the study. These projects selected had been procured through Competitive Tendering prior to the award and execution of the works, under the supervision of the Consultancy Unit of Department of Building Technology, Kumasi Polytechnic.

The following building elements were identified as cost significant elements of the building based on the Cost significant items calculation performed on four selected projects. Superstructure blockwork was found not to be cost significant item, however, it was included for the purposes of it being one of the materials every client procure first before the commencement of the building. The extraction of the relevant building materials needed for selected component was used for the development of the model.

Table 1 Cost significant items on Substructure of Construction of Proposed Workshop Furniture Department for Kumasi Polytechnic at Adako Jachie

<table>
<thead>
<tr>
<th>PROJECT TITLE: CONSTRUCTION OF PROPOSED WORKSHOP FOR FURNITURE DEPARTMENT FOR KUMASI POLYTECHNIC AT ADAKO JACHIE</th>
<th>APRIL 2011</th>
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<tbody>
<tr>
<td>ITEM</td>
<td>COMPONENT DESCRIPTION</td>
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<td>1</td>
<td>SUBSTRUCTURE</td>
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<td>2</td>
<td>Pits excavation</td>
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<td>3</td>
<td>Trenches, width &gt; 0.30m</td>
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<td>4</td>
<td>Filling to make up level</td>
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<tr>
<td>4</td>
<td>Mass insitu concrete</td>
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<td>5</td>
<td>Floor Beds</td>
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<td>6</td>
<td>Blinding</td>
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<td>7</td>
<td>Reinforced insitu concrete</td>
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<tr>
<td>8</td>
<td>Formwork</td>
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<tr>
<td>9</td>
<td>Reinforcement</td>
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<tr>
<td>10</td>
<td>Blockwork</td>
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<tr>
<td></td>
<td>TOTAL COST OF SUBSTRUCTURE</td>
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</table>

Coloured are the Cost significant items
To extract or estimate the material for a particular project, the user will have to input project specific design data; e.g. the length and breadth of rooms in the building, at the user interface after which the corresponding material quantities are generated in a printable form at the click of a button. The various interfaces of the model are shown below.

MODEL DESCRIPTION
The model comprises of the under-listed interfaces

- **Project Information:** Here the project title, Name and address of client, Date including all relevant project details are provided
- **Design Information:** Here the design criteria including their dimensions are entered, title of spaces, sizes and number of rooms
- **Material Quantities:** The material quantities are automatically generated based on the design information provided.
- **Summary Of Material Quantity:** On this interface, the total quantities of similar items are grouped

Material Extraction Process

The procedure for use of the model is outlined below

- Launch the BME model on your PC. The main interface is as shown below
Click on the project information button and enter the necessary data.

<table>
<thead>
<tr>
<th>PROJECT TITLE</th>
<th>CONSTRUCTION OF FOUR BEDROOM SINGLE STOREY RESIDENTIAL BLOCK AT ATONSO - KUWAIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>27 December, 2012</td>
</tr>
<tr>
<td>NAME OF CLIENT</td>
<td>KUMASI POLYTECHNIC</td>
</tr>
<tr>
<td>ADDRESS OF CLIENT</td>
<td>ADAKADO MACHIE - KUMASI</td>
</tr>
<tr>
<td>PREPARED BY</td>
<td>G. FOBIRI, BTech (Hons)</td>
</tr>
</tbody>
</table>

Click on the Design information button and select the category of building. The residential category is used in the description.
Enter the number, length and breadth of the spaces of your design (in metres). E.g. Master Bedroom No. = 1, Length = 6.6, Width = 4.5

<table>
<thead>
<tr>
<th>Title of Space</th>
<th>Dimension (m)</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Length (m)</td>
<td>Width (m)</td>
</tr>
<tr>
<td>Master Bedroom(s)</td>
<td>1</td>
<td>6.60</td>
<td>4.50</td>
</tr>
<tr>
<td>Bedroom(s)</td>
<td>0</td>
<td>4.20</td>
<td>4.20</td>
</tr>
<tr>
<td>Living Area/Lounge/Hall</td>
<td>0</td>
<td>6.60</td>
<td>6.00</td>
</tr>
<tr>
<td>Dining</td>
<td>0</td>
<td>3.00</td>
<td>4.20</td>
</tr>
<tr>
<td>Kitchen</td>
<td>0</td>
<td>3.00</td>
<td>4.20</td>
</tr>
<tr>
<td>Store</td>
<td>0</td>
<td>2.00</td>
<td>4.20</td>
</tr>
<tr>
<td>Washroom(s)</td>
<td>0</td>
<td>1.90</td>
<td>3.00</td>
</tr>
<tr>
<td>Terrace</td>
<td>0</td>
<td>2.40</td>
<td>12.00</td>
</tr>
<tr>
<td>Corridor</td>
<td>0</td>
<td>1.80</td>
<td>15.60</td>
</tr>
<tr>
<td>Balcony</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Garage</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Other(s)</td>
<td>0</td>
<td>0.00</td>
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</tr>
</tbody>
</table>

Figure 7 Building Category Information interface

Click on the Material Quantities Button and select the category of building and obtain the material quantities of your selected design. A summary of the materials by type can be acquired by selecting that option. The generated interfaces are shown below.

Figure 8 Extracted material quantity interface
Assumptions Made

The model is applicable based on the following assumptions:

- To Single storey buildings only
- To residential and educational buildings only
- It covers material quantities of cost significant items only NOT all building materials
- The land conditions were considered to be a firm and a fairly flat ground.
- A depth of 750mm and 450 width for foundation trench
- 150mm thick mass concrete in foundation
- An average depth of 450mm thick hardcore filling was used
- 150mm thick mass concrete floor bed
- 3000mm height of wall
- Standard sizes of openings were used
- Reinforced concrete column of 250 x250mm x 2400mm height
- Gable / hip roofing with a height (rise) ranging from 1.5 – 3.0m
- Roofing members, standard sizes and centres were used
- 36mm thick cement sand mortar screeding
- 12mm thick cement sand rendering and plastering
- 3mm thick plywood ceiling with battens

VALIDATION OF MODEL

In order to test the model, the model estimation process was run for six (6) different projects, three (3) each for residential and educational buildings. It should be noted that projects that had been used in the development of the model were not used in the testing process.

In the testing process, manual material extraction process first was used for the calculating the material quantities of Cost Significant Items (CSI) of the project. The
model was then used to estimate the material requirement and the results of the two processes compared.

Differences between the manual quantities and model quantities of the projects were found to be over a range of -8.42% and +24.35% for residential buildings and -14.05% and 35.68% for educational buildings. The average variances for the educational and residential buildings together are -11.24% and +30.02%.

The reasons for the variances could be varied and a further study needs to be carried out to ascertain the reasons for these variances. See appendix for the Differences between Manual and Model Based Material Estimating for Residential Buildings.

The level of accuracy of the model was determined by comparing the model quantities extracted to quantities extracted manually from various designs and establishing the percentage of differences in the quantities of both facilities. Averages of the percentage of differences of each item of facilities were determined to establish the level of accuracy the model would produce.

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>MINUS</th>
<th>PLUS</th>
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<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>-8.42%</td>
<td>24.35%</td>
</tr>
<tr>
<td>EDUCATIONAL</td>
<td>-14.05%</td>
<td>35.68%</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>-11.24%</td>
<td>30.02%</td>
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</table>

EVALUATION OF THE MODEL

The developed estimating model was evaluated by experienced professionals in the construction industry. A structured questionnaire was used for the evaluation of the model to find out the opinions of experienced professionals on the model. The first section addressed the performance indicators of the model and the second section addressed the professionals comment on the model. The three professionals were Quantity Surveyors from the following institutions; Kumasi Metropolitan Assembly, Building Road and Research Institute and Architectural Engineering Services Limited. A period of one week was allowed for the professionals use the model and thereafter, assess the model.

All the evaluation members accepted the Building Material Estimating (BME) model as a potential application that is highly needed to solve the problem of quick and reliable material quantity estimation. However, the following comments were indicated:

- The model should be developed to cover all items not only the cost significant items.
- Model should have different alternatives finishes.
The model should be developed to cover more categories of buildings.

Different levels of building should be considered. Thus, two storey, three storey, etc.

All the comments received call for a further research and development of the software

CONCLUSION

Computer based building material extraction is key to effective and efficient material estimating. As set out, the computer based models generally used locally for material extraction are QS pro, QS Solution and Microsoft Excel. The framework for the extraction of building materials and the building material extraction computer based model were successfully developed. The building material extraction model has shown some level of conformity to the quantities of materials that are acquired using the traditional estimating approach. From the variances observed between the model and manual estimates, the model which is under progressive development, will need to be subjected to further improvement by carrying out the further data collection from approved drawings to ensure the robustness of the model for adoption by the Ghanaian Construction industry.
## Estimating model

### MATERIAL QUANTITIES

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<th>Item</th>
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### APPENDIX A - Differences between Manual and Model Based Material Estimating for Residential Buildings Case 1

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403
REFERENCES


EFFECT OF BID BOND ON CONSTRUCTION PROJECT PERFORMANCE IN NIGERIA

Oke, A.E.1, Ogunsemi, D. R., Aje I. O. and Ogundimu, A. F.

Department of Quantity Surveying,
Federal University of Technology, P. M. B. 704, Akure, Nigeria

Bid bond is a type of construction bond that keep frivolous bidder out of the bidding process by ensuring that successful bidder will enter into the contract and provide the required performance and payment bonds. The aim of this research is to assess performance of bid bond in Nigerian construction industry and its effect on project time and cost. Data for the study were collected using well structured questionnaire administered on professionals in the construction industry as well as cost data of completed building projects. The data was analyzed using mean score, mean group difference, percentage, Spearman’s rank correlation coefficient (Rs) and linear regression analysis. The study revealed the purposes and benefits of bid bond as well as risk associated with construction projects with and without bid bond. It was observed that there is significant relationship between cost of bond and initial cost; final cost; cost overrun; number of days to secure bond; initial time, final time and time overrun. Finally, the study recommended that bid bond should be properly used in construction industry by consulting appropriate professionals at the tendering stage of the project so as to reduce abandonment of the project, incompetent contractors, risk that can arise during the construction, quality failure, poor performance as well as cost and time overrun.

Keywords: bid; bid bond; construction bond; construction project performance; Nigeria.

INTRODUCTION

Before the advent of the due process policy, construction project in Nigeria was facing a lot of challenges. These challenges according to Ogunsemi and Aje (2006) includes the implication of project failures on the image of the Nigeria construction industry in terms of project abandonment, delay in project delivery; cost inflation, poor quality of work and high initial cost of project and so on. Arguably, poor methods and procedures of selection of contractor could be linked to this. However, these methods are not only subjective, decisions on public contract awards are based on informal relationship between contractors, public officials and project teams. Thus most of the models of assessment used for the selection of contractors are not based on value and merits of bids but on the tender price and ‘‘initial’’ lowest bids, as well as other informal factors.

CBN (2008) stated that the contribution of the construction industry to the growth of the Gross Domestic Product (GDP) of Nigeria is steady and improving, from 5% in 2001 to over 13% in 2007. Budgeting Monitoring and Price Intelligences Unit (2005) observed that the growth is motivated by continued interest of Government to the

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reposition Nigeria’s economy as one of the top 20 largest economic in the world. Interestingly, the Government is responsible for about 75% of infrastructural development in Nigeria. Evidently, there is very strong relationship between the Nigeria construction industry and larger economies, both in Nigeria and Africa at large. Thus, the Government is not only keen to the development of the sector of the economy but there is also critical interest for the government to improve the image of the country through the construction sector.

The construction industry is generally responsible for the physical development or the transformation of the environment which is very vital to the socio-economic development of a nation. That is the affordability of its products and or service affects the confidence of the citizen in their existence in any nation. Wase (2004) observed that construction industry plays important and dynamic role in the process of sustainable economic growth and development of a nation and more than 50% of the Gross Fixed Capital budget in Nigeria normally takes the form of construction output. Datamonitor (2006) stated that construction industry contributes more than 5 per cent to the country’s GDP and generates more than $30 billion in revenues. Growth of the industry has greatly influenced the economic development in Nigeria, stimulating significant growth in other sectors. Therefore, improvement in efficiency and productivity in construction sector make significant contribution to the improvement in productivity in other sectors.

The bid bond is intended to keep frivolous bidder out of the bidding process by assuring that successful bidder will enter into the contract and provide the required performance and payment bonds. If the lowest bidder fails to honour these commitments, the owner is protected, up to the amount of the bid bond, usually for the difference between the low bid bond and the next higher responsive bid. Emily (2009) stated that on most major construction projects, work is awarded through a process known as bidding. Here, contractors submit prices for the job to the project owner. The contractor with the lowest price is typically awarded the job. Many owners will request that a bid bond be submitted along with the proposed bids. This bid bond acts as a guarantee that the contractor will honour their bid, and will sign a contract for the project at that amount if they are low bidder. Bid bonds are backed by financial and insurance brokers, and typically cost the contractor a small percentage of the full contract amount.

Debbi (2010) observed that written guaranty from a third party guarantor (usually a bank or an insurance company) submitted to a principal (client or customer) by a contractor (bidder) with a bid bond ensure that on acceptance of bid by the client the contractor will proceed with the contract and will replace the bid bond with a performance bond. Otherwise, the guarantor will pay the customer the difference between the contractor’s bid and the next highest bidder. The difference is called liquidate damages which cannot exceed the amount of the bid bond. Unlike a fidelity bond, a bid bond - also known as bid guaranty or bid surety- is not an insurance policy, and (if cashed by the principal) the payment amount is recovered by the guarantor from the contractor.

LITERATURE REVIEW

Bonds

According to Moffatt (2011) a bond is a fixed interest financial asset by government, companies, banks, public utilities and other large entities. Bonds pay the bearer a fixed
amount a specified end date. A discount bond pays the bearer only at the ending date, while a coupon bond pays the bearer a fixed amount over a specified interval (month, year, etc.) as well as paying a fixed amount at the end date. Bonds are another word for loans taken out by large organisations, such as corporations, cities, and the Nigeria government. Since these entities are so large, they need to borrow the money more than one person or bank. Therefore, bonds are a piece of a really big loan. The borrowing organization promises to pay the bond back, and pays interest during the terms of bond. Since large organization don’t like to actually say they are borrowing money, they say they are selling bonds presumably because it sounds better. Like loans, bonds return interest payments to the bond holder in the old days, when people actually held paper bonds; they would redeem the interest payments by clipping coupons. Today, most bonds are held by financial planning institution, and interest is atomically accrued for the life of the bond.

Bonds are financial instruments of debt used by corporations and government agencies of all levels. An issuer borrows money from investors (“bondholders”) and agrees, by written contract, to repay the amount borrowed plus interest at an agreed upon rate. The amount borrowed is referred to as the “principal” amount. Normally, bonds are repaid through semi-annual payments, consisting of interest payments, with the final payment including a return of the principal. The semi-annual payments to bondholders are called “debt service”. Bonds are normally sold in Nigeria in denominations of ₦1,000 or ₦5,000 each, or multiples of these amounts.

Bonds generally have a predetermined date of maturity. The maturity date is when the principal amount of the bond is due and future interest payments cease. When bond financing is needed, the issuer will normally sell a large quantity of bonds at once. The maturity dates are often staggered so that repayment is spread evenly across the term of the bond issue, making debt service amounts level and therefore more manageable. In those cases, bonds with shorter maturities will normally carry a lower interest rate than those of longer maturities, since the longer time frame creates more risk of repayment.

Bonds are usually resold before they mature, or reach the end of the loan period. This is how bond rise and fall in value. Since bonds return a fixed interest payment, they tend to look more attractive when the economy and stock market decline. When the stock market is doing well, investors are less interested in purchasing bonds, and their drops. Like stocks, bond can be packaged into a bond mutual fund. This is a good way for an individual investor to let an experience mutual fund manager pick the best selection of corporate bonds. A bond fund can also reduce risk through diversification. This way, if one corporation defaults on its bonds, then only a small part of the investment is lost. In the case of Government Bonds, these are usually issued by auctions, where both members of the public and banks may bid for bond. Since the coupon is fixed, but the price is not, the percent return is a function both of the prices paid as well as the coupon.

**Types of Bonds**

The following descriptions are not mutually exclusive, and more than one of them may apply to a particular bond according to Glenn (1990). They are: Performance bonds; Variable rate bonds; Land secured bonds; Municipal Bonds; General obligation bonds; Saving bonds; Payment bond; Treasury bonds; Secured bond; Callable bond; Contract surety bond; License and permit bonds; Court bonds; Public official bond; Miscellaneous bonds; Inflation linked bond; Subordinate bond; Perpetual bond; Bearer bond; Registered bond; Lottery bond; Fixed rate bonds; and Revenue bond.
Construction Bond

Victor (2006) stated that construction bond is a form of surety bond which is a mandatory for financial investors for large construction and federal construction projects. The principal has given the written statement that he will complete the entire contract according to the norms. He will complete the contract at no additional cost, in case the contractor fails to perform his obligation. Since construction bond is a risk management bond, it is not guaranteed that it will complete the construction projects. This bond will protect interest of the individual and other structure that the construction has been taken place as per contract. Emily (2009) stated that construction bonds are risk management tool used to protect project owners and developers. A bond constitutes a legal guarantee that the project will be completed as expected. In instances where a bonded contractor fails to perform, the bonding company will provide some form of restitution to the owner. While bonds are not required on all projects, there are strict bonding standards on government work. Many private owners and developers might also require bonds to protect the interests on various projects.

According to Victor (2006), construction contractors are well known with the concept of securing surety bonds, but they do not know that they will create a relationship between the principal, the obligee the surety. Construction lawyers, are aware of the legal rules and act of the principal, oblige and surety, but they are not aware of knowledge of obtaining bonds. A construction surety bond is written statement that the contractor will perform his obligation per bond. Construction bond is otherwise called condition bond. If the principal fails to perform his obligation, both the principal and the surety will be asked to pay penalty amount. Construction surety bond are of different types like bid bond, performance bond, payment bond.

Construction bond ensures proper completion of contract within stated period. Other importance includes: it ensures the obligee that the contract will be completed within stated period; the principal ensures that he will finish the contract as per norms; it improves the reputation of the constructor or the contractor; and it improves the quality and quantity work.

Bid Bond

Victor (2006) stated that bid bond is a written statement which guarantees to the obligee that the principal will offer his bid, as awarded in the contract. In this type of bid, both principal and the surety are sued, in failure of their contract. They have to pay the additional expenses incurred by the obligee for breaking of contract. The penalty amount will be ten to twenty per cent of the contract. If the principal refuses to bid the surety has to undergone the risk.

Bid bond is a debt secured by a bidder for a construction job or similar type of bid based selection process for the purpose of providing a guarantee to the project owner that the bidder will take on the job if selected. The existence of a bid bond provides the owner with assurance that the bidder has the financial means to accept the job for the price quoted in the bid. Juan (2011) stated that a bid bond is important to show proof of guarantee to the project owner that you can comply with the bid contract and also that you can accomplish the job as laid out in the contract. A bid bond is a guarantee that you provide to the project owner stating that you have the capability to take only and implement the project once you are selected during the bidding process.
Normally, project owners do not know if a contractor is financially stable or has the necessary resources to take on a project. However, because of a bid bond, they will be more comfortable to award a project to a contractor knowing that if the project fails, they can collect compensation from the surety bond. Victor (2006) define a bid bond as a bond where the contractor that is the principal guarantees the obligee that is the owner, that the principal will honour the bid and sign the contract, if bid is awarded. In default of the bid the owner may sue both the obligator that is the principal and surety. This bond guarantees that the bidder will carry on the contract at bid price if bid is awarded. If the bidder is allowed to take away the bid before granted, no action may be taken against the bidder or bid security.

The deposit of cash certified check, cashier’s check, bank draft, money order or bid bond submitted with a bid and serving to guarantee to the owner that the bidder, if awarded the contract will execute such contract in accordance with the contract document. If bid bond required, it should be enclosed separately from the pink and green envelopes. Sub-bidders do not have to bid to every general contractor before they go out to bid and to the extent that they limited oversight. Bid bonds protect clients offering large-scale projects by ensuring follow-through by the contracting company.

A bid bond is a surety instrument supplied by companies to prospective client’s contractual bidding arrangement. The bid bond is an insurance guaranteed expression by a bidding company of its promise to enter into a contract with the client should its bid be successfully accepted. Once the client has contracted the client in writing, the client returns the bid bond to the client. In most cases, this occurs only once the company has produced a performance bond in its place.

The bid bond generally indemnifies the faithful performance with regards to the bid. Bid bonds are issued during the bidding process. They constitute a guarantee that a company will sign a contract for their specified bid price if they are the low bidder. These are obtained to ensure that a successful tendered will enter into a contract. Their value varies, but is usually somewhere between 1% and 5% of the tender sum. Most typically, they are requested by a contractor to ensure a sub-contractor’s commitment to enter into a sub-contract agreement. The associated costs and disruption to a contractor’s programmed in the event of a sub-contractor withdrawing an offer can be significant. A new sub-contractor will have to be found and appointed, which may cause delays to the programme resulting in liquidated damages becoming payable to an Employer and/or acceleration costs for the completion of the project.

**Purposes of Bid Bond in Construction Project**

Submitted alongside a company’s bid for a given project, a bid bond is issued to the prospective client by a third party insurer on behalf of the bidder (Boswall, 2010). It constitutes the bidder’s promise that, if chosen, it will contractually engage the client for the project and not withdraw as doing so would result in a penalty. Once the chosen company has signed on contractually with the client, the company generally submits a performance bond which replaces the bid bond.

According to Mike (2011), the main purposes of bid bond are:

**No frivolous bids:** establishes a baseline threshold of bidder and responsibility and prevents or militates against contractors submitting frivolous bid they do not intend to honour.
Covering Agency costs: compensate the public agency for its cost in the event the low bidder fails to execute a contract with the owner after award the project.

To provide financial recompense for the costs associated with the refusal by a tendered to honour a tender.

To afford protection against a change involving substantial damages loss or detriment.

However, Micheleholloway (2006) stated that the purpose of bid bond is classified into two, that is, purpose for owner and purpose for bidder. Owners look for a bid bond so they can be sure that the contractor has the ability to carry on the project as the bid stated. Some contractors may attempt to bid on a project that they are not qualified for, or that they cannot complete in time. A bid bond imposes fees on the contractor and arranges for adequate preparation for the contractor so the owner has assurance the job will be done.

On the other hand, the bidder uses a bid bond to apply for the best projects available in the contracting market. The Government and other large organisations, typically require bid bonds, so contractors that are able to easily create such bonds can effectively compete for lucrative projects. The more often contractors create bid bonds, the better relationship they have with a lender and the easier it becomes.

**RESEARCH METHODOLOGY**

Reputable Architectural firms, Quantity surveying firms and Contractors are the population of this field survey and questionnaires were administered accordingly to sample their opinions on the performance of bid bond in Nigeria construction industry. In order to arrive at an accurate sample frame, the lists of these registered firms were obtained from the Ondo State Ministry of Works (as at February 2011) as shown in table 1. This was on the premise that most projects where bonds are administered are government owned and only registered firms with the state government can submit bid for such projects. Two sets of data were collected for the study. This include qualitative data from the opinion of respondents as well as quantitative data on previous completed bonded projects by the contracting firms.

### Table 1: Sample Size

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Source: Ondo state Ministry of Work, Akure

The sample size was calculated using Ling and Liu (2005) proposed formula for confirming the adequacy of a number of questionnaires, where \( n \) is the sample size for estimating the population, \( N \) is the population size, \( \sigma^2 \) is the desired variance (95% was adopted)

\[
0.25 N = (N-1) \sigma^2 + 0.25
\]
57 (representing the calculated sample size) questionnaires were administered on relevant stakeholders out of which 47 were retrieved. However, only 45 of the retrieved questionnaires were appropriately filled and deem fit for the study.

**FINDINGS AND DISCUSSION**

Table 2: General characteristics of respondents

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<td></td>
<td>21-25</td>
<td>11.11</td>
<td>5</td>
</tr>
<tr>
<td>Over 25</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>100.00</td>
<td>13.33</td>
</tr>
</tbody>
</table>

As shown in table 1, a total of 57 questionnaires were administered to different organisations within the study area out of which 45 were retrieved. Out of 45 respondents under survey, table 2 shows that Quantity surveyors are 28.89%; Architects are 28.89% while 42.22% are Contractors. The average years of experience of the respondents is 8 years while the years of experience/establishment of
surveyed organisations is 13 years and this shows that the respondents have a fair level of experience require for the study.

**Purpose of bid bond**

Table 3: Purposes of bid bond

<table>
<thead>
<tr>
<th>Purposes</th>
<th>Significance Mean</th>
<th>Rank</th>
<th>Ext. of Agr. Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>To apply for the best projects available in the contracting market.</td>
<td>4.2</td>
<td>3</td>
<td>36.2</td>
<td>2</td>
</tr>
<tr>
<td>To afford protection against a change involving substantial damages</td>
<td>4.1</td>
<td>4</td>
<td>36.6</td>
<td>1</td>
</tr>
<tr>
<td>loss or detriment.</td>
<td></td>
<td></td>
<td>-32.5</td>
<td>-</td>
</tr>
<tr>
<td>To provide assurance that the job will be executed at the stipulated</td>
<td>4.3</td>
<td>2</td>
<td>34.8</td>
<td>3</td>
</tr>
<tr>
<td>time.</td>
<td></td>
<td></td>
<td>-30.5</td>
<td>-</td>
</tr>
<tr>
<td>To ensure that the contractor has the ability to carry on the project</td>
<td>4.4</td>
<td>1</td>
<td>36.6</td>
<td>4</td>
</tr>
<tr>
<td>as the bid stated.</td>
<td></td>
<td></td>
<td>-32.2</td>
<td>-</td>
</tr>
<tr>
<td>To provide financial recompense for the costs associated with the</td>
<td>4.1</td>
<td>4</td>
<td>34.0</td>
<td>5</td>
</tr>
<tr>
<td>refusal by tendered to honour a tender</td>
<td></td>
<td></td>
<td>-29.9</td>
<td>-</td>
</tr>
</tbody>
</table>

The result of the analysis on table 3 shows that “to ensure that the contractor has ability to carry on the project as bid stated; “to provide assurance that the job will be executed at the stipulated time” and “to apply for the best projects available in the contracting market”, were ranked 1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} with mean score of 4.4, 4.3 and 4.2 representing the three most significant purposes of bid bond. While to afford protection against a change involving substantial damages loss or detriment, To apply for the best projects available in the contracting market and To provide assurance that the job will be executed at the stipulated time were ranked 1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} with mean score of 36.6, 36.2 and 34.8 this indicate the extent of agreement with the purposes of bid bond.

**Benefits of Bid Bond**

Table 4: Benefits of bid bond in construction industry

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without bid bonds, project bidder could make ludicrous quotes without</td>
<td>4.2</td>
</tr>
<tr>
<td>any fear or obligation of living up to the terms of the agreement.</td>
<td>2</td>
</tr>
<tr>
<td>To ensures that all bidders are financially sound.</td>
<td>4.3</td>
</tr>
<tr>
<td>Where a bond is thought appropriate for the risks inherent in a project.</td>
<td>3.9</td>
</tr>
<tr>
<td>4 4</td>
<td></td>
</tr>
</tbody>
</table>
To ensure the quality and quantity of a project.

3.8

To provide the project owner with assurance the bidder will honour the agreed upon quote.

4.13

The result of the analysis in table 4 shows that “to ensure that all bidders are financially sound”, “without bid bonds, project bidder could make ludicrous quotes without any fear or obligation of was living up to the terms of the agreement” and “to provide the project owner with assurance the bidder will honour the agreed upon quote” were ranked; 1st, 2nd and 3rd with mean score of 4.3, 4.2 and 4.1 and this indicates that these are the most significant benefits of bid bond.

**Bid Bond and Construction Project Cost and Time**

This section examines the relationship between cost of the bond and construction project time and cost. Spearman rank coefficient was adopted in order to determine the significance of the relationship between identified variables as shown in table 5. More so, regression equation was used in order to predict the relationship between cost of the bond, cost of securing bond, time taken to secure bond and project delivery indices (initial time, final time, time overrun, initial cost, final cost and cost overrun). The equation with the highest $R^2$ value is believed to be the suitable model and this is expressed in table 5.

**Table 5: Effect of bid bond on construction project; cost and time**

<table>
<thead>
<tr>
<th>Variables Equation</th>
<th>Correlation Rs-value</th>
<th>Remark</th>
<th>Regression $R^2$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of bid bond &amp; initial cost 0.197+2.795IC (SL equ)</td>
<td>0.700</td>
<td>significant</td>
<td>0.494 COB=</td>
</tr>
<tr>
<td>Cost of bid bond &amp; final cost 0.225+2.835FC (SL equ)</td>
<td>0.703</td>
<td>significant</td>
<td>0.501 COB=</td>
</tr>
<tr>
<td>Cost of bid bond &amp; cost overrun LnCOB=1.511+1.513CO (SLequ)</td>
<td>0.220</td>
<td>significant</td>
<td>0.222</td>
</tr>
<tr>
<td>Number of days to secure bond &amp; initial time 58.810-0.638IT (SL equ)</td>
<td>0.997</td>
<td>significant</td>
<td>0.049 NDB=</td>
</tr>
<tr>
<td>Number of days to secure bond &amp; final time 0.243NDB=58.435-0.381FT (SL equ)</td>
<td>0.903</td>
<td>significant</td>
<td></td>
</tr>
<tr>
<td>Number of days to secure bond &amp; time overrun 39.264-0.755TO (SLequ)</td>
<td>0.375</td>
<td>significant</td>
<td>0.315LnNDB=</td>
</tr>
<tr>
<td>Cost of securing bond &amp; initial cost 0.202+2.922 (SL equ)</td>
<td>0.811</td>
<td>significant</td>
<td>0.533 CSB=</td>
</tr>
<tr>
<td>Cost of securing bond &amp; final cost 0.320+3.751 (SL equ)</td>
<td>0.852</td>
<td>significant</td>
<td>0.644 CSB=</td>
</tr>
<tr>
<td>Cost of securing bond &amp; cost overrun 1.966+1.601 (SL equ)</td>
<td>0.601</td>
<td>significant</td>
<td>0.399LnCSB=</td>
</tr>
</tbody>
</table>

**KEY:** COB= Cost of the bond, IC=Initial cost of project, FC= Final cost of the project, Cost overrun= CO, NDB= Number of days to secure bond, IT= Initial time of project, FT= final time of the project, TO= Time overrun, CSB= Cost of securing bond, SL= Linear equation.

It could be deduced that there is a significant relationship between COB & IC with the Rs value of 0.700 while the most suitable model for the relationship is that of simple linear equation with $R^2$ value of 0.494. The second equation also showed that there is
a significant relationship between COB & FC with the Rs value of 0.703 while the most suitable model for the relationship is that of simple linear equation with $R^2$ value of 0.501. Also, the third equation showed that there is a significant relationship between COB & CO with the Rs value of 0.220 while the most suitable model for the relationship is that of simple linear equation with $R^2$ value of 0.222.

It could also be deduced from the fourth equation that there is a significant relationship between NDB & IT with the Rs value of 0.997 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.049. The fifth equation showed that there is a significant relationship between NDB & FT with the Rs value of 0.903 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.234.

The sixth equation showed that there is a significant relationship between NDB & TO with the Rs value of 0.375 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.315. The seventh equation showed that there is a significant relationship between CSB & IC with the Rs value of 0.811 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.533.

The eighth equation showed that there is a significant relationship between CSB & FC with the Rs value of 0.852 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.644. The ninth equation showed that there is a significant relationship between CSB & CO with the Rs value of 0.601 while the most suitable model for the relationship is simple linear equation with $R^2$ value of 0.399.

## Discussion of Findings

### Purposes of Bid Bond

As observed, “to ensure that the contractor has ability to carry on the project as bid stated” is the most significant purpose of bid bond. According to William (2010), debt secured by a bidder for a construction job or similar type of bid-based selection process for the purpose of providing a guarantee to the project owner that the bidder will take on the job if selected. The existence of a bid bond provides the owner with assurance that the bidder has the financial means to accept the job for the price quoted in the bid. In agreement with Micheleelloway (2006), who noted that, owners look for a bid bond so they can be sure that the contractor has the ability to carry on the project as bid stated, which is in agreement with the finding of the research.

### Benefits and Extents of Usage of Bid Bond

From the analysed result, it was discovered that to ensuring that all bidders are financially sound is the most significant benefit of bid bond in construction project. This can be justified since bonds issued by organisation known as surety companies, the surety will evaluate the contractor as well as the risk associated with the project before determining the bond rate (Tyler, 2010) in agreement with the findings of the research. According to William (2010), observed that bid bonds provide the project owner with assurance the bidder will honour the agreed upon quote. Without bid bonds, project bidders could make ludicrous quotes without any fear or obligation of living up to the terms of the agreement.

### Effects of Bid Bond on Construction Project Performance Overrun

The study showed that there is significant relationship between cost of bond and other cost indices and same is also applicable to time taken to secure the bond and time
overrun. This can justified as Akinci & Fisher, (1998) and McKim, (2000) asserted that although it is easy to reach an agreement on the change of dimensions, it is very difficult to agree on whether unexpected conditions warranted a contract modification but fluctuation in price of material and labour can greatly influence cost performance. This finding also confirmed Smith et al. (1999) assertions that, professional negligence and incompetent project manager are likely to have effect on the construction project performance. Since construction projects have been perceived as being unique; it has been very difficult or impossible to gather sufficient and reliable historical data on which to elicit objective probabilities (Shen, 1997).

**Conclusion and Recommendation**

After given an in-depth coverage to the concept of the bid bond in Nigerian construction industry, the research revealed that there is significant relationship between cost of bond, time overrun and project cost which helps in successful delivery of building projects. The result of the analysis shows that “how to ensure that the contractor has ability to carry on the project as bid stated” and “to afford protection against a change involving substantial damages loss or detriment” are the most significant purposes of bid bond in the construction industry.

The study recommended that the clients should be well informed in order to understand the importance of bid bond in both corporate and public sectors of the Nigerian construction industry so as to ensure efficient project delivery within time and cost frame. More so, the actors in the construction industry should be made to understand that bid bond is important to show proof of guarantee to the project owner that you can comply with the bid contract and also that you can accomplish the job as laid out in the contract. A bid bond is a guarantee that the contractor provide to the project owner stating that he has the capability to take only and implement the project once he is selected during the bidding process.

**References**


EFFECTS OF NIGERIAN METAKAOLIN (MK) ON CEMENT MORTAR AND COMPRESSIVE STRENGTH OF CONCRETE

Abalaka, A.E. 1, Mohammed I., Mohammed B.M.
Department of Building, Federal University of Technology, Minna, Nigeria

The effects of MK produced by calcining raw kaolin at 700°C using materials passing 75µm sieve on physical properties of cement mortar at standard consistence were determined in the laboratory. The MK was also used as partial ordinary Portland cement (OPC) replacement in concrete at water/cement (w/c) ratio of 0.30 and 0.40. In cement mortar, standard consistence water content change as a result of MK addition was marginal; the initial setting times reduced with increase in MK content, but no unsoundness was recorded. The results of compressive strength tests on cube specimens show that at 28 and 90 days, the specimens containing 15% MK recorded the maximum strength increase at a w/c ratio of 0.40.

Keywords: metakaolin, compressive strength, concrete.

INTRODUCTION

Concrete is an inorganic plastic that can be locally produced and easily placed in forms, making it the most common construction material globally; it is estimated that the concrete industry produces about 12 billion tonnes of concrete annually (Rashad, 2013a). The production of one ton of cement releases an estimated 0.9-1.0 ton of CO₂ gas mainly from the kilns as a result of calcining limestone (Eco-serve 2006; US Green Concrete Council, 2010). The production of CO₂ and other gases that cause acid rain has been the main global drive for the reduction of clinker cement consumption in concrete production by promoting the use of more sustainable materials by the construction industry. The use of mineral admixtures to reduce cement consumption and at the same time improve durability properties of concrete has become topical in concrete research. Silica fume, rice husk ash (RHA), and MK are some of the common mineral admixtures that are used in concrete to improve its strength and durability properties. These mineral admixtures improve strength and durability properties of concrete by pozzolanic reactions. MK (Al₂O₃:2SiO₂) is a natural pozzolan produced by heating kaolin-containing clays over a temperature range of about 600–900°C which it recrystallizes, rendering it to mullite (Al₆Si₂-O₁₃) or spinel (MgAl₂O₄) and amorphous silica (Murat et al.1985). The plate like morphology of MK allows the particles to move readily over one another, giving rise

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to physical properties such as softness, soapy feel and easy cleavage (Kingery et al. 2004).

The amorphous silica in MK is highly reactive but its reactivity varies with calcining temperature (Rashad, 2013b). Studies have shown that MK produced by calcining kaolin at 700°C was most reactive (Ambroise et al. 1985; Ambroise et al. 1992). Calcining temperature below 700°C resulted in less reactive metakaolinite with more residual kaolinite; calcinations higher than 850°C results in reduced reactivity due to crystallization (Rashad, 2013b).

MK reacts mainly with calcium hydroxide in concrete (Shekarchi et al. 2010). MK also contains alumina (Al₂O₃) that reacts with calcium hydroxide (CH) to produce additional alumina-containing phases, including calcium aluminate hydrate (C₆AH₁₃), calcium aluminiumsilicate hydrates (C₂ASH₈), and C₃AH₆ (Cachim et al. 2010; Zhang and Malhotra, 1995; Changling et al. 1995; Paiva et al. 2012). The additional CSH gel formed as a result of pozzolanic MK reactions penetrates pores, promoting pore refinement due to the decrease in average pore size caused by extra water that was not used in cement hydration in concrete. This effect is also observed in the interfacial transition zone (ITZ) between the binder and aggregate, resulting in densification. The refinement of pores and densification of ITZ can justify improvements in the mechanical strength and reduction of capillary water absorption, improved chemical resistance and increased durability (Siddique and Klaus, 2009; Khatib and Clay, 2004; Bredy et al. 1989; Khatib and Wild, 1996; Largier and Kurtis, 2007).

In addition, MK reacts with portlandite in hydrated cement, thus decreasing its concentration (Vejmelková et al. 2010). Since portlandite is the most often chemically attacked phase in concrete, the use of MK in concrete leads to improved environmental performance.

Research results have shown that MK in concrete enhances early strength, increases resistance to alkali silica reactions and resistance to sulfate attack (Wild et al. 1996; Jones et al. 1992; Khatib and Wild 1998). The study by Valipour et al. (2013) shows that the optimum cement replacement by MK at w/b ratio of 0.40 to be 10-15% by mass. The study of Qian and Li (2001) show that compressive strength and tensile strength of concrete containing MK at specific surface of 12,000 m²/kg continued to increase up to 15% MK content at w/b ratio of 0.38. The optimum OPC replacement level with MK varies depending on cement content; with normal strength concrete, optimum level is ≈20% at w/c=0.50, whereas in high performance concrete it is≈ 10% at w/c ratio of 0.30 (Vejmelková et al. 2010). These studies used MK milled to high specific surface that are several times that of OPC. Though these high specific surface MK are used in concrete research, milling MK to very high specific surface requires considerable grinding energy.

Nigeria has natural kaolin deposits of purities above 90% estimated at over 3 billion metric tonnes of sedimentary or residual origin in various parts of the country.
including the Federal capital area of Abuja (Gushit et al. 2010). These deposits are vastly undermined for industrial purposes and it is estimated that about 7.1-31% of the national demand for its use mainly by the commercial, pharmaceutical and ceramic industry is met by the local kaolin production industry (Gushit et al. 2010; Talabi et al. 2012).

This aim of this study was to determine, the level of MK reactivity at low specific surface in concrete by determining its effects on compressive strength of concrete using materials passing 75µm sieve. The MK was produced by calcining natural kaolin sourced from deposits in the Nigerian capital Abuja at 700°C.

MATERIALS AND METHODS

Crushed granite of 20 mm maximum size with specific gravity of 2.67 was used as coarse aggregates; natural river bed quartzite sand with specific gravity of 2.62 was used as fine aggregates. The results of the sieve analysis of the aggregates are given in Table 1. The particle size distribution of the fine aggregates correspond to zone 4 sand by the BS 882: 1983 classification. The concrete mix proportions used are given in Table 2. A commercial brand of OPC type 1 locally produced with specific gravity of 3.30 was used for this study.

Table 1. Particle size distribution of aggregates as percentage by weight passing sieve sizes

<table>
<thead>
<tr>
<th>Sieve size (mm)</th>
<th>20</th>
<th>10</th>
<th>5</th>
<th>2.36</th>
<th>1.18</th>
<th>0.60</th>
<th>0.30</th>
<th>0.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine aggregates</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>97.79</td>
<td>94.38</td>
<td>84.94</td>
<td>50.81</td>
<td>4.81</td>
</tr>
<tr>
<td>Coarse aggregates</td>
<td>64.60</td>
<td>31.27</td>
<td>4.13</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2. Concrete mix proportions

<table>
<thead>
<tr>
<th>Cement content</th>
<th>Sand</th>
<th>Coarse aggregates</th>
<th>Free w/c ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>530kg/m³</td>
<td>548kg/m³</td>
<td>1,302kg/m³</td>
<td>0.30-0.40</td>
</tr>
</tbody>
</table>

Raw kaolin was milled and sieved using 75µm sieve. Only materials passing 75µm sieve was used for this study. Natural kaolin passing 75µm sieve was calcined at 700°C for seven hrs using industrial furnace at a heating rate of 5°C/ min. The resulting MK was allowed to cool to ambient temperature, hermetically sealed in polythene bags until it was used.
Table 3. Composition of MK by mass

<table>
<thead>
<tr>
<th></th>
<th>SiO₂</th>
<th>Fe₂O₃</th>
<th>CaO</th>
<th>MgO</th>
<th>K₂O</th>
<th>Na₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>55.14%</td>
<td>6.16%</td>
<td>2.01%</td>
<td>0.84%</td>
<td>0.04%</td>
<td>0.10%</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>1.30%</td>
<td>Al₂O₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>28.45%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The composition of the MK used for this study, determined by chemical analysis is given in Table 3.

The MK was weighed and mixed in the dry state with the cement. Half of the course aggregates was poured into the mixer, half of the mixing water containing the plasticizer was poured into the mixer followed by the cement and the MK. Fine aggregates were poured into the mixer and the remaining water containing the plasticizer was finally added into the mixer. This mixing sequence has been found from experience to be the best practical sequence to virtually eliminate cement sticking to the mixer wall. The concrete was mixed in a tilting drum mixer for 3 minutes, and manually compacted in two layers in 100 mm steel moulds. A chloride free lignosulfonate based plasticizer (Fosroc Conplast P505) complying with BS EN 934 (2001) standard was used to increase the slump for the mixes.

After 24 hrs the cubes were removed from the steel moulds and cured in water in compliance to BS 1881 (1997) procedures and the compressive strength determined at 3, 14, 28 and 90 days.

The compressive strength of the cubes was determined using digital compression machine at a loading rate of 3.00 kN/s using BS 1881: Part 4 (1970) standard procedures. Four samples were tested for each parameter investigated and the results represent the average of four test specimen results. Concrete cube specimens without MK were used as the control.

The effects of RHA in OPC mortar of standard consistence and soundness were measured using the Vicat and Le-Chatelier apparatus using procedures complying with BS 4550: part 3 specifications. The immersion in cold and boiling water method complying with BS 4550: Part 3: Section 3.7: 1978 specifications were used in measuring soundness. Vernier caliper was used to measure the separation of the Le-Chatelier apparatus. The MK was weighed and used dry as cement replacement by mass to determine the standard consistence water, soundness, initial and final setting times.

**RESULTS**
The effects of MK on physical properties of cement mortar at standard consistence are shown in Table 4. The effects of MK on compressive strength of concrete at cement replacements of 5%, 10%, 15%, and 20% and w/c ratio of 0.30 and 0.40 at test ages of 3, 14, 28 and 90 days are given in Table 5.

Table 4. Effects of MK in cement mortar of standard consistence

<table>
<thead>
<tr>
<th>Kaolin (%)</th>
<th>Standard consistence water content (g)</th>
<th>I.S.T. (min.)</th>
<th>F.S.T. (min.)</th>
<th>Soundness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>93.0</td>
<td>159</td>
<td>237</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>93.7</td>
<td>155</td>
<td>226</td>
<td>0.30</td>
</tr>
<tr>
<td>10</td>
<td>94.0</td>
<td>138</td>
<td>200</td>
<td>0.10</td>
</tr>
<tr>
<td>15</td>
<td>94.2</td>
<td>136</td>
<td>180</td>
<td>0.00</td>
</tr>
<tr>
<td>20</td>
<td>94.0</td>
<td>147</td>
<td>265</td>
<td>0.02</td>
</tr>
</tbody>
</table>

I.S.T. = initial setting time; F.S.T. = final setting time

Table 5. Effects of MK on compressive strength of concrete

<table>
<thead>
<tr>
<th>Free w/c</th>
<th>Kaolin (%)</th>
<th>Plasticizer (l/m³)</th>
<th>Slump (mm)</th>
<th>Compressive strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 days</td>
</tr>
<tr>
<td>0</td>
<td>4.56</td>
<td>3</td>
<td>32.17</td>
<td>58.31</td>
</tr>
<tr>
<td>5</td>
<td>4.91</td>
<td>16</td>
<td>37.48</td>
<td>41.60</td>
</tr>
<tr>
<td>0.30</td>
<td>10</td>
<td>4.91</td>
<td>33.58</td>
<td>35.02</td>
</tr>
<tr>
<td>15</td>
<td>5.09</td>
<td>32</td>
<td>38.06</td>
<td>38.92</td>
</tr>
<tr>
<td>20</td>
<td>5.44</td>
<td>40</td>
<td>39.28</td>
<td>39.66</td>
</tr>
<tr>
<td>0</td>
<td>4.04</td>
<td>192</td>
<td>30.53</td>
<td>31.03</td>
</tr>
<tr>
<td>5</td>
<td>4.21</td>
<td>180</td>
<td>31.28</td>
<td>34.66</td>
</tr>
<tr>
<td>0.40</td>
<td>10</td>
<td>4.21</td>
<td>26.69</td>
<td>33.47</td>
</tr>
<tr>
<td>15</td>
<td>4.21</td>
<td>190</td>
<td>26.45</td>
<td>35.27</td>
</tr>
<tr>
<td>20</td>
<td>4.21</td>
<td>220</td>
<td>26.19</td>
<td>22.50</td>
</tr>
</tbody>
</table>

DISCUSSION

The results in Table 4 show that the maximum standard consistence water recorded was 94.2 grams at 15% cement replacement with MK. This was 1.3% higher than the 93 grams recorded for the control. The standard consistence water content in Table 4 shows that MK water demand in cement mortar is low. Therefore, when MK is used in concrete at this replacement content, it is not expected to substantially result in lower slumps. The results of initial setting time tests show that MK in cement mortar resulted in slightly lower initial setting times as a result of the pozzolanic reactions. The reduced initial setting times recorded in this study agrees with the findings of Wild et al. (1996) that MK accelerates cement hydration. Similarly, Khatib and Clay (2004); Lagier and Kurtis (2007) agree that MK seems to have a catalytic effect on the
cement hydration, accelerating this reaction. The final setting times reduced as the MK replacement increased as a result of rapid lime consumption, but as the 20% replacement has shown, the final setting time substantially increased. It appears that at this MK content, the maximum pozzolanic reaction from lime consumption had been exceeded and the unreacted amorphous silica delayed the final setting time of the cement mortar. The results of the separation of the Le-Chatelier apparatus measurement show that MK actually lowered the unsoundness of cement mortar. The maximum separation measured at 0.3mm was less than that of the control and less than the maximum separation of 10mm allowed. The use of MK in concrete is therefore not expected to result in destructive concrete expansion. The results of tests on physical properties of cement mortar at standard consistence containing OPC replacement with MK shows that low specific surface MK was reactive.

The results of the compressive strength tests in Table 5 show that at a w/c ratio of 0.30 cube specimens containing MK did not record compressive strength higher than the control at all the test ages. The maximum compressive strength recorded was at 15% MK content at 28 and 90 days. The test result at 3 days show that though specimens containing MK recorded compressive strength higher than the control this strength gain could not be sustained at later test ages. The relatively low specific surface of the milled MK resulted in this low reactivity recorded at this w/c ratio. Additionally, since the filler effect of fine mineral admixtures contribute to strength increase in concrete, the coarse MK used had relatively lower fine particle size distributions, thus the resultant lower compressive strength recorded compared to the control.

However at a w/c ratio of 0.40, the maximum compressive strength was recorded at 15% MK content at test ages of 28 and 90 days. The compressive strength gains started at the age of 14 days. The results recorded suggest that w/c ratio effects the pozzolanic reactions of MK and the resulting OPC optimum replacement level. Water plays an important role in pozzolanic reactions of mineral admixtures and the results appear to suggest that low water content may interfere with pozzolanic reaction of MK, particularly for the coarse MK used in this study. The major product in pozzolanic reactions of MK in concrete responsible for compressive strength increase is calcium silicate hydrate (CSH). Cement hydration alone produces CSH gels, known to be the main agent for the cohesion and strength of concrete. As pozzolanic reactions of MK results in the formation of additional CSH gels, strength increases are recorded. The use of MK to reduce cement consumption in concrete production would result in greener construction. The slump of the concrete was substantially improved at w/c ratio of 0.40 as the MK content increased, possibly due to the plate like microstructure of the MK particles.

CONCLUSION
The results in this study have shown that relatively coarse MK resulted in pozzolanic reactions in cement mortar at standard consistence and in concrete. Increased acceleration of initial setting time of cement mortar as MK content increased was recorded, but no unsoundness was recorded in the mortar. At a w/c ratio of 0.40, 15% of OPC could be replaced by low specific surface MK without compressive strength reduction at 28 and 90 days.

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INTRODUCTION

Housing has been widely acknowledged globally as one of the basics of human existence. Regardless of economic status, where to live is of paramount importance to human existence. The rapid population growth, uncontrolled urbanization, slow pace of construction and dwindling income have continued to complicate the problem of Nigerian cities and the issue of urban housing especially for the poor and low-income households, who constitute over 70% of the Nigerian urban population (Opoko 2004). The low income group according to National Housing Policy of 1991 is ‘all wage earners and self employed people whose annual income is N5,000 or below as of 1988 or whose annual income is twenty(20%) or below the maximum annual income of the salary grade level within the civil service structure at any given time whichever is higher, about 70% of Nigerian falls into this category. The 1991 housing policy

Keywords: sites and services, Nigerian cities, sustainable development, low-income housing.
A definition of low income group was varied by that of 2002 which re-define the low income group as ‘all employees or self employed persons whose annual income as at the year 2001 is N100,000 or below (i.e. the equivalent of salary grade level 01-06 in government work),this group takes about 90% of the Nigeria population and characterized with living at high density housing environment by virtue of the extent of their income power. Going by the view of Nigerian Institute of Social and Economic Research NISER (2003), the poor was described as the share of Nigerian population below the national poverty line and this increased from 42.8% in 1992 to 65% in 1996. It was estimated that about 70% of Nigerian urban populace live below the national poverty level Omoujine (2000) and that 35 of 36 states in Nigeria experience poverty level above 50%. This was corroborated by Federal Office of Statistics (1991) which categorizes the non poor (rich) Nigerians to have taken 82.8% of Nigerian population in 1980, this was dropped to 41.8% in 1996 while the proportion of those in the core poor increased from 3% in 1980 to 25.2% in 1996. The proportion of those who are moderately poor rose from 14.2% in 1980 to 33.0% in 1996..As a result of the failure of the complete house approach to effectively meet housing needs of the people, government experimented with core housing during the 4th National Development Plan period (1980-1985), referred to as ‘Shagari’ houses, the programme adopted two housing design prototypes. The one-bedroom core, intended for low-income people and the 3 bedroom units which was intended for middle income households. At the end of the plan period, only 25% success was recorded (Gana, 2002.; Okupe, 2002). The realization that providing a “complete” serviced house by government agencies is not possible or simply cannot be afforded by most low-income families prompted a shift in focus from supplying a fully serviced house to that of providing only serviced land otherwise called site and service. The 2002 World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa recognizes the importance of sites and services schemes likewise the various housing policies of Nigerian Government from 1991 National housing policies up to date. This implies or suggests that the sites and services approach can be useful or be regarded as a viable alternative in solving housing related problems of Nigerian poor. If it is effectively adopted, sites and services scheme can make housing affordable and also solve housing related problems of Nigerian poor. Affordability is one of housing related problems of Nigerians Egunjobi (1994) which can be minimized through sites and services. Housing affordability is the ability to back up a desire for housing units with adequate financial resources such that other basic needs like food, transportation, education, health etc do not as a result suffer. When this ability is lacked in any household, such household is noted to have affordability problem Egunjobi (1994) Indeed the term housing affordability is both income and price related concept. Income is the determinant of affordability of housing from demand side while price is the determinant of housing affordability from the supply side. Income here refers to the disposable income i.e. the gross income minus all expenses in other basic needs. Price includes both the total production cost and the expected profit at the developer’s point of view. But at the public developer’s point of view, price is equivalent to all costs incurred in the production of housing because it should not be seen as profit oriented activity, but rather a social service. Therefore price is equal to overall production cost of housing at government perspective Bello (2006). Since infrastructure cost account for 30-40% of building housing estate Majule (2007), the Nigerian government should lead in building comprehensive public and robust infrastructure in order to open non discriminatory
access to infrastructure to all people in Nigeria and serve as a good enabling synergy for housing construction by low income group in Nigeria.

**NINGERIAN CITIES: HISTORY, CLASSIFICATION, DEVELOPMENT, PLANNING AND MANAGEMENT**

The main urban places in Nigeria have long historical origin. They were in the past, major centres of politics, education, economic and sometimes religious activities, and of course, continue to play many of these roles till today. The physical and social characteristics of Nigerian cities as they exist today are to a very great extent, the legacy of history. At inception, they created satisfaction for the needs of the traditional societies. Nigerian towns can be classified under orthogenetic recognition and heterogenic recognition (Redfield & Singer, 1954) Orthogenetic represents pre-industrial and traditional towns, they are ancient cities that have been in existence before industrial revolution period and are characterized with an ethnic group with peculiar culture. They lack formal planning and this makes a noticeable effect when there is a need for urban physical development. The lack of formal planning also necessitated urban renewal programme for its development. Example of orthogenetic cities in Nigeria are Abeokuta and Ile-Ife. Historical cities in Nigeria generally lack pre planning, they sprang and developed from villages and trade post and still retaining their old slum and semi permanent structures. Because of its orthogenetic nature, urban managers in developing countries Nigeria inclusive do not have the necessary incentives to change the development pattern of their cities ADB (2008). The heterogenetic cities represent modern and industrial towns that were deliberately formed, planned and developed after industrial revolution or for a given purpose. Such cities include Abuja for nation’s capital and New Busa for industrial purpose. It can also be categorized as generative or parasitic. (Hoselits, 1955). Generative towns ensure economic growth and prosperity for the hinterland while parasitic towns are growing fat on the proceeds of the hinterland, while giving nothing in return. Regrettably, Nigerian cities are not playing their expected role as engines of growth, incubators of innovation and centers of social transformation, mainly because infrastructures are dysfunctional Olabode (2001). The growth in population and size of cities are not commensurate with that of infrastructure and service provision. ‘Development in a national context refers to process of change, particularly of a structural nature, towards the enhancement of a people’s socio-economic welfare and the average individual’s scope for fulfillment (Onyemelukwe, 1977). It involves the society’s transformation through its institutions, organizations, social rules, customary usages and attitudes-to an extent that makes the society more and more positively responsive to desired modern changes. Certain types of plan-less and uncontrolled urbanization may actually arrest rather than stimulate development. City development involves all decisions that will bring out the economic function and physical potentials of a city. It is the conscious direction and control of city structures with the aim of securing optimum and satisfying returns in its financial, social, political and other benefits. Cities came into the existence as product of and as focal points in the social and economic life of a community. The goal of city development is to develop a dynamic system of urban settlement which will foster economic growth, promote efficient urban and regional development and ensure improved standard of living and well being of the citizens. Only few of these cities specifically, Kaduna, Owerri and Abuja had plans before they were built. Some cities like Minna, Bida, Ilorin etc had Physical Development Plan. Plan is a drawing or diagram drawn on a plane as a top or horizontal
view of an object or a large-scale map of a small area or a method for achieving an end to orderly physical setting of an area.

Unfortunately, such plans were not implemented probably because of lack of institutional capacity coupled with corruption by the officers concerned with their implementation. Lagos had its own Physical Development Plan prepared with assistance from UNDP National housing policy (1991) and these were in the custody of the survey department in Lagos secretariat. Many of Nigerian cities development was attributed to their strategic locations as state capitals, local Government headquarters, or seat of specialized projects e.g. Onne and Aladja. A creative city can however not be built from scratch but it is possible to build for the creative city. (Get-Jan & Roy, 2005)

**NIGERIAN CITIES AND INFRASTRUCTURE DEVELOPMENT**

Sustainable development of the cities is one of the basic conditions for sustainable national development since the cities are recognized as veritable engines of growth (Egunjobi 1998). It is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs World Commission of Environment and Development (1987). These entail the fact that sustainable development is futuristic in nature because it has to do with living standards that go beyond the basic minimum but having due regard for long-term existence. In reality, the condition of Nigerian cities is central to any successful transition to sustainable development in Nigeria. Development is sustainable only when cities are rationally planned in terms of development and management of structures and infrastructure services needed to meet the basic needs of the citizens. Development of Sites and Services Scheme without a corresponding management of the same cannot assure sustainability. The Nigerian National Urban Development Policy (2002) also identifies the provision of urban infrastructure as a national priority. Development is sustainable only when cities are rationally planned in terms of development and management of structures and infrastructure services needed to meet the basic needs of the citizens. Development of Sites and Services Scheme without a corresponding management of the same cannot assure sustainability. The Nigerian National Urban Development Policy (2002) also identifies the provision of urban infrastructure as a national priority. The housing sector is a key component of the urban economy. Housing investment in Nigeria has been found to account for between one (1) percent and eight (8) percent of the Gross Domestic Product (GDP) while the flow of housing services account for an additional five (5) percent to ten (10) percent of the GDP. Majule (2007). Government housing policy will therefore impact greatly on the performance of housing sector in particular and on the economy in general. Any urban housing scheme without infrastructure will not be habitable. Facilities such as well-drained roads, water supply, electricity and telephone services are needed to make for a healthy living. However in Nigeria most housing construction tends to precede the provision of infrastructure in most projects. On-site infrastructure is not integrated into the city wide network because of lack of institutional capacity and adhere regulations thereby resulting in slum development. Housing is more than shelter and investment in infrastructure system could go a long way in encouraging housing investment by the private sector. Ideally, housing program should respond to quantitative, qualitative, sociological and physiological needs of human being. Infrastructure cost account for about 30% to 40% of total cost of building housing estate and the rest is accounted for by building and other auxiliary facilities (Majule 2007). Adequate infrastructure is a prerequisite for opening up access to investment flows, increasing the competitiveness of production and services and sustaining the nation’s economic growth. It will also improve access and coverage of basic services and increase the supply of land for housing development. The major impediment to infrastructure facilities which as well spread to site and services schemes in Nigeria according to Akinwale (2010) is negligence by the coordinating officers coupled with
corruption. Akinwale in his work examined the menace of infrastructure in Nigeria and discovered that attempt to enhance infrastructure failed due to negligence and corruption and that majority of Nigerians have suffered as a result of endemic corruption in the country. The 1999-2007 democratic government of Nigeria acknowledged corruption as bane of infrastructure and housing development and as a result renewed its efforts to improve infrastructure with anti-corruption policy and reform such as, Economic and Financial Crime Commission (EFCC) and Independent Corrupt Practice and related offences Commission (ICPC). With respect to housing estate development in Nigeria, infrastructure needs are considered at two levels viz: Off-site and on-site infrastructure. The former refers to the network that links the development to the city wide such as link roads, electricity and water mains, telephone and telecommunication cables etc. while the latter refers to those facilities provided in situ that make for efficient functioning of the estate. A Developer preoccupies himself with the provision of on-site building facilities while the city administrator is expected to provide the off-site facility from the common fund earlier contributed by the developer tagged development levy. That is the existing situation in Nigeria.

**CONCEPT OF SITES AND SERVICES SCHEME**

Site and services scheme is a programme carried out either by the government or private organization which involves facilitating a particular area with the essential infrastructural amenities so that private individuals or corporate bodies can carry out developments in such area at affordable cost. Site and service scheme basically relates to the need of establishing the dwellers as an active participant, in the total process of housing. It is one of the housing scheme requirements carried out mostly by governmental bodies as municipal services because in nature it is not more capital intensive compared with other schemes. Plots of land (or sites) with infrastructure on it (or services) were provided, and the beneficiaries had to, in most of the schemes build their own houses, ranging from the subdivided plots only to a serviced plots of land with a “core” house built on it. Site service scheme allowed the owner of land to construct the house with a variety of building materials depending on his desires and preference as well as his income. In this scheme, residential plots are laid out with major infrastructural facilities such as road, schools, open spaces, health centers etc incorporated in the layout. It offers landless housing aspirants the opportunity and hope of a services plot of land with prospect of home ownership as incentive towards house building. Site and service scheme are the provision of plots of land either ownership or land lease tenure along with a bare minimum of essential infrastructure needed for habitation (Pealtic, 1982). The legal framework for site and services scheme in Nigeria is in the National Housing Policy (NHP, 1991) this policy document spelt it out as one of the strategies for assisting low income group; ‘provide sites and services to facilitate home ownership and orderly urban and rural development page 11 section 2.4(ix) and for all income groups with emphasis on the low income group in the major cities in Nigeria page 16 section 3.7.2. In the schedule of housing functions to public authorities, the National housing policy of 2004 (section 3.4.1a) assigned the responsibility of production of residential sites and services to the Local Governments (but this responsibility was pursued by majority of local government authority in Nigeria). This is however expected to be complemented by private sector that are expected to participate in the development of estates and houses for sale or for rent, or shared ownership. The philosophy behind the site and services facilities hinged on the fact that the medium and high income earners could easily source for funds and construct their own houses whereas the low income
group may not find this easy. It was hoped that if the government develop sites and provide essential services, low income group could get allocation after paying some fees to cover what has been spent on the land and service provided and it will now be the task of the allottees to complete the houses at their pace and financial capability.

**COMPARISON OF GOVERNMENT AGENCIES AND PRIVATE DEVELOPERS SITES AND SERVICES**

The nature and procedure for site and services development by government agencies show wide divergences from what operates in the private land market where development is maximally managed at market prices. Site and services as a method of housing delivery entails enormous outlay in terms of funding, particularly with respect to escalating costs of various input. Essentially, there are four stages in the provision of sites and services. These include preparation of layout, which primarily involves the sub-division of parcel of land into plots and provision of services (like standard roads, drainage channels, electricity, water supply etc before allotting of plots), construction of houses and occupation by owners. Of the four stages, the various governments have taken the responsibility for the first two which are very important and vital to the orderly and efficient development of residential communities. This contrasts what obtains in the private land market where the procedure is based on the philosophy of quantity i.e. ‘supply of developable land and quantity’ which deals with the provision and improvement of infrastructure at the later stages of further development by the allottees. This is not unrelated to the thinking of having shelter first in order to secure tenure of land and later enhancing quality and comfort through incremental development as resources become available. One can see the sharp differences between governments direct involvement in the two stages while the allottees in the case of the private land market takes responsibility from the onset. This issue has great import in the viability of sites and services projects. In table 1, the Federal Housing Authority as government agency in its wisdom has developed sites in many urban conurbations particularly at the state capitals to ensure affordability, in most cases, bulk of the plots were for residential housing.

From table 1, it was demonstrated that the choice of sites in towns like Abuja, Rivers Kano, Kaduna, Benue, Imo, Lagos, and Sokoto has helped to assist the pattern of urban development. Some funds have also been disbursed to provide services like water, road, electricity, and recreational facilities in many other locations. Recent visit to some of these sites have shown that some efforts have been made by the Federal Housing Authority to keep in line with the philosophy of the Housing Policy as regards site and services approach to solving housing problems in Nigeria. However, certain features of the site and services programme by the government or its agencies as opposed to the private land market also constitute a cog in the wheel of progress. One of the major problems of the site and services schemes relates to procedural problem i.e. plotting services. The Federal Housing Authority has often involved itself in mass beckoning which often leads to loss of beacons largely due to late physical development of the derelict and allotted plot(s) and sometimes allocation of plots not chosen by applicants; this should be given urgent attention. The second issue is related to unrealistic plot sizes, which often are out of tune with the actual needs of some allottees. This has often resulted into the emergence of bushy areas, and ill-maintained surroundings of dwellings arising from financial incapability of the allottees. In some cases allottees are known to have sub-leased part of their plots to others for re-densification and in fact non-development of prime locations within layouts is common. All these hampers the processes of creating viable sites for
housing development and development agencies need to be more cautious of these habits. Thirdly, many funds have been wasted in the provision of infrastructure. (Amdii, 1993).

Table 1 F.H.A. Sites and Serviced lands

<table>
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<th>S/N</th>
<th>STATE</th>
<th>LOCATION</th>
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<th>COMMERCIAL</th>
<th>RELIGIOUS</th>
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<th>TOTAL</th>
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The plots are not usually of the same size and where such occurs; large quantities of infrastructure are required. Such a practice should be left to the private land market where variations in plot sizes are tolerable. In the face of increasing government shedding of its involvement in direct housing supply, the situation with government layouts contributes to the elimination of the low income group from government ‘housing’ schemes. This is so because; high density houses required by the low income group by virtue of their low income are neither tolerated nor lucrative to allottees of government plots. By the provision of most building regulations, only about 35% of such plots are permitted for development -as against 65% in private areas. (Amdii, 1993). The elimination of the low income earners because of the prices of the sites tend to defeat the blossom objectives of governments’ attempts to meeting demand for land as a basic need. As at now, the housing market is characterized by the interplay of market forces and the pricing system itself which is beyond the control of the government, this because in real market situation pricing can not be influenced by external forces irrespective of any legal mechanism that may be in place. A more mundane factor that has compounded the problem of the low income group hinges on location question. The National Housing Policy has stressed the
utilization of housing location as a virile “instrument for population distribution in order to minimize associated problems of transportation and services” (National Housing Policy, 1991, p.12). On the contrary, Site and Services have been located in areas farther away from the hub or centers of the towns—a factor that may be understood in terms of where land is available at affordable rate. Although sites and services scheme has been successful in meeting housing needs of low-income families in other countries like Kenya, Ghana, South-Africa, Pakistan, Indonesia and Cuba, it failed in the Nigerian case because it could not effectively bring within the reach of the low income group. This was mainly as a result of the high infrastructural standards employed, inequitable distribution of infrastructural facilities and limited scale of the project compared with demand. And as such, the scheme benefited more of the higher income group to the detriment of the low income group.

SITES AND SERVICES SCHEME IN NIGERIA

Governments have been developing sites and services schemes in most cities in Nigeria, but they have been paying little emphasis on the management of such schemes. Sites and Services must have futuristic approach to ensure sustainability. The past systems of mere lay-outing by private developers or lay-outing with part-provision of facilities by government is not keeping to the rule of sites and services scheme hence can not guarantee sustainable development. Apart from acquisition and preparation of layout drawings of the site, the infrastructural facilities should be provided to guarantee the first aspect of the scheme-development, and then followed by proper monitoring to ensure continuous functioning of such facilities otherwise, called scheme management Lawal (2000). It is only when these two aspects are achieved that we can say that there is sustainability. The alarming scenario about most site and services schemes in Nigerian cities is that of scheme availability with non functionality. Sites are laid-out but the facilities are either not provided or when provided, they are provided in part and vandalized due to late allocation and occupation. Even when provided in full, they are not functioning, because availability does not guarantee functionality. When infrastructures are provided, there will be facilities provision but it is only when such facilities are functioning that we can call such a service. Facilities availability ensures services. For example, when public water supply facilities are provided in a scheme, in terms of provision of supply pipe network that would be termed infrastructure provision or availability of facility. Services is said to be rendered when the water is constantly flowing in such pipe network, but when water is not flowing therein, there is no service. This translates to the fact that most of the schemes in Nigerian cities are having site and facilities but not with services i.e. with technical infrastructure without utilities. It is also a known fact that the value of land in terms of plot on any site and services scheme is a factor of the extent and level of the facilities and services provided in such schemes. Even the site itself in the form of layout are adjusted and violated so that the scheme originality disappears as the scheme is ageing. The planning provisions were violated and at times tampered with impurity. The first and second phase of federal government sites and services indicated that the schemes has bulk for medium density and majority of them are at beaconing stage of development, see table 2 and 3

INHERENT ADVANTAGES OF SITES AND SERVICES SCHEME TO NIGERIA

The underlying principle of sites and services project is that authorities would provide the land and the infrastructural facilities, while the individual and his family who are
allocated the serviced plot proceed to build their house in accordance with approved plans but of their own choice (National Housing Policy, 1981). According to Aribigbola & Ayeniyo (2012) in sites and services scheme, the government or its agency will be able to provide infrastructural serviced plots for individuals who are then encouraged to erect their own type of buildings. In the approach, the scheme land is furnished with access roads, drainage, water, sewage, electricity and a variety of other individual as well as community services.

Table 2: Federal Government Sites and Services Project Progress Chart for Phase I.

<table>
<thead>
<tr>
<th>State</th>
<th>Location</th>
<th>Consultant</th>
<th>Density Low</th>
<th>Medium</th>
<th>High</th>
<th>Total No. Of Plots</th>
<th>Stage of Development</th>
<th>Area of Site (Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kwara</td>
<td>Ilorin</td>
<td>Molaj Consultant</td>
<td>140</td>
<td>623</td>
<td>-</td>
<td>763</td>
<td>Beaconed</td>
<td>147.27</td>
</tr>
<tr>
<td>Kano I</td>
<td>1 Takum-</td>
<td>Molaj Consultant</td>
<td>23</td>
<td>179</td>
<td>134</td>
<td>393</td>
<td>Beaconed</td>
<td>85.74</td>
</tr>
<tr>
<td></td>
<td>Tawa</td>
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<td>99</td>
<td>26</td>
<td>-</td>
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<td>29.91</td>
</tr>
<tr>
<td>Anambra</td>
<td>Trans-</td>
<td>In House URD (Div)</td>
<td>-</td>
<td>141</td>
<td>141</td>
<td></td>
<td>Progress</td>
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</tr>
<tr>
<td></td>
<td>Enugu II</td>
<td>In House URD (Div)</td>
<td>-</td>
<td>49</td>
<td>59</td>
<td>106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ondo</td>
<td>Akure</td>
<td>Molaj Consultant</td>
<td>-</td>
<td>189</td>
<td>420</td>
<td>608</td>
<td>Beaconed</td>
<td>116.05</td>
</tr>
<tr>
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<td>Isheri-Olufin</td>
<td>City Beautiful Association</td>
<td>332</td>
<td>152</td>
<td>787</td>
<td>1,271</td>
<td>Beaconed in Progress</td>
<td>240.69</td>
</tr>
<tr>
<td>Rivers</td>
<td>Woji</td>
<td>URD (Div)</td>
<td>15</td>
<td>120</td>
<td>49</td>
<td>184</td>
<td></td>
<td>24.02</td>
</tr>
<tr>
<td>Lagos I</td>
<td>Aboru</td>
<td>In House Franktai</td>
<td>224</td>
<td>1,292</td>
<td>284</td>
<td>1,800</td>
<td>Beaconing in Progress</td>
<td>271</td>
</tr>
<tr>
<td>Lagos</td>
<td>Abesan Site I (Suberu Oje)</td>
<td>Plurtran Planning Consultant</td>
<td>90</td>
<td>802</td>
<td>197</td>
<td>1,907</td>
<td></td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>Beaconing in Progress</td>
<td>285</td>
</tr>
<tr>
<td>Oyo I</td>
<td>Moniya III</td>
<td>Environ State Planing</td>
<td>65</td>
<td>68</td>
<td>69</td>
<td>202</td>
<td>Submitted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ayunre</td>
<td>Con. Urban Dev. Consultant</td>
<td>46</td>
<td>85</td>
<td>31</td>
<td>164</td>
<td>Final Drawing</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>Iwo Road</td>
<td>Dev. Consultant</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>To submit</td>
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</tr>
<tr>
<td>Bauchi</td>
<td>Bauchi Town</td>
<td>URD (Div) in House</td>
<td>41</td>
<td>133</td>
<td>106</td>
<td>280</td>
<td>Final Drawing</td>
<td>58.34</td>
</tr>
<tr>
<td>Borno</td>
<td>Maiduguri</td>
<td>Urban Design Associate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Submitted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phase I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Submitted</td>
<td></td>
</tr>
</tbody>
</table>

Source: Federal Ministry of Works & Housing, Urban & Regional Development Division, Lagos (1989)
reduce the direct involvement of government in housing construction, thereby reducing the prohibitive costs of building government housing estates on the part of government and reducing the cost of construction through the economy of scale. The strategy also helps to reduce wastages and conserve government resources. In addition to the above, the approach affords the low-income household the opportunity of benefiting from infrastructural facilities and services such as pipe-borne water, paved roads health facilities, and in some cases water-borne sewage. This is capable of solving the problem of sub-standard housing, over-crowding, lack of utilities and poor environmental conditions associated with spontaneous development in most of the urban centers in Nigeria. But as good as this programme would have been in solving housing problems of low income group,

Table 3: Federal Government Sites and Services Project Progress Chart for Phase 2

<table>
<thead>
<tr>
<th>State</th>
<th>Location</th>
<th>Consultant</th>
<th>Density</th>
<th>Medium</th>
<th>High</th>
<th>Total No. Of Plots</th>
<th>Stage of Development</th>
<th>Area of Site (Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kwara</td>
<td>Ilorin</td>
<td>Molaj Consultant</td>
<td>140</td>
<td>623</td>
<td>-</td>
<td>763</td>
<td>Beaconed</td>
<td>147.27</td>
</tr>
<tr>
<td>Imo</td>
<td>Owerri</td>
<td>Hambi Plan</td>
<td>184</td>
<td>532</td>
<td>-</td>
<td>716</td>
<td>Beaconed</td>
<td>102.48</td>
</tr>
<tr>
<td>Kano I</td>
<td>Takum-Tawa Sharada</td>
<td>URD (Div.) In House System Planning Group</td>
<td>23</td>
<td>179</td>
<td>-</td>
<td>13</td>
<td>Beaconed</td>
<td>85.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>99</td>
<td>26</td>
<td>4</td>
<td>125</td>
<td>Beaconed</td>
<td>29.91</td>
</tr>
<tr>
<td>Anambra I</td>
<td>Trans-Ekulu Onitsha</td>
<td>URD (Div) In House System Planning Group</td>
<td>-</td>
<td>141</td>
<td>-</td>
<td>141</td>
<td>Progress</td>
<td>44.98</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>49</td>
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<td>Enugu II</td>
<td>Akure</td>
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<tr>
<td>Lagos</td>
<td>Iseri-Olofin</td>
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<td>332</td>
<td>152</td>
<td>78</td>
<td>1,271</td>
<td>Beaconed Provision of Infrastructures in Progress</td>
<td>240.69</td>
</tr>
<tr>
<td>Rivers II</td>
<td>Woji Remuene</td>
<td>URD (Div) In House System Planning Group</td>
<td>15</td>
<td>120</td>
<td>49</td>
<td>184</td>
<td>Beaconed</td>
<td>24.02</td>
</tr>
<tr>
<td>Lagos II</td>
<td>Abesan Site II</td>
<td>Franktai Associates Plurtran Planning Consultant</td>
<td>224</td>
<td>1,292</td>
<td>28</td>
<td>1,800</td>
<td>Beaconing in</td>
<td>271</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90</td>
<td>802</td>
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<td>1,907</td>
<td></td>
</tr>
<tr>
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<td>City Beautiful Associate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Beaconing in</td>
<td>285</td>
</tr>
<tr>
<td>Oyo I</td>
<td>Moniya III</td>
<td>Environ State Planning</td>
<td>65</td>
<td>68</td>
<td>69</td>
<td>202</td>
<td>Submitted final</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ayunre</td>
<td>Iwo Road</td>
<td>46</td>
<td>85</td>
<td>31</td>
<td>164</td>
<td>Drawing</td>
<td>119</td>
</tr>
<tr>
<td>Bauchi</td>
<td>Bauchi Town</td>
<td>URD (Div) in House System Planning Group</td>
<td>41</td>
<td>133</td>
<td>10</td>
<td>280</td>
<td>Final Drawing</td>
<td>58.34</td>
</tr>
<tr>
<td>Borno</td>
<td>Maiduuri Phase I</td>
<td>Urban Design Associate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Submitted Drawing</td>
<td>Final</td>
</tr>
</tbody>
</table>

Source: Federal Ministry of Works & Housing, Urban & Regional Development Division, Lagos (1989)

**SITES AND SERVICES SCHEME EXPERIENCE FROM OTHER COUNTRIES.**

There are several examples of housing programmes from which Nigeria can benefit (Opoko, 2004). Since 1985, the U.N. Habitat in conjunction with building and social housing foundation in Britain has tried to identify and publicize exemplary housing programmes considered to be replicable and sustainable. The application of the site and services scheme of some countries of the world, which do not only have serious
housing problems like Nigeria, but also share similar socio-economic conditions with Nigeria will be looked into for Nigeria’s consolidation:

**The Pakistan experience (‘KHUDA-KI-BASH’)**

There is an incremental Housing Scheme popularly known as ‘Khuda-ki-Bash’ or God’s settlement) as an expression of appreciation by poor beneficiaries of the scheme in a housing programme, which has benefited the poor in Hyderabad, Pakistan. The main aim of the scheme was to make land available to the low income at affordable price and facilitate such family’s access to services over time according to their ability to pay. The planners of the scheme familiarized themselves with housing realities in the area prior to the formulation of the scheme. Basic concepts of the scheme after modification based on feedback include the following:

The local authority. Hyderabad Development Authority. HAD, provided technical expertise in the form of laying out the settlement, assisting householders in constructing their dwellings and service connections, monitoring and general administration of the scheme. This was facilitated via the establishment of an office in the settlement.

Un-serviced plots of land, measuring 24ft x 30ft were made available to the households at a price affordable by majority of the population below 50th percentage, due to high cost of services. Only potable water was provided at the initial time. The cost of a plot was Rs1, land ‘grabbers’ or speculators could obtain 100 compared to Rs10,000 the price at which similar plots could be obtained in the land market.

To eliminate speculators, middlemen and higher income people, prospective beneficiaries were screened through a reception area located within the vicinity of the HAD office. Each applicant was expected to live with his family in the area for a period of about 15 days before taking possession of his allocation. It was believed that only those in dire need of accommodation would be willing to go through such rigorous screening processes.

Sale or transfer of allocations was frowned at and attracted heavy penalties.

Households built for themselves using what materials they could afford. There were no restrictive standards except for ventilation and daylight. Quality of design and construction was improved via a loan programme and technical advice on design and counter techniques.

Other social sector facilities like health, transport, and education have been largely provided by private entrepreneurs and NGOs via the intervention of the HAD, which also provided plots for them.

Between March 1986 and January 1990, a total of 2,883 (93%) houses were already developed. While 79% respondents purchased plots from HAD, 11% purchased from brokers and 10% from original owners. Keys to the success of the scheme include the low cost of land, which has been made possible by separating land and service costs, and initially charging for the former lonely, and the development of strategies for preventing speculation. In addition, the missionary zeal and dedication of the staff has been exemplary. They were very familiar with the housing issues in the area including strategies and actors, and were committed to evolving an efficient alternative. Constant monitoring of development helped in eliminating speculators and timely interventions.
The Indonesia experience (KAMPUNG IMPROVEMENT PROGRAMME)

In Indonesia, out of a total annual housing demand of 7,000,000 units, public sector intervention has been able to meet only 10% while the people’s effort account for the remaining 90%. Considering the alarming rate of urbanization and the growing poverty level of the urban people, 83% of whom are engaged in the informal economy. The challenge was how to redefine official policy in order to support the people’s self-supporting activities and strengthen their capacities in meeting their housing needs. In the early stages, the programme that took off in Jakarta in 1969, aimed at improving public infrastructure facilities in order to improve the quality of the housing. The policy elements in the programme included:

- Developing functional community institutions that will serve in mobilizing local resources for development programme;
- Enhancing security of tenure via people targeted subsides as a way of motivating people to improve their houses and environment;
- Providing incentives for community collective effort via provision of basic public utilities/infrastructure;
- Developing community based economic programmes such as small credit and skill acquisition schemes in order to sustain development in the area.

By 1993, the programme had been replicated in 386 cities in the marked improvement of the quality of housing of households, increase in housing stock and improved income generation opportunities within the communities. The programme successfully addressed key issues in low income housing namely: security of tenure, poverty, harnessing of peoples’ abundant but often hidden resources in improving and maintaining their settlements. It is important to note that this approach involves close cooperation between government authorities and local communities.

The Cuba experience (Architects in the community programme, (ACP))

Severe economic crises as a result of collapse of communism in 1990 and subsequent withdrawal of support from USSR and Eastern Europe, led to a halt in public housing programme in Cuba. Alternative approaches to housing supply, included support for self-help construction, development of locally produced building materials and technical support for the people. The ACP scheme was established in 1994, as a collaborative venture by the national Housing Institute, Habitat Cuba (a local NGO) and two local governments. It was initiated as a pilot project to undertake the above tasks aimed at improving the housing conditions and quality of life of the people. Household’s interest in the scheme were assigned an architect each. The architect visits the household to formulate a design brief and take measurements, as applicable. Thereafter, he prepared 4-5 design proposals, which he discusses with the family before developing the final design. He seeks as much as practicable, the comments and views of every household member, to ensure that the final design suits the needs of all. The focus is on evolving a cost effective solution suited to each household’s needs instead of repetition of prototypes. The range of services rendered by the architect include design for new houses, remodeling or expansion of existing ones, obtaining approvals and supervision of construction. The programme has provided jobs for 630 architects in 156 of Cuba’s 169 municipalities where the programme has
assisted over 250,000 households in realizing their housing dreams. The programme won the 2002 World Habitat Award and has been replicated in Uruguay and is currently being explored by South Africa, Argentina and Peru. The beauty of the programme is that it is accessible, self-supporting and has provided affordable technical support to poor households. The participatory design approach used in the project provides households with the required skills and confidence which have translated into better living conditions and confidence to face the future. Good working knowledge of the circumstances of the households, cooperation with local planning authorities as well as commitment to have enhanced the success of the project.

The Kenya experience (BUILDING GROUPS IN DANDORA)

The Dandora Community Development Project in Nairobi, Kenya, is considered one of the most successful sites and services schemes in Africa, especially with regard to reaching the target group. Conceived by the Nairobi City Council (NCC) and the Government of Kenya, it was implemented by NCC with loan and credit support from World Bank. The project consisted of 6,000 plots of about 1230 square meter with a core consisting of either a kitchen (33%) or toilet and shower (67%). These were allocated by ballot to the target group of people earning between the minimum and the median income, who were also given technical support and a soft loan to build additional rooms. The plots were serviced with access roads, security, lighting, water and sewage. There was also provision for primary schools, markets, health and community centers for the neighbourhood. A major objective of the project was community development. To this end, there were communities development workers who assisted residents with project administration and technical guidance. To ensure that the poorer households participated effectively, they were encouraged to form building groups.

Buildings groups were legally registered and were assigned a Community Development Assistant each who provided support, training and advise on construction, finance and management. They were autonomous and democratic in operation. Decisions were by consensus. The main function of the building groups included:

Mobilization of savings of members through monthly collection of contributions to augment loans.

Pooling together of limited finances and building materials loans available to individual members and

Management of construction of members’

This was done in different ways; some worked communally, others managed construction as a group, while for some, funds were released to individual members who then organized their own construction. In all cases, the group served as a monitoring group, ensuring that progress of work was commensurate with funds released, 57% of group members were women heads of households. Within two and half years of the first phase of the project, 90% of residents were able to accomplish the set target of self-construction of one or two rooms. The Dandora project succeeded as a result of several reasons. The local government authority played an enabling and supportive role, which served as a catalyst. The strong community development objective of the project also ensured that economically disadvantaged families, especially female-headed households were encouraged and supported to move
alongside others. The project implementation provided a wide variety of options, which were broad enough to accommodate majority of the target group, for instance, beneficiaries could supervise construction on their own sides on individual basis; or hire a skilled craftsman to do so on their behalf or even be part of a building group where more self-labour is used. Furthermore, the design and concept of the project made it unattractive to people of higher income groups. There was also transparency in the selection of beneficiaries.

LESSON FOR LOW-INCOME HOUSING DEVELOPMENT

The lessons to be learnt which will be beneficial to the Nigerian cities is that all of the projects were based on the understanding that poor people possess inherent capabilities, which can be judiciously harnessed if given necessary support. Successes recorded by the projects have also buttressed this notion. Housing for the poor should be seen as both a product and a process (Agbola, 1998) and an effective vehicle for individual actualization of community development, cohesion and empowerment. In the process of building their houses, residents will have ample opportunity for social interaction and support. Skills acquired in the process of building also give people confidence and opportunities for employment and income generation. Evidence from these countries has confirmed that for housing to impact on the low income people, the people have to be involved in such housing scheme. This partnership has to be initiated right from the conception stage of the scheme and the people carried along through the various stages of design, specification, implementation and post construction stages. The participation of the poor in legal housing will integrate them better into society, thereby enhancing their self esteem as well as their bargaining power, as revealed from the case-studies. It will also engender a high level of residents’ satisfaction with their houses and neighborhoods. This is because they will participate at all levels of the project. Close interaction between households and support groups enabled both groups to work together in identifying best options to meeting household needs. Housing should not be seen as a wasteful drain of scarce resources, rather it should be seen as a vital catalyst for poverty alleviation, income generation and empowerment amongst other benefits. There is need for programme designers/promoters to be familiar with realities and challenges of housing in the areas where they wish to intervene. For planning to be realistic and successful, it has to be based on realistic data which is the product of sustained research, development and documentation. The projects enjoyed technical support from dedicated professionals in the Cuban case; about 630 architects were gainfully employed. Professionals in Nigeria do not give there focus on low-income housing giving rise to increase in the level of unemployment amongst architects, use of quacks by prospective homeowners and their associated menace. It is often believed that low-income people cannot pay. However, evidence from the case studies show that low-income housing can be a legitimate source of income for professionals. Although the returns from provision of housing for the poor may not be much, but, when the rate of turnover is considered, the income accruing from low-income housing can be substantial and sustained. This is bearing in mind the magnitude of low-income housing needs in the country. Adopting this strategy has benefits; It will provide job for architects. It will ensure proper development of housing with expected improvement on quality of life. With more people being able to afford the services of architects, there will be more effective demand, which will lead to more housing developments without associated linkages. The projects were broad-based and flexible enough to accommodate peculiar circumstances of a wide
spectrum of poor households. Selection criteria and standards also ensured that projects reached the target group.

**CONCLUSION/RECOMMENDATIONS**

Sites and services scheme is an approach which has been adopted by many developing countries, including Nigeria to provide housing for the poor and under-privileged in the society who cannot afford the rising cost of constructing houses and because of the high standards established by the government. Housing for poor households is increasingly becoming an emotive issue and a major source of concern not only to the poor but also to the affluent. Inadequate housing is a major and visible dimension to poverty. Hitherto, the poor were seen as a helpless bunch that could not do anything for themselves. Since infrastructure cost account for between 30-40% of the total cost of building Majule (2007), then the Nigerian Government should lead in building a comprehensive public infrastructure in order to open non discriminatory access to infrastructure for all the people in the country and serve as enabler for house construction to the low income group. The Government should not only be concerned about development of site and services scheme but should be particularly concerned about the functionality and proper maintenance of the facility provided to the scheme because inability of these will not make the impact of the scheme to be fully felt. Good governance and sound public policies remain the most important aspect of the management of cities Andrew (2010) Nigerian government should therefore ensure monitoring of development of sites and services scheme and avoid rather than encouraging land hoarding because it hinders development. This is reflected in the case of Lekki scheme where some plots of land have changed hands many times and still remain bare. There is no doubt in the fact that Lekki scheme has been converted to a speculative scheme and Government is encouraging this by theoretically indicating in the title document that the land should be developed by allottee within 2 years or else it will be forfeited, but in reality Government has been aiding this attitude by collecting 10% consent fee from the people from transferring such plots over the years .Therefore the resultant effects is that the land remain bare while title change hands in multiple time. Also, the incessant practice of partitioning part of a plot to another semi-allottee illegally should be checked by the appropriate authority concerned because this is a negative reflection. The practice of spontaneous destruction of informal housing and settlements in the major urban area should be stopped, and be replaced with a more urban poor friendly policy of upgrading and provision of sites and services for informal housing. Destroying informal housing put up through self-help efforts by poor urban residents is not consistent with the concept of poverty alleviation, it simply aggravates poverty by rendering more people homeless, endangering their health and livelihood by further depleting their meager capital. In so far as all the foregoing recommendations require land for their effective implementation, the general complain of people about the 1978 land use Act currently much vilified for the multiple ways it has inhibited land development in the country, should be expunged from constitution and be replaced with a properly redesigned legislation. Conclusively, the management of site and services scheme should be revisited, redesigned and made in time with the socio-cultural attributes of the local communities where they are to be sited because a universal approach may not be suitable for all communities in Nigeria, given the diversity of value, culture and social values and natural environmental settings. The government should encourage beneficiaries of site and services scheme to pool resources together to speed up development process and to reduce the housing development costs.
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Low income housing


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EFFECTS OF CURING CONDITIONS ON COMPRESSIVE STRENGTH DEVELOPMENT OF CONCRETE CONTAINING OPTIMUM RICE HUSK ASH REPLACEMENT

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²Department of Building, Ahmadu Bello University, Zaria, Nigeria.

Concrete cube specimens containing optimum cement replacement with low specific surface rice husk ash (RHA) were cured in water and ambient air (uncured). The results of compressive strength tests at 28 days show that uncured cube specimens containing optimum RHA replacement had higher compressive strength compared to specimens without RHA at water/binder (w/b) ratio of 0.35, 0.40, 0.45, 0.50 and 0.55. However, the water cured cubes containing optimum RHA replacement recorded higher compressive strength above control at 28 days at w/b ratio of 0.35, 0.45, 0.50, and 0.55.

Keywords: compressive strength, curing, RHA, incinerator

INTRODUCTION

Rice plants absorb silica from the soil during growth and accumulate it into their structures. Silica is taken up by the roots of rice plants in the form of silicic acid as an un-dissociated molecule. After uptake, silica is immediately trans-located to the shoot together with the transpiration stream and then polymerized and accumulated on the cell surface of the rice leaf to form the silica–cuticle double layer and silica–cellulose double layer (Mitani et al., 2005). Silica accumulation in rice plant increases resistance to diseases, pests and restores nutrient imbalances (Mitani and Ma, 2005). Silicon is a beneficial element for plant growth and helps plants to overcome multiple stresses including biotic and abiotic stresses (Mitani and Ma, 2005). The silica in the rice husks is at the molecular level, and is associated with water; the concentration of silica is high on the external face of the husk, and much weaker on the internal face and practically non-existent within the husk (Jauberthie et al. 2000). When this silica is concentrated by thermally processing rice husks under controlled conditions, the resulting ash is predominantly composed of amorphous silica.

The milling of paddy rice (Oryza sativa) produces husk as an agricultural waste with low nutrition value that is difficult to dispose. Nigeria has the potential for ample quality RHA production suitable for use in the construction industry; it is the second largest rice producing country in Africa and 748,000-990,000 metric tonnes of rice husk was estimated to have been produced based on paddy rice production in 2010

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(FAO 2010; Flake and David 2009). Though the potential exists for commercial RHA production in the country, this has not been exploited to the fullest.

The use of a pozzolan like RHA in concrete would reduce demand for clinker cement consumption and at the same time reduce the environmental problems associated with disposal of rice husks.

For the production of quality RHA with low loss on ignition (LOI) and high amorphous silica content, it is important that incineration temperature be above 500°C and below 900°C (Howlett, 2003). Amorphous silica in RHA reacts with \( \text{Ca}^{2+} \), \( \text{OH}^- \) ions and \( \text{Ca(OH)}_2 \) (lime) liberated as a result of cement hydration to form a calcium silicate hydrate (CSH) gel that improves concrete strength (Feng et al., 2004; Yu et al., 1999). The formation of these additional CSH gels results in increase in concrete strength when RHA is used in concrete. The consumption of lime by RHA pozzolanic reaction also results in lower lime content in concrete containing RHA. The pozzolanic reactions of RHA in concrete results in compressive and tensile strength increases, and improvement in durability properties of concrete by reducing the porosity of concrete at the interface between cement paste and aggregate and the filler effect of the fine particle sizes (Givi et al., 2010; Kartini et al. 2010; Bui et al., 2005; Giaccio et al., 2007). In addition to the RHA pozzolanic reactions that improves concrete strength, the filler effects of fine RHA particles does not only improve the pore structure of concrete but, act as nucleation point for hydration products and restrict development of the unfavorable crystals generated in the hydration process (Rodriguez et al. 2008).

Though pozzolanic reactions of RHA in concrete results in strength increase it is important to determine the optimum OPC replacement with RHA. Research results from literature suggest that the optimum OPC replacement with RHA depends on w/c ratio for water cured specimens, the results generally indicates that higher w/c mixes had higher optimum OPC replacement contents; water therefore plays an important role in pozzolanic reaction of RHA in concrete (Bui et al., 2005; Gastaldini et al., 2007; Gastaldini et al., 2009; Rodrıγuez de Sensale, 2006; Saraswathy and Song 2007). The importance of water content is related to the rapid water absorption by RHA and the chemical reactions in cement. Rapid water absorption by RHA particles effectively reduces water available for cement hydration in the first 24 hrs, effecting the rheology of fresh concrete; as less water is available for cement hydration the number of microscopic pores and sizes that causes strength reduction in concrete reduces (Elrahman et al. 2011; Friedemann et al. 2006; Prokopski and Langier 2000). However, the most significant effect of RHA in concrete is the pozzolanic reaction in concrete. When the RHA content is higher than the optimum, strength decrease would result due to the fact that the quantity of RHA present in the mix would be higher than the amount required to combine with the liberated lime during the hydration process; this results in excess silica leaching out, causing a deficiency in strength as it replaces part of the cementitious material but does not contribute to strength (AI-Khalaf and Yousif 1984; Givi et al., 2010).

Curing is the process used for promoting the hydration of cement and consists of a control of temperature and of the moisture movement from and into the concrete; with the aim of keeping the concrete saturated or as nearly saturated as possible until the originally water-filled space in the fresh cement paste has been filled to the desired extent by the products of cement hydration (Neville, 1981). Hydration of cement can be defined as the combination of all chemical and physical processes that take place after contact of the anhydrous solid with water (Stark, 2011). For hydration to
Compressive strength

proceed, it is important to saturate calcium silicate hydrate (CSH) gels with water (Taylor, 2000). Proper curing reduces the rate of moisture loss and provides a continuous source of moisture required for the hydration that reduces the porosity and provides a fine pore size distribution in concrete (Alamri, 1988). Continuous curing reduces the sizes of microscopic pores and blocks their interconnections resulting in improvement of concrete microstructures and improved durability properties.

The aim of this study was to determine the effects of water and air curing conditions on compressive strength of concrete cubes containing optimum OPC replacement with RHA at different w/c ratio at test ages of 3, 7, 14 and 28 days. The optimum OPC replacements with RHA were determined from previous studies using RHA of the same characteristics and 100mm cube specimens that were water cured (Abalaka 2012).

MATERIALS AND METHOD

The cement used is a commercial brand of ordinary Portland cement (OPC) Type 1 available in Nigeria. The composition of the OPC by X-ray florescence (XRF) analysis is given in Table 1.

Table 1. Composition of OPC by XRF.

<table>
<thead>
<tr>
<th></th>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>CaO</th>
<th>MgO</th>
<th>SO₃</th>
<th>K₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na₂O</td>
<td>Mn₂O₃</td>
<td>P₂O₅</td>
<td>TiO₂</td>
<td>Cl-</td>
<td>SR</td>
<td>AR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.79%</td>
<td>6.35%</td>
<td>0.92%</td>
<td>58.50%</td>
<td>2.87%</td>
<td>4.91%</td>
<td>0.80%</td>
</tr>
<tr>
<td></td>
<td>0.65%</td>
<td>0.0%</td>
<td>0.15%</td>
<td>0.06%</td>
<td>0%</td>
<td>3.41</td>
<td>6.88</td>
</tr>
</tbody>
</table>

SR: silica ratio=SiO₂/(Al₂O₃+Fe₂O₃), AR=alumina ratio= Al₂O₃/Fe₂O₃

Natural river bed quartzite sand with specific gravity of 2.73 was used as fine aggregates; crushed granite of 20mm maximum size with specific gravity of 2.63 was used as coarse aggregates. The particle size distributions of the fine aggregates correspond to zone 2 sand by the BS 882: 1983 classification. The particle size distributions of the aggregates are given in Table 2.

Table 2. Particle size distribution of aggregates as percentage by weight passing sieve sizes.

<table>
<thead>
<tr>
<th>Sieve size (mm)</th>
<th>20</th>
<th>10</th>
<th>5</th>
<th>2.36</th>
<th>1.18</th>
<th>0.60</th>
<th>0.30</th>
<th>0.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine aggregates</td>
<td></td>
<td></td>
<td></td>
<td>92.4</td>
<td>81.6</td>
<td>61</td>
<td>38.3</td>
<td>14.5</td>
</tr>
<tr>
<td>Coarse aggregates</td>
<td>95.00</td>
<td>40.62</td>
<td>0.80</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Concrete mix proportions

<table>
<thead>
<tr>
<th>Cement content</th>
<th>Sand</th>
<th>Coarse aggregates</th>
<th>Free w/c ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>530kg/m3</td>
<td>458kg/m3</td>
<td>1.302kg/m3</td>
<td>0.30-0.55</td>
</tr>
</tbody>
</table>
The concrete mix proportions are given in Table 3. The concrete was mixed in a tilting drum mixer for 3 min., and manually compacted in two layers in 100 mm steel moulds. The milled RHA was weighed and added dry to the cement before mixing. A chloride free lignosulphonate based plasticizer (Fosroc’s Conplast P505) complying with BS EN 934 standard was used to increase the slump of the mixes. Two sets of cubes were cast for each mix proportion; one set of cubes were continuously cured in water while another set were stored in the open on the laboratory floor. After 24hrs in the moulds, the cubes to be continuously cured in water were de-molded and cured in water in compliance to BS 1881. P111:1997 standard. The cubes that were designated uncured were de-molded and stored on the laboratory floor and at specific ages, the strength determined. Concrete cubes without RHA cured in water were used as control. The average recorded daily relative humidity and temperatures were 44% and 23°C. The compressive strength of the cube specimens was determined in compliance to BS 1881: part 4:1970 standard using ELE ADR 3000 digital compression machine at a loading rate of 3.00kN/s. The results of strength tests are averages of three specimen tests.

The RHA used for this study was produced from rice husks sourced from local rice mills in Minna town, Nigeria using a charcoal fired incinerator. Minna is the state capital of Niger state; a major rice producing state in the middle belt region of Nigeria.

The RHA used was thermally processed in an incinerator that used charcoal as solid fuel. The incinerator consists of two concentric fine steel mesh baskets. The small steel basket was placed inside the bigger basket with the tops level and the space between the two baskets filled with rice husk. Red hot charcoal was poured into the small fine steel mesh basket acting as the receptacle and allowed to burn out. Temperature measurements in the incinerator using type k thermocouples recorded maximum temperature of 758°C in the rice husk for less than 4 hours duration. A maximum temperature of 838°C was recorded in the charcoal chamber. After production, the RHA was ground using a commercial hammer mill. The hammer mill was chosen for its availability, high milling output and affordability.

A laser diffraction particle size analyzer, Mastersizer 2000 by Malvern Instruments U.K., was used to determine the particle size distribution of the milled RHA. The milled RHA used had a specific surface of 235m²/kg. Fifty percent of the RHA particles are less than 46.451µm in diameter and ninety percent of the particles are less than 178.521µm in diameter. The measured median particle size of the milled RHA was 46.451µm. The RHA was roasted at 800°C for 6 min. resulting in loss on ignition (LOI) of 0.77%. The LOI recorded was less than the ASTM C618-03 requirement of 6% (max.). Further characterization of the RHA by back scatter electron (BSE) image, X-ray diffraction (XRD) and energy dispersive X-ray spectroscopy (EDS) spectra techniques showed that the amorphous silica was 90%, cristobalite 1%, quartz 6% and trace minerals 3% by mass.

RESULTS

The results of compressive strength tests at 3, 7, 14 and 28 days for water cured and uncured cube specimens are given in Table 4. The relative compressive strength losses of uncured cube specimens compared to control at different test ages are shown in Table 5.
Table 4. Effects of air and water curing on compressive strength of concrete containing optimum RHA replacement.

<table>
<thead>
<tr>
<th>Freew/c ratio</th>
<th>RHA replacement (%)</th>
<th>Plasticizer (l/m³)</th>
<th>Slump (mm)</th>
<th>Uncured Compressive strength (N/mm²)</th>
<th>Water cured Compressive strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3day</td>
<td>7day</td>
</tr>
<tr>
<td>0.35</td>
<td>0%</td>
<td>6.7</td>
<td>73</td>
<td>29.0</td>
<td>34.2</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>7.2</td>
<td>106</td>
<td>33.7</td>
<td>41.6</td>
</tr>
<tr>
<td>0.40</td>
<td>0%</td>
<td>2.5</td>
<td>120</td>
<td>28.7</td>
<td>30.3</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>2.7</td>
<td>137</td>
<td>28.4</td>
<td>32.7</td>
</tr>
<tr>
<td>0.45</td>
<td>0%</td>
<td>1.2</td>
<td>200</td>
<td>22.1</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>1.7</td>
<td>130</td>
<td>23.4</td>
<td>28.9</td>
</tr>
<tr>
<td>0.50</td>
<td>0%</td>
<td>0</td>
<td>200</td>
<td>19.1</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td>15%</td>
<td>0</td>
<td>20</td>
<td>20.3</td>
<td>22.9</td>
</tr>
<tr>
<td>0.55</td>
<td>0%</td>
<td>0</td>
<td>200</td>
<td>13.2</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>0</td>
<td>200</td>
<td>13.5</td>
<td>16.3</td>
</tr>
</tbody>
</table>

Table 5. Percentage compressive strength losses of uncured cubes relative to control

<table>
<thead>
<tr>
<th>Free w/c ratio</th>
<th>RHA replacement (%)</th>
<th>3 days</th>
<th>7 days</th>
<th>14 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.35</td>
<td>0%</td>
<td>-18.04</td>
<td>-17.85</td>
<td>-19.88</td>
<td>-26.28</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>-4.60</td>
<td>-0.19</td>
<td>+5.51</td>
<td>-8.31</td>
</tr>
<tr>
<td>0.40</td>
<td>0%</td>
<td>-1.14</td>
<td>-13.13</td>
<td>-16.87</td>
<td>-21.90</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>-0.12</td>
<td>-6.41</td>
<td>-18.04</td>
<td>-20.26</td>
</tr>
<tr>
<td>0.45</td>
<td>0%</td>
<td>-7.09</td>
<td>+8.24</td>
<td>-7.98</td>
<td>-1.59</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>-1.68</td>
<td>+4.52</td>
<td>-6.35</td>
<td>+1.06</td>
</tr>
<tr>
<td>0.50</td>
<td>0%</td>
<td>-8.14</td>
<td>-15.43</td>
<td>-9.21</td>
<td>-15.14</td>
</tr>
<tr>
<td></td>
<td>15%</td>
<td>-2.73</td>
<td>-4.92</td>
<td>-9.46</td>
<td>-1.48</td>
</tr>
<tr>
<td>0.55</td>
<td>0%</td>
<td>-12.57</td>
<td>-4.36</td>
<td>-11.66</td>
<td>-4.45</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>-10.86</td>
<td>-3.83</td>
<td>-1.48</td>
<td>-9.09</td>
</tr>
</tbody>
</table>

DISCUSSION
The effects of curing conditions on compressive strength of concrete specimens at different curing days given in Table 4 shows that all the uncured specimens containing RHA had compressive strength higher than specimens without RHA at all the w/b ratio used at the test age of 28 days. The higher compressive strength recorded for cube specimens containing RHA compared to cube specimens without RHA appear to show that pozzolanic reactions were still taking place in the specimens at 28 days; RHA particles rapidly absorb water from the concrete matrix and that water was apparently later used for hydration. The water absorbed by RHA could be substantial...
depending on the water content of the mix. RHA particles could rapidly absorb its equal weight of water in the first few minutes in fresh concrete. This appears to account for the relatively lower compressive strength losses of uncured specimens containing RHA compared to that of specimens without RHA relative to the control as shown in Table 5. At 28 days, all the uncured specimens had compressive strength that was lower than water cured specimens.

All the water cured specimens containing RHA had compressive strength higher than control at the test age of 28 days; except at w/b ratio of 0.40. The results at w/c ratio of 0.40 for water cured specimens containing 5% RHA appear to be anomalous. At w/c ratio of 0.35, 0.45, 0.50 and 0.55 all the water cured specimens containing RHA had compressive strength higher than control at 28 days. The results generally show that continuous hydration of water cured specimens resulted in compressive strength gains for specimens containing RHA. As RHA in concrete reacts with lime liberated from cement hydration, additional CSH gels are produced; as the CSH gels hydrate as a result of curing concrete strength increases. The effect of hydration in improving compressive strength could be seen by comparing the results of water cured specimens with uncured specimens for specimens containing RHA and those without RHA at all the test ages.

The compressive strength test results for uncured and water cured specimens at all the test ages suggest that the optimum OPC replacement level with RHA increased with increase in w/c ratio. For example at w/c ratio of 0.35 and 0.40 the optimum RHA replacement was 5%, at w/c ratio of 0.45 the optimum RHA replacement recorded was 10%. It peaked at 15% RHA replacement at w/c ratio of 0.50 and then declined to 5% replacement at w/c ratio of 0.55. Water therefore plays a very important role in the pozzolanic reactions of RHA in concrete.

The results have also shown that though the specific surface of the RHA used was low, 15% of it could be used to replace OPC without compressive strength loss at 28 days at w/c ratio of 0.50. It has also shown that a commercial mill with relatively high milling output compared to laboratory mills could be used to produce RHA that can be used in concrete production. The results also suggest that amorphous silica content of RHA may be more important in pozzolanic reactions than specific surface. This is important, considering that most RHA studies use considerable milling that takes time and consume energy.

CONCLUSIONS

The results in this study have shown that RHA predominantly composed of amorphous silica produced in charcoal incinerator milled to low specific surface exhibited pozzolanic reactivity in concrete. The RHA was used to replace 15% of OPC at w/c ratio of 0.50 without compressive strength loss when the specimens were water cured. The results show that affordable commercial mill could be used to grind RHA used for concrete production. Compressive strength increases were also recorded in specimens at other w/c mixes containing RHA. The results of compressive strength tests have generally shown that water curing of concrete containing RHA was very important in gaining substantial strength increase.

REFERENCES


EFFECTS OF MANAGEMENT PRACTICES ON THE COMPLETION TIME OF BUILDING PROJECTS IN GHANA

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Time is an important factor in the life of any project, more especially in the construction industry. It is therefore paramount that all efforts are channelled towards identifying factors that have the potential to derail project schedule. The aim of the study was therefore to assess the effect of some management practices on the completion time of building projects in Ghana. The study adopted survey research design; relative importance index and binary logistic regression statistical approach in the identification of the management practices that have significant impact on construction project time in Ghana. The study identified: poor site management, poor supervision, poor planning, low capacity of contractors, long waiting time for approval of drawings by client, delay in design information and discrepancies in design as the most significant factors that influence project duration in Ghana.

Keywords: time, management practices, project time and project

INTRODUCTION

This paper discusses the various management practices applied on building projects that have effect on the completion time of building projects and tries to identify, the practices that has the strongest effect.

Management may be defined in so many ways, but the concept that runs through all the definitions is that, it is a process of achieving goals through the coordinated performance of specific functions of planning, organising, staffing, directing and controlling (Mullins, 2002; Kerzner, 2003). This definition no doubt shows that application of management practices will be essential in achieving any goal including project goals. The business dictionary (2012) explains management practices as the methods or techniques found to be the most effective and practical means in achieving an objective (such as timely completion of projects) while making the optimum use of the resources. Management therefore is essential in the construction industry. The recent evolution of the project management procurement arrangement into the

construction industry is an evidence of the importance of management on a building project.

Management practices have been found to be most critical to project success. Mensah (2012) in the study of the management practices of three organizations (Social Investment Fund (SIF), Ghana Education Trust Fund (GETFund) and District Assembly Common Fund (DACF) asserted that management practices have serious repercussion on the success of construction project in Ghana. Furthermore, project time has long been discovered by researchers as one of the paramount factors to project success. Oppong (2003) argued that a project is said to be successful if it is completed on time, within budget, without accident, to a specific quality standard and overall client satisfaction. Chan (1998) also established that construction time performance is regarded as one of the critical project success factors and also gives an indication of an efficient industry. These assertions indicate that timely completion of a project is essential and can be best achieved with management. Frimpong et al. (2003) on groundwater projects in Ghana indicated that 33 out of 47 projects were delayed and among the most significant delay factors were finance related and poor contract management. A lot of the delay causes have been found to be management related (Oppong, 2003; Nick G. et al, 2004; Ahmad et al, 2006 and Elinwa and Joshua, 2001).

However, despite the proliferation of such studies on identifying management practices as causing delay, the exact extent or impact to which management practices affect delay and the management practices that affect delay the most is not known in Ghana. It is against this background that, this study was carried out to ascertain the effect of various management practices on construction projects schedule.

**Literature Review**

A construction project is said to be successful if it is completed on time, within budget, without accident, to a specific quality standard and overall client satisfaction (Oppong, 2003).

The first challenge in successfully managing building project is ensuring that the project is delivered within the defined constraints. The second and more ambitious, challenge is the optimized allocation and integration of the inputs needed to meet those pre-defined objectives. The project management, therefore, is a carefully selected set of activities chosen to use resources (time, money, people, materials, energy, space, provisions, communication, quality, risk, etc.) to meet the pre-defined objectives (Hendrickson, 2003; Kerzner, 2003). The management of building construction projects requires knowledge of principles of management as well as an understanding of the design and construction process. Effective management is therefore needed to achieve a desired specific objective and constraint such as the required time frame for completion which is the major concern of this study.

A significant number of research works have emphasized more on time as an indicator of project success. Both Nkado (1995) and Chan and Kumaswamy (1998) concluded that completing projects on time serves as an indicator of an efficient industry. Latham (1994) also reported that ensuring timely completion of project is one of the important needs of clients in the building industry. All these examples indicate that time management of building projects are essential.

In Ghana, Oppong (2003) for instance identified poor site management and supervision, mistakes and discrepancies in design documents flow of information.
between project team members, delays in design information, differences in planning and scheduling at pre-tender stage and long waiting time for approval of test samples of materials as some of the major causes of construction delays. Agyakwa and Fugar (2010) identified poor supervision and underestimation of completing time by contractors to be among the five strongest factors causing delay which are also management practices.

Odeh and Batteinei (2001) identified inadequate contractor experience, slow decision making and improper planning as some management practices that affect project delivery in Jordan. In Malaysia Sambasvan and Soon (2007) came out with improper planning, poor site management, inadequate contractor experience, lack of communication between parties and Alaghbari et.al (2007) identified coordinating problems as the second most important factor causing delays. Chan and Kumaswamy (1998) also indicated six significant factors of delays all which happen to be management issues, these are; poor site management and supervision, low speed of decision making involving all project teams, client initiated variations, necessary variations of works and inadequate contractor experience. Mezher and Tawai (1998) also identified financial problems and changes in design and availability of drawings. Several works by researchers such as Almomani (2000) also identified other delay factors such as poor designs, site and economic conditions. Elinwa and Joshua (2001) found out in Nigeria other factors such as improper planning and underestimating of project duration. In Arabia, Assaf et al (1995) came out with strong factors such as slowness by owners and decision making process. Ahmaiet and Nahapiet (1985) also added client experience and decisiveness and good working relation between main parties with Nick et al (2004) identifying client indecisiveness and non-uniformity. Ahmad et al, (2006) discovered the disruptions in communication of information and poor timely communication of information. Okpala & Aniekwu (1988) postulated that ineffective management of site operations can be due to lack of experience level, inadequate technical and managerial manpower as well as low level of production.

Analyses of the foregoing research works indicate that, a lot of delay factors are management issues (practices). Although other research works have shown finance as a major factor of delay in most building projects in Ghana (Oppong, 2003). Mensah (2002) asserted that the problem of financing could be minimised if the client managed his/her affairs adequately to pay contractors on time and contractors also adopt a good cost control mechanism which is an aspect of management which enhances financing during production.

In the execution of building projects the methods or techniques that are found to be the most effective and practical means in achieving an objective (such as timely completion of projects) while making the optimum use of the resources are the management practices and these determined or extracted from management functions such as control, planning, directing, staffing and organizing. The right mix of planning, monitoring, and controlling can make the difference in completing a project on time, on budget, and with high quality results (Mochal, 2009).

**RESEARCH METHODS**

The study adopted multiple research approach involving structured questionnaire and interviews. The survey employed structured questionnaire to solicit information from construction clients (public, corporate and private), consultants (architects, Quantity Surveyors and Engineers) and contractors (D1/K1). Management practices were drawn from literature and complemented with interviews. Respondents were required
to rank using 6-point likert scale (0 representing not applicable to 5 strongest) which of these management practices contribute to delay. Contractors were also required to provide information on the kind of management tools they use in managing their projects and how these tools impact on project schedule. Finally, clients who are the financiers and users for these facilities were also asked to provide information on how projects are administered from inception to completion in their respective organizations. This afforded the researchers to draw meaningful conclusion on management practices from these three bodies and how each influence project duration.

Due to the absence of defined population size of clients for this research, a total sample size of fifty (50) was decided on for clients. The Kish formula was used to determine the sample size for the consultants using the 2012 published list of professional bodies of architects, engineers and quantity surveyors. List of D1K1 contractors from the Ministry of Water Resources, Works and Housing data base was used to determine the population for contractors. Table1 presents the sample details.

Table1: Sampling Detail

<table>
<thead>
<tr>
<th>Population</th>
<th>Sample size</th>
<th>No. issued</th>
<th>No. responded</th>
<th>Percentage of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>50</td>
<td>43</td>
<td>32</td>
<td>75%</td>
</tr>
<tr>
<td>Contractor</td>
<td>96</td>
<td>60</td>
<td>51</td>
<td>73%</td>
</tr>
<tr>
<td>Consultant</td>
<td>293</td>
<td>90</td>
<td>77</td>
<td>53%</td>
</tr>
</tbody>
</table>

*QS=68, Architects=, Engineers=

METHOD OF ANALYSIS

The data obtained was analyzed using Relative importance index and Binary logistic regression to aid in identifying the management practices that were perceived to have strongest impact or project duration. Binary Logistic Regression Module was also employed to determine the significance of the strongest practices. The formula used for calculating the RII is:

$$RII = \frac{\sum W}{S \times N}$$

Where, ‘\(\sum W\)’ is the summation of weighting given to each factor, ‘S’ is the highest weight (i.e. 5) and ‘N’ being the total number of respondents in the sample (Kometa et. al., 1995 and Oppong, 2003).

Hypothesis testing for the model

This test determines whether the inclusion of a particular independent variable in the model makes a significant difference. This aspect of the analysis is very important especially when it comes to determining the quality of overall model. In this test the hypothesis used is:

Evaluation of Overall Performance of the Model.

In the evaluation of the overall performance of the logistic regression model, the model likelihood ratio test is used. The likelihood test is a general large-sample test which is based on the maximum likelihood method. It consists of using -2log \(\alpha\) which
has a chi-square distribution with “r” degrees of freedom. Where “r” represent the number of independent variables except the intercept.

\[ L.R(r) = [-2 \times \text{initial LL}] - [-2 \times \text{ending LL}] \]

The initial LL refers to the log likelihood of the model without restrictions i.e. full model with all the independent variables in the model and ending LL is the log likelihood under restrictions i.e. the model with intercept only.

**RESULTS AND DISCUSSIONS**

Responses from clients (public and private), consultants (architects, engineers and quantity surveyors) and contractors (DIKI) gathered on the management practices they considered to have much impact or effect on construction time were ranked using RII which is presented in Table 2.

<table>
<thead>
<tr>
<th>Code</th>
<th>Management Practices</th>
<th>Weighting</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2-27</td>
<td>Poor planning</td>
<td>439</td>
<td>0.798</td>
<td>1</td>
</tr>
<tr>
<td>S2-20</td>
<td>Inadequate contractor experience</td>
<td>435</td>
<td>0.791</td>
<td>2</td>
</tr>
<tr>
<td>S2-37</td>
<td>Long waiting time for approval of drawings by client</td>
<td>431</td>
<td>0.784</td>
<td>3</td>
</tr>
<tr>
<td>S2-38</td>
<td>Delay in design information, mistakes and discrepancies in design documents</td>
<td>429</td>
<td>0.78</td>
<td>4</td>
</tr>
<tr>
<td>S2-30</td>
<td>Dealing with unreliable sub contractors and suppliers</td>
<td>422</td>
<td>0.767</td>
<td>5</td>
</tr>
<tr>
<td>S2-39</td>
<td>Long waiting time for approval of test samples of materials</td>
<td>421</td>
<td>0.765</td>
<td>6</td>
</tr>
<tr>
<td>S2-14</td>
<td>Poor site management and supervision</td>
<td>415</td>
<td>0.755</td>
<td>7</td>
</tr>
<tr>
<td>S2-33</td>
<td>Inability to follow schedule</td>
<td>414</td>
<td>0.753</td>
<td>8</td>
</tr>
<tr>
<td>S2-35</td>
<td>Communication of variations in design at inappropriate time</td>
<td>412</td>
<td>0.749</td>
<td>9</td>
</tr>
<tr>
<td>S2-29</td>
<td>Work overload</td>
<td>405</td>
<td>0.736</td>
<td>10</td>
</tr>
<tr>
<td>S2-18</td>
<td>Poor coordination of the project manager for the whole project</td>
<td>404</td>
<td>0.735</td>
<td>11</td>
</tr>
<tr>
<td>S2-5</td>
<td>A job poorly done that must be done over</td>
<td>399</td>
<td>0.725</td>
<td>12</td>
</tr>
<tr>
<td>S2-4</td>
<td>Unreasonable time constraint set by client</td>
<td>397</td>
<td>0.722</td>
<td>13</td>
</tr>
<tr>
<td>S2-34</td>
<td>Slow decision making by client</td>
<td>396</td>
<td>0.72</td>
<td>14</td>
</tr>
<tr>
<td>S2-13</td>
<td>Unsuitable leadership style of contractor/ project manager</td>
<td>392</td>
<td>0.713</td>
<td>15</td>
</tr>
<tr>
<td>S2-17</td>
<td>Poor coordination between design team</td>
<td>391</td>
<td>0.711</td>
<td>16</td>
</tr>
<tr>
<td>S2-50</td>
<td>Lack of authority to make decision</td>
<td>383</td>
<td>0.696</td>
<td>17</td>
</tr>
<tr>
<td>S2-6</td>
<td>Client indecisiveness and non uniformity</td>
<td>379</td>
<td>0.689</td>
<td>18</td>
</tr>
<tr>
<td>S2-28</td>
<td>Too many people involved in minor decision making</td>
<td>379</td>
<td>0.689</td>
<td>19</td>
</tr>
<tr>
<td>S2-36</td>
<td>Lack of effective communication between project team</td>
<td>375</td>
<td>0.682</td>
<td>20</td>
</tr>
<tr>
<td>S2-19</td>
<td>Poor cooperation</td>
<td>374</td>
<td>0.68</td>
<td>21</td>
</tr>
<tr>
<td>S2-12</td>
<td>Lack of technical and managerial skills of the project manager</td>
<td>372</td>
<td>0.676</td>
<td>22</td>
</tr>
<tr>
<td>S2-7</td>
<td>Lack of job information in a ready to use format</td>
<td>366</td>
<td>0.665</td>
<td>23</td>
</tr>
<tr>
<td>S2-16</td>
<td>Non establishment of standards of performance</td>
<td>365</td>
<td>0.664</td>
<td>24</td>
</tr>
<tr>
<td>S2-32</td>
<td>Lack of project organisation</td>
<td>361</td>
<td>0.656</td>
<td>25</td>
</tr>
<tr>
<td>S2-40</td>
<td>Inadequate design team experience</td>
<td>351</td>
<td>0.638</td>
<td>26</td>
</tr>
<tr>
<td>S2-15</td>
<td>Poor organisational structure</td>
<td>350</td>
<td>0.636</td>
<td>27</td>
</tr>
<tr>
<td>S2-47</td>
<td>Constant unforeseen interruptions</td>
<td>350</td>
<td>0.636</td>
<td>28</td>
</tr>
</tbody>
</table>

Table 2: Results of Ranking of Management practices based on RII Continued.
Although, these practices were ranked as the strongest factors, there is the need to find out if they really have an effect on completion time or cause delays and the exact extent to which they significantly can cause delay. This called for subjecting these practices into the binary regression model. The logistic regression model was built on the dependent variable delays which hold values one (1) for delays and zero (0) for no delays and the independent variables were the ten strong management practices. The Statistical package for social sciences (SPSS) was used to develop the module and the output which is of much relevance to the work is shown in tables 3, 4 and 5.

Table 3 Omnibus Test of Model Coefficient

<table>
<thead>
<tr>
<th>Step</th>
<th>Chi-square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>19.650</td>
<td>10</td>
<td>0.033</td>
</tr>
<tr>
<td>Step Block Model</td>
<td>19.650</td>
<td>10</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>19.650</td>
<td>10</td>
<td>0.033</td>
</tr>
</tbody>
</table>

Table 4 Model Summary

<table>
<thead>
<tr>
<th>Step</th>
<th>-2 Log likelihood</th>
<th>Cox &amp; Snell (R²)</th>
<th>Nagelkerke (R²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56.165</td>
<td>0.164</td>
<td>0.328</td>
</tr>
</tbody>
</table>
Determination of the extent to which Management practices affect completion time

The main interpretation of the model is based on Table 5, since it gets into the heart of the results. It shows the coefficient (B), the standard error (SE), the Wald chi-square statistic (Wald), the associated P-value (Sig) and the odds ratio (Exp (B)). Interpreting using the coefficient can be awkward. E.g. for a unit increase (good application) of the practice poor site management and supervision (S2_14), the log odds of it affecting delay (vs. not affecting delay) increase by 1.346. Therefore the odds ratio will be preferred in interpreting the results. As earlier explained, an odds ratio greater than one suggest a positive relationship, and the larger the difference between the observed odds ratio and one, the stronger the relationship. Hence, from Table 5, it can be seen that S2_37 (Long waiting time for approval of drawings by client), S2_39 (Long waiting time for approval of text samples of materials), S2_14 (poor site management and supervision) and S2_29 (work overload) are the only practices whose application will have with positive effect on delay. However, only S2_14 (poor site management and supervision) is significant at the 95th percentile. Although S2_20 (Inadequate contractor experience) is significant, it does not have a positive effect on delay. That is, holding all other variables constant, one unit change in the application of the practise inadequate contractor experience, the odds of it affecting delay (vs. not affecting delay) is decreased by a factor of 0.21. Interpreting the practice poor site management and supervision which has the highest and significant odds ratio(Exp (B)), we can say, holding all other variables constant, one unit increase (or a good application) in poor site management and supervision, will cause the odds of it affecting delay (vs. not affecting delay) to increase by a factor of 3.84. In summary, the model only finds poor site management and supervision as the most significant management practice that affect completion period of building projects.

These deductions from the module can only be accepted if the module itself is significant. The likelihood ratio chi-square of 19.65 with a p-value of 0.03 from Table 3 shows that the model as a whole fits significantly better than the empty model (Model 0). The -2 log likelihood was used to compare the fit of this model with model...
0. The value of the model likelihood ratio (LR) which was the statistic used to test the performance or the overall regression model was 56.16 (Table 4). The LR with a degree of freedom of 10 (the number of independent variables), at a significance of 0.05 lead to the conclusion that the overall model was statistically significant. The value obtained from the statistical Tables (the critical value) was 1.81.

CONCLUSIONS

Management practices as applied by major parties in the Ghanaian construction industry have an effect on the completion time of building projects. The practices that affect completion time the most are Poor planning, Inadequate contractor experience, Long waiting time for approval of drawings by clients, Delay in design information, mistakes and discrepancies in design document, Dealing with unreliable subcontractors and suppliers, Long waiting time for approval of test samples of materials, Poor site management and supervision, Inability to follow schedule, Communication of variations in design at inappropriate time and Work overload. Of these strong management practices, whiles practices such as Long waiting time for approval of drawings by client, Long waiting time for approval of text samples of materials, Poor site management and supervision and Work overload have a positive effects on delays the others such as Poor planning and Inadequate contractor experience have negative effect on completion time. Poor site management and supervision was identified as the practice that significantly affected delay the most.

Based on this conclusion it is expected that when clients, consultants and contractors are adequately trained in the proper application of these management practices it will help to a large extent to help minimise delays on building projects.

REFERENCES


Completion time of buildings

Owners, Engineers, Architects and Builders" Second Edition prepared for World Wide Web publication
Mochal T (2009). “10 best practices for successful project management” Tech Republic’s free newsletters
International Journal of project Management, 20 (1), page. 67-73
The research investigates the effect of the variance in Rents paid on Occupancy Ratio of multi-storey commercial properties within a period of seven years (2006-2012) using the commercial city of Kaduna in Nigeria as the case study. The study was carried out using a semi-structured questionnaire along with personal interview administered on tenants and managing agents of 3 selected multi-storey buildings. Using Correlation and Time-series analysis, it was discovered that the incessant increase in rent on the properties over the years has impacted on the occupational ratio of these buildings as there is an inverse relationship between the occupancy-status and rents-paid in the buildings, thus, as the occupancy ratio in the buildings continue to decline, the rental value continued to increase. Among the recommendation was that Landlords should not be too ambitious as to continuously increase the rents charged, even as against the recommendations of their professional managing agents, to curtail the incessant decrease in occupancy ratio.

Keywords: rent; multi-storey buildings; occupancy ratio; Kaduna

INTRODUCTION

Kaduna derived its name from a Hausa word “KADA” which means crocodile. Kaduna became the Headquarters of the Northern Province, as far back as the early 20th century when Sir, Fredrick Lugard became High Commissioner and ever since has had a great influx of populace from every part of Nigeria, thus became a cosmopolitan city therefore performing a dual function as an administrative and also a commercial centre, which has great influence on the population and commercial activities. According to the 2006 census. Kaduna metropolis (comprising 5 local governments ie Kaduna North, Kaduna South and parts of Igabi, Chikun and Kajuru local governments) have a population of about 900,000 people.

Kaduna metropolis has been chosen for this study for the fact that it is one of the cosmopolitan areas in Northern Nigeria thus housing commercial storey buildings.

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80 sanibalarabea@yahoo.com
81 fatsalbode@yahoo.com
82 gimbasd@yahoo.com


465
Commercial activities usually play a great role in nations building and economic development thus the significance of buildings in terms of commercial activities cannot be over-emphasized. The nature of commercial buildings in Kaduna metropolis includes purposely built shops, offices, and converted tenement buildings, these activities are today found in storey buildings in Kaduna metropolis thus playing a significant role in the commercial activities and consequently having a great impact on the pattern of land use in the area.

Over the years, it has been observed, through the study of the trends in commercial property values (Abdullah, 2004; Kathung 2009), that the rents passing on commercial properties in Kaduna metropolis has been on the rise as such rents are indiscriminately levied by the landlords neglecting the professional advices proffered by valuers.

Thus, the research covering the period of the most severe financial crises of recent times, not only in Nigeria but around the globe observed the trend in rental value vis-avis occupancy ratio by means of time series analysis. This method shows the changes that had occurred in the number of occupants of the various floors of each building including the cases of empty spaces and the rental value within the stated period.

The three selected properties are some of the pioneer commercial storey buildings in the Northern part of Nigeria jointly owned by the Northern states. Two of them are on 10 floors while Turaki Ali is on 6 floors but all share a characteristics of an open floor where the floors are further partitioned according to tenants requirements in m² and leased on similar terms of yearly tenancies. **Ahmed Talib House** was constructed in 1968 by the Northern Nigeria Development Company (NNDC) owned by the then Northern Nigerian States as an office complex with a design capacity of Eighty (80) number office spaces meant to generate funds for the Northern State Governments. **Nagwamatse House** was constructed about 6 years later in 1974 by the New Nigerian Newspaper owned by the Northern Nigerian States. It was also constructed for office purpose to accommodate a Hundred (100) number tenants and managed by a financial institution also owned by the Northern Nigerian government, Bank of the North (now Unity Bank Plc). Then 8 years later the third building was constructed and named **Turaki Ali House**, it is also one of the NNDC projects jointly owned by the Northern states of Nigeria, constructed in 1982 to provide office space for the intending investors, also with the aim of increasing the financial base for the northern states. The details of the properties so selected are as shown below;

<table>
<thead>
<tr>
<th>Name of Property</th>
<th>Location</th>
<th>Year of Construction</th>
<th>No. of Floors</th>
<th>No. of Tenants</th>
<th>Designed Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmed Talib House</td>
<td>Ahmadu Bello Way by Kanta Road.</td>
<td>1968</td>
<td>10</td>
<td>67</td>
<td>80</td>
</tr>
<tr>
<td>Nagwamatse House</td>
<td>Ahmadu Bello Way opposite UTC Building</td>
<td>1974</td>
<td>10</td>
<td>74</td>
<td>100</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td>Kanta Road ,behind Ahmed Talib house</td>
<td>1982</td>
<td>6</td>
<td>78</td>
<td>96</td>
</tr>
</tbody>
</table>

**Statement of Research Problem**

Rent passing on commercial properties in Kaduna metropolis, just like most urban cities in Nigeria, has been on the rise. As such rents are indiscriminately levied by the landlords neglecting the professional advices proffered by valuers which has resulted in occupants vacating premises while those that remain, in most cases, does so for lack of close substitutes or created goodwill over time.
Aim of the paper; To examine the effect of trends in rents charged on occupancy ratio of multi-storey commercial properties in Kaduna metropolis from 2006-2012

Hypothesis

Alternative Hypothesis- The occupancy ratio of commercial storey buildings is determined by the rents charged on such properties in Kaduna metropolis.

Null Hypothesis- The occupancy ratio of commercial storey buildings is not determined by the rents charged on such properties in Kaduna metropolis.

THEORETICAL BASIS

Variations in outcome of studies of office rent is caused by attributes of different geographical locations as well as characteristics in relation to the nature of economies; building attributes; varying contractual arrangements; and even government policies. Thus, studies on the determinants of office prices and rents abound in literatures, but little evidence exists on the effects of such determined rent on occupancy ratio of these office spaces. The available literatures focus on the influence of building characteristics, architectural design, leasing provisions and locational factors on rents, with little, attention paid to effect of rent itself on occupational ratio of office spaces.

Clapp (1980) used a sample of 105 office buildings located in Los Angeles to regress the quoted annual rental rate per square foot of office space on building characteristics and three locational variables: distance to the CBD, average commute time of the building’s workers and square footage of office space within a two-block radius, he concluded using Beta coefficients to indicate that the importance of CBD distance is substantially greater than the other two effects, thus that office occupiers are willing to pay a premium for access to face-to-face contacts, especially those within the CBD, and to the residences of employees.

Cannaday and Kang (1984) used 19 office buildings located in Champaign-Urbana, Illinois to estimate the hedonic rent equation using two locational factors including air-line distance in miles between the office building and the nearest shopping centre and air-line distance in miles between the office building and the quadrangle on the University of Illinois campus. They found out that only the latter variable is found to have a statistically significant effect on office rents.

Rental value

Rent to the economist is the surplus of income above the minimum supply price it takes to bring a factor into production. Relative to landed properties, rent is seen as the sum of money paid annually or periodically by tenants to the landlord for the occupation and use of properties.

The popular and the most acceptable meaning of the term rent as adopted in this study i.e. rent is “the actual payment made for the use of a property of others normally agreed in advance”.

In his study on the rental trends in the metropolitan Kano, Kabir (1994) observed that rental values varies with the nature of the properties as well as their locations which is often affected by the rising inflationary trends indicating that there is a general upward trend in values of commercial properties within the metropolis. He related these variations to the high cost of construction resulting into steep decline in the supply of properties in the area.
Factors affecting Market Value of Properties

Turner (2004) identifies the general and specific drivers of commercial property values to include population growth, level of development in the node, property use, the size and condition of improvements on the site, and the demand and supply in property class within the local real estate market. In a free market economy, market forces and other factors influence the prices buyers are willing to pay for a listed property in the property market. In practice, the estimation of the market values of properties is made without due consideration to a holistic range of influential factors. In most cases, this has resulted in overpricing and a risky property market marked with ups and downs.

Meikel (2001) identifies four sets of main determinants of house prices, namely, the supply of housing, the supply of finance, the demand of housing and level of properties builders’ confidence. The supply of buildings is influenced by the volume of the existing stock of dwellings available for sale, and less of new developments and conversion. The supply of housing finance is influenced by the financial circumstances of the average borrowers and to the lending requirements demanded by lending institution. On the other hand, the demand for housing is related to the changes in the number of investors seeking for buildings. This in turn is mostly influenced by the population increase, sizes of structure formation and regional migration pattern.

Occupancy Ratio

The Oxford Advanced Learner Dictionary (2005) defined occupancy status as quantitative relation between occupiers and available accommodation space by the tenants within a particular building. Thus, the term refers to the ratio of rented space to the total amount of space available. Take for an instance a 1000 units commercial office building which currently has 400 units occupied, therefore the occupancy ratio is \( \frac{400}{1000} \) or 40% (Real Estate Agent.com. 2008)

Vacancy status on the other hand is usually calculated from the proportion of vacant space relative to the total floor space of buildings within the area covered.

Ikoma (2002) opined that significant differences have been noticed in the vacancy ratio in Japan, most especially in the major metropolitan areas. The peculiarities of the vacancy necessitate its study in Tokyo, Osaka and Nagoya. Where the designed capacity in a building is say 50 meters, and about 40 meters is occupied.

Multi Storey Building

Wikipedia defined multi-storey building as a building that has multiple floors above ground in the building i.e having more than one storey, usually with the aim to increase the floor area of the building without increasing the area of the land/land mass the building is built on, hence saving land and, in most cases, money (depending on material used and land prices in the area). But the common usage of multi-storey building is for buildings that have a rise in storeys of more than 3, and contains 2 or more separate dwellings.

RESEARCH METHODOLOGY

The instruments used in collecting data are closed and open ended questionnaires, interviews and observation, where two categories of questionnaires A and B were designed and administrated to elicit information on the problem of study. Purposeful sampling technique was used in administering the questionnaires, in that, questionnaires were administered to the specific occupants and managing agents.
Copies of coded questionnaire A was administrated to the tenants while those of questionnaire B were administrated to managing agents.

With the number of the tenants in the entire properties totaling about one hundred and Eighty (180), a semi-structured questionnaire was drafted and administered to the tenants occupying the commercial properties and the managing firms in respect of same properties where a set of 180 questionnaires were administered so as to cover a wide range and to be able to receive all relevant information required for the analysis, out of which 164 questionnaires were returned representing 91%, the detail is shown below.

<table>
<thead>
<tr>
<th>Property</th>
<th>No. Administered</th>
<th>No. Returned</th>
<th>% of answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagwamatse House</td>
<td>60</td>
<td>51</td>
<td>85</td>
</tr>
<tr>
<td>Ahmed Talib House</td>
<td>60</td>
<td>55</td>
<td>92</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td>60</td>
<td>58</td>
<td>97</td>
</tr>
</tbody>
</table>

(Source: Yakub et al, 2012)

The result is presented using descriptive presentation technique including tables and figures represented in charts and graphs for easy viewable information, containing details on Rental values on an annual basis, the trend in the variation as well as the occupancy ratio of the properties.

This self-administered questionnaire was complemented by personal interview especially at the initial stage of data gathering process. Here the researchers, armed with the interview schedule, met the respondents, asks questions from the respondents and completes the interview schedule themselves. There was an opportunity here to go beyond what is contained in the interview schedule to ask questions for clarifications in order to enrich the response. Moreover, interviews allow explanation of issues in the questionnaire by the interviewer in areas where some respondents may not be fully knowledgeable. The intention here is to frame questions and administer them personally.

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagwamatse House</td>
<td>1,800</td>
<td>2,000</td>
<td>2,100</td>
<td>2,100</td>
<td>2,200</td>
<td>2,200</td>
<td>2,400</td>
</tr>
<tr>
<td>Ahmed Talib House</td>
<td>2,100</td>
<td>2,300</td>
<td>2,500</td>
<td>2,500</td>
<td>2,500</td>
<td>2,800</td>
<td>2,800</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td>1,900</td>
<td>2,000</td>
<td>2,200</td>
<td>2,300</td>
<td>2,300</td>
<td>2,400</td>
<td>2,400</td>
</tr>
</tbody>
</table>

(Source: Yakub et al, 2012)

In analyzing the study, Correlations and the Time series Analysis were adopted in the linear regression of the rents charged vis-a-vis the occupancy ratio on one hand and the other factors that may be responsible for the variation in occupancy level on the other
The technique showed a comprehensive trend in occupancy ratio and rents charged at various times for the past six years and the relationship between the rent and the occupancy ratio were clearly shown in each of the properties.

RESULTS AND DISCUSSIONS

From the survey carried out, it was deduced that Ahmed Talib House has the best variety of services provided amongst its comparables thereby commanding the highest Rent Charged due to the provisions of and maintenance of services provided.

Table 4; Showing the Trends in Occupancy ratio of the Buildings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagwamatse House</td>
<td>87</td>
<td>84</td>
<td>75</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>Ahmed Talib House</td>
<td>95</td>
<td>85</td>
<td>84</td>
<td>86</td>
<td>86</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td>91</td>
<td>89</td>
<td>85</td>
<td>81</td>
<td>83</td>
<td>84</td>
<td>85</td>
</tr>
</tbody>
</table>

(Source: Yakub et al, June, 2012)

The occupation ratio of Ahmed Talib House indicates better occupation as compared with the other properties, most especially from 2009 to date while Nagwamatse House recorded the lowest percentage of occupation throughout the period of the study. Furthermore, it was discovered that the status of tenant’s occupation shows that quite a number of tenants prefer the lower floors to the upper floors as the data indicates that as one moved up the upper floors, the number of tenants also decline.

Table 5: Showing Correlation of Occupancy Ratio and Amount of Rents charged

<table>
<thead>
<tr>
<th>Buildings</th>
<th>Correlated Figure</th>
<th>(Explained Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>r^2</td>
</tr>
<tr>
<td>Nagwamatse House</td>
<td>-0.47648</td>
<td>0.227034</td>
</tr>
<tr>
<td>Ahmed Talib House</td>
<td>-0.8525</td>
<td>0.726748</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td>-0.85036</td>
<td>0.72312</td>
</tr>
</tbody>
</table>

(Source: Yakub et al, 2012)

Using the Pearson correlation analysis, the above correlation table was generated showing that there is an inverse relationship between the independent variable Rents Levied and the dependent variable Occupancy Ratio, implying that the higher the Rents Levied, the lower the occupancy Ratio and vice versa.

The correlation values were used to generate a coefficient of determination r^2 respectively representing the explained variable for each of the properties considered where, for example Ahmed Talib House had 0.73 as value of r^2 which has the highest influence of occupancy ratio by the Rents Levied while other factors other than Rents Levied account for about 0.27 for the period under review.

In an attempt to satisfy the equation for the linear regression i.e \( y = a + bx \), the various values of a and b for the three properties were also obtained using the formula:

\[
a = \frac{\sum y - b \sum x}{n}
\]
\[ b = n\sum xy - \sum x \sum y \]
\[ n\sum x^2 - (\sum x)^2 \]

The values of a and b were obtained to plot the scattered diagrams also showing the lines of best fit as well as the regression equations, as follows;

Where Values of \( b = -0.9315 \) and \( a = 107.12 \), while Regression line: \( y = 107.12 - 0.9315x \)

Values of \( b = -1.8947 \) and \( a = 124.94 \) while Regression line: \( Y = 124.94 - 1.8947X \)

Values of \( b = -1.5063 \) and \( a = 118.78 \) while Regression line: \( y = 118.78 - 1.5063x \)

From the results obtained through the correlation and regression of the occupancy ratio on Rental Values, it can be concluded that amount of Rents charged has a significant effect on the occupancy ratio, thus the Alternative hypothesis is therefore accepted.

However, the results also shows that other factors may also affect the occupancy ratio, thus, the analysis of the data gotten through the questionnaire survey which is herein presented below using the Time Series Analysis;

<table>
<thead>
<tr>
<th>Factors Affecting Occupancy Ratio of the Properties</th>
<th>Very Influential</th>
<th>Influential</th>
<th>Somewhat Influential</th>
<th>Of Little Influence</th>
<th>Not Influential</th>
<th>No Response</th>
<th>Total No. of Respondents</th>
<th>Total Points</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent Charged</td>
<td>59</td>
<td>54</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>127</td>
<td>550</td>
<td>VI</td>
</tr>
<tr>
<td>Service Charge Levies</td>
<td>57</td>
<td>56</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>127</td>
<td>548</td>
<td>VI</td>
</tr>
<tr>
<td>State of repairs cum Facilities in the building</td>
<td>60</td>
<td>47</td>
<td>15</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>127</td>
<td>541</td>
<td>VI</td>
</tr>
<tr>
<td>Political stability</td>
<td>43</td>
<td>42</td>
<td>14</td>
<td>12</td>
<td>15</td>
<td>1</td>
<td>127</td>
<td>464</td>
<td>I</td>
</tr>
<tr>
<td>Location of the property</td>
<td>58</td>
<td>42</td>
<td>17</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>127</td>
<td>526</td>
<td>VI</td>
</tr>
<tr>
<td>Standard of construction</td>
<td>34</td>
<td>54</td>
<td>21</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>127</td>
<td>472</td>
<td>I</td>
</tr>
<tr>
<td>Government Policies</td>
<td>12</td>
<td>11</td>
<td>40</td>
<td>61</td>
<td>2</td>
<td>1</td>
<td>127</td>
<td>348</td>
<td>SI</td>
</tr>
<tr>
<td>Availability of infrastructure</td>
<td>46</td>
<td>34</td>
<td>41</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>127</td>
<td>498</td>
<td>I</td>
</tr>
<tr>
<td>Safety and Convenience</td>
<td>29</td>
<td>39</td>
<td>26</td>
<td>23</td>
<td>6</td>
<td>4</td>
<td>127</td>
<td>431</td>
<td>I</td>
</tr>
<tr>
<td>Availability of and Rent Passing on substitutes</td>
<td>34</td>
<td>43</td>
<td>22</td>
<td>4</td>
<td>21</td>
<td>3</td>
<td>127</td>
<td>437</td>
<td>I</td>
</tr>
</tbody>
</table>

(Source: Yakub et al., 2012)

**Key to decision making**

From the table, approximately 125 persons responded, thus, Total Points = 5 points x (127-2) respondents = 625 points i.e. (Highest Point Obtainable, if all respondents had chosen Very Influential)

Thus, Very Influential will take - 500-625 points

Influential will take - 375-499 points

Somewhat Influential will take - 250-374 points

Of Little Influence will take - 125-249 points
Not Influential will take -124 points

The above data implies that the Rental Value of the properties, Service Charge Levies, State of repairs cum Facilities in the building and Location of the properties also have significant effect on occupancy ratio as they take the highest marks of 550, 548, 541 and 526 marks respectively, thus rated as ‘very influential’, while all other factors on the table were rated as being ‘influential’ except for Government Policies on developments which was rated lowest as ‘somewhat influential’.

Thus from the ratings by the respondents it is observed that the Rents charged have a tremendous effect on the occupancy ratio as it takes the highest points in the rating.

CONCLUSION AND FURTHER RESEARCH

In conclusion therefore, most of the properties in the study are not filled to their maximum accommodation provision as such it is found out from the analysis that the amount of rents charged has an impact on the occupancy ratio of buildings, while other factors that may equally influence the occupancy ratio may include Service Charges levied on the properties; State of repairs cum Facilities in the building and Location of the properties.

Furthermore, the research only covered three properties which serves as a constraint, thus emerging new possibilities and further research revealed during the course of the research include a comparative spatial study of the effect of rental values cum service charge levies on occupancy ratio of commercial storey buildings where it will be expected that the researcher to carry out studies of atleast five storey buildings in two different metropolitan cities.

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APPENDIXES

Table 7: Showing the Design Capacity and Occupancy Status/Ratio of the Buildings

<table>
<thead>
<tr>
<th>Year</th>
<th>AT NG</th>
<th>TA NG</th>
<th>AT NG</th>
<th>TA NG</th>
<th>AT NG</th>
<th>TA NG</th>
<th>AT NG</th>
<th>TA NG</th>
<th>AT NG</th>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>2012</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>No Occupied Desig Capacity</th>
<th>Occupancy Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT NG</td>
<td>2006</td>
</tr>
<tr>
<td></td>
<td>2007</td>
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<td></td>
<td>2008</td>
</tr>
<tr>
<td></td>
<td>2009</td>
</tr>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>2012</td>
</tr>
</tbody>
</table>

(Source: Yakub et al., June, 2012)

Table 8: A Cross tabulation of the Rents Levied and the Occupancy Ratio

<table>
<thead>
<tr>
<th>Property</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagwamatse House</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rents Levied (in '00'naira)</td>
<td>18</td>
<td>20</td>
<td>21</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>Occupancy Status (%)</td>
<td>95</td>
<td>85</td>
<td>84</td>
<td>86</td>
<td>86</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Ahmed Talib House</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rents Levied (in '00'naira)</td>
<td>21</td>
<td>23</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Occupancy Status (%)</td>
<td>87</td>
<td>84</td>
<td>75</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>Turaki Ali House</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rents Levied (in '00'naira)</td>
<td>19</td>
<td>20</td>
<td>22</td>
<td>23</td>
<td>23</td>
<td>24</td>
<td>24</td>
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<tr>
<td>Occupancy Status (%)</td>
<td>91</td>
<td>89</td>
<td>85</td>
<td>81</td>
<td>83</td>
<td>84</td>
<td>85</td>
</tr>
</tbody>
</table>
ENVIRONMENTAL JUSTICE, PLANNING AND OIL AND GAS PIPELINES IN THE NIGER DELTA REGION OF NIGERIA

Friday A. Ogwu and Abdulrahaman A. Sahabo
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This paper analyses the impact of oil and gas pipelines on the environment and settlements from the perspective of environmental justice, using a case study of the oil-producing communities in the Niger Delta region of Nigeria. The paper mobilises theories of environmental justice to support an in-depth empirical analysis of the development and management of oil and gas pipelines in the region. The empirical evidence equally suggests that the lack of community involvement and appropriate recognition of some groups of stakeholders in the management of the oil and gas pipeline project is strongly related to the incidence of pipeline impacts on the communities. The paper advocates a new approach, based on the core principles of environmental justice that promotes inclusion of the necessary stakeholders, including the physical planners, and would incorporate local knowledge and experience into the environmental management of the region in a way to protect the environment and people from the impacts of the pipeline.

Keywords: environmental justice, planning, oil and gas pipelines, Niger Delta, Nigeria

INTRODUCTION

Pipeline maintenance is another important activity that ensures the integrity of pipelines and the safety of people in the vicinity. The oil producing communities have often attributed most of the spillages to the lack of proper maintenance of oil and gas pipelines by the companies. After construction, periodic monitoring and repairs are vital requirements for a successful pipeline network. Figure 1 below shows a scene of fire outbreak caused by an oil pipeline leakage.

Even when the pipeline is no longer in use, it is left to rust in the open field as the companies are not very willing to spend money dismantling (decommissioning) the pipeline. For example, a respondent to a group discussion has argued that “some oil and gas pipelines in their community well are over 35 years old”. Readings from literature further support the respondent’s view. For example, Nwilo and Badejo (2008) point out that the actual life span of an oil pipeline recommended by the International Body of Oil and Gas Pipelines Marketing is between 20-25 years. While the communities continue to point accusing fingers at the negligence of the oil companies in failing to replace old pipelines, the oil companies have defended themselves during the interviews by lamenting that the local communities would

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not allow replacement of oil and gas pipelines without being given monetary compensation.

Figure 1: A ruptured oil pipeline burns in a Lagos Suburb after an explosion in 2008 which killed at least 100 people


However, during field observation, it was noticed that when oil pipelines are left on the surface, they occupy agricultural land, separate communities and impede free movement of people. More so, it was observed that oil companies prefer leaving unused pipelines on the surface instead of burying them underground. It was a collective view from the staff of oil companies that they prefer leaving unused pipelines on the surface than installing them underground because, as long as oil pipelines are buried underground, whether or not they are in use, the communities will assume they are functioning in order to justify their demand for further compensation.

Figure 2 below shows a young girl walking across the vast oil and gas pipelines that run through the middle of her town of Okrika in the Niger Delta region of Nigeria.

LITERATURE REVIEW

Air, Land and Water Pollution

In 2006, the United Nations Development Programme (UNDP) pointed out that between 1976 and 2001; a total number of 6,817 oil spill incidents were recorded in the Niger Delta, with a significant loss of approximately 2.1 million barrels of oil to the environment. However, Moffat and Linden (1995) do not only blame the activities of the oil multi-nationals in the Niger Delta, but also the Nigerian government, because decades of non-existent environmental regulations have allowed oil companies to operate their facilities without incorporating the costs of environmental damage into their decision-making policies.
Environmental planning

Air, land and water pollution occur in the course of petroleum pipeline construction. For example, it was gathered from the empirical findings in the course of this paper that large volume of dust and air-borne particulate matter, originating from construction sites during pipeline route digging, were discharged into the air in one of the study cases (Eleme community). When the air is laden with such dust, it can cause health hazard for some people. Pollution studies around Bille community in Rivers State of Nigeria have shown that several people are suffering from eye-related problems and asthmatic attacks due to the dust-laden air that prevails within a few kilometres radius of the oil pipelines construction sites (Aigbedion, 2005). As mentioned earlier, oil spillage, resulting from oil pipelines, has caused extensive water, air and land pollution in many parts of the Niger Delta Region.

Another negative impact of the oil pipelines which the research analyses elbow is the kind of damage they cause to the vegetation of Niger Delta.

![Figure 2: Erosion exposes Oil pipelines in a community of Okrika.](image)

Source: Circles of Blue, 2009.

**Damage to the Vegetation**

In attempts to construct oil and gas pipelines, oil companies have constructed canals that in some cases have caused saltwater to flow into freshwater zones, destroying the fresh water ecological system. Oil companies constantly dredge river channels to facilitate navigation. Similarly, oil spillage adversely alters the biodiversity of the environment as it destroys soil, plants, animals and water resources as a result of the toxicity of oil. In 1980 for example, about 340 hectares of mangrove forest were lost
to oil spillage in the Niger Delta Region of Nigeria as a result of pipeline blow-out at a Texaco offshore location (Awosika, 1996).

As indicated from speaking to a member of a non-government organisation; vast hectares of vegetation in the form of natural forest or crop plantation have been lost due to oil and gas pipelines networking. The NGO member referred to above further narrated that at Eleme and Okrika communities of Rivers State, a large amount of vegetation were stripped due to route clearing. Tolulope (2004) supports the NGO member when he stated that, in the Niger Delta region, oil spillage has equally affected the growth of vegetation; consequently, the growth of economic crops like kola nuts has been drastically reduced within the vicinity of the spill due to the amount of oil that retards vegetative growth. Apart from information collected on air pollution and damage to vegetation of the Niger Delta region of Nigeria, data was also collected on the coastal and ecological disturbance which is reported below.

**Coastal Pollution and Ecological Disturbance**

In the context of this paper, the term coastal pollution is used as defined by the United Nations Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP):

> "Introduction by man of substances into the marine environment resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction of amenities" (GESAMP, 1969:60).

In 1993, a study by the Organisation for Economic Cooperation and Development (OECD) showed that waste disposal and pollution control is one of the critical competing demands for coastal and marine resources. Nakashima (1997) makes it clear that oil and gas activities pose some significant threats to the long-term sustainability of coastal ecosystems through their hydrocarbons operations and the corresponding marine transportation of their products worldwide.

The biodiversity of communities living in the region are affected in various ways. According to the empirical materials obtained in the course of this paper, the gas pipelines construction at Ughelli community in Delta State of Nigeria affected the plant and animal populations. Some of the animals were said to have migrated to other parts of the Niger Delta region. In like manner, the oil spills that occurred in Peremabiri community of Bayelsa in the year 2000 was said by interviewees to have affected both soil and water, resulting in the death of, especially, fishes and other aquatic creatures, as well as some terrestrial animals particularly those that feed on fish and lower plants.

Aigbedion and Iyayi (2007) further lament the effects of oil spillage on Niger Delta communities when they note that whenever oil spill occurs, the soil gets soaked in oil, and water will be filmed with oil, consequently, the ecosystem suffers not only disequilibria but also pronounced degradation with dire consequences on the food chain.

**Degradation of Natural Landscape**

Patin (1999) maintains that the coastal zone is where the main living resources of the ocean reproduce and at the same time, it serves as home to most of the known oil and gas fields. Talking of the assimilation capacity of the ecosystem, Beatley et al. (2002) argue that, over time, the recuperative abilities of the natural environment in this zone
will not be able to withstand the pressures from the oil and gas sectors without a significant alteration or degradation. The degradation of natural landscape was clearly observed with the Eleme vegetation where oil pipeline construction has resulted in the destruction of scenic landscape and has left widespread erosion and some alluvial heaps behind. A resident at Eleme noted this during an informal discussion.

When asked about the efforts of the company to help reduce the degradation of the natural landscape, responses from the oil company staff suggest that there are huge challenges in working in the Niger Delta region. These challenges they expressed in the areas of their relationship with the host communities; securities of their lives and properties; and their relationship with the Nigerian government in terms of policies and procedures guiding their operations. On the other hand, the oil companies blamed the communities for making them undertake multiple negotiations before they could be allowed to work. They argued that the issues concerning oil and gas pipelines is a matter in which the generality of the populace should be involved, since they have observed that most of the time, the communities are not well represented by their representative, particularly on the issue of compensation.

They further expressed some bitterness about the fact that the Niger Delta youths come from the surrounding towns to the companies to stage rioting. They also blamed the government which has not performed well in providing infrastructure and has not approved a certain sum for infrastructure provision. This they said has forced them to use the money from their vote to settle with the communities, often as the needs arise.

STUDY AREA AND METHODOLOGY

The above map shows the six geo-political zones with the oil rich Niger Delta region occupying the South-South Zone. This study was conducted in the Niger Delta region of Nigeria. The region serves as the epicentre of Nigeria’s oil industry activities which involve most of its crude oil exploration and marketing for the past 50 years.

Sources of Data, Method of Data Collection and Data Analysis

The data collection for this paper took place in three case study areas, and included a total of 6 group discussions, 30 in-depth interviews and 2 workshops. The method of data collection determines the reliability and validity of the result. The major approaches adopted for data collection in this study are group discussion and in-depth
Ogwu and Sahabo

interviews with key informants. In addition, field observation and textual analysis were used to supplement the data.

**Group Discussions**

For this paper, the groups were all made up of 6 persons and above. Four group discussions were conducted at the beginning of the fieldwork to provide useful background information on the main impacts of the oil and gas pipelines, and to identify the main oil pipeline stakeholders and their roles regarding the impacts. This also helped to identify the policy actors to be enlisted for in-depth interview.

**In-Depth Interviews**

To balance the information on the issues of oil and gas pipelines under investigation and in addition to the group discussions, 30 in-depth interviews were conducted. For these interviews, five respondents were drawn from each of the following organisations: academia, local residents, government departments concerned with petroleum resources, non-governmental organisations (religious and environmental activist groups), oil companies, and physical planning departments.

**Field Observation and Feedback Workshop**

Two feedback workshops were organised towards the end of the fieldwork. The workshop made it possible to communicate preliminary results to the community in a way that would motivate them to act on and use the information, especially in local decision making. The question and answer time helped in gaining further information, for example, information on pipeline leakages and the compensation paid to the community.

**RESULTS/DISCUSSIONS**

A notable environmental effect of oil and gas pipeline activities is that of oil spills. No oil and gas pipeline activity is 100% efficient; even in the most technologically advanced countries; pipeline failure may result in oil spills. According to Ukwe et al. (2006), apart from marine pollution and marine debris, oil spillage caused by human activities poses a great danger to the marine environment of the Niger Delta. As such, it is a matter that requires an urgent attention. Whilst the oil companies did blame the local communities for most of the oil spill incidents in the Niger Delta region, the communities on the other hand have equally attributed oil spill as a major problem caused by the oil companies. When asked, during a group discussion, what might be the likely cause of an oil spill, a resident blamed the oil company before anything else. The result of the responses from the 30 respondents to the in-depth interviews is displayed in Table 1 below. Here, the respondents were asked to state the single most important cause of oil spillage in the Niger Delta region.

<table>
<thead>
<tr>
<th>Sources</th>
<th>No of respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil well leakage</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Pipeline related sources</td>
<td>20</td>
<td>67</td>
</tr>
<tr>
<td>Reservoir/tankers related sources</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Facility failures/ageing (Mechanical and engineering errors associated with other oil installations apart from pipelines)</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 1: In-depth Interview Responses
From table 1 and figure 4 above, the impact of oil and gas pipelines is something of concern to the communities. When asked to rank the causes of oil pollution in their local communities, 67% of the respondents blamed the pipelines for most of the oil pollution incidence that have affected their sources of water, land, vegetation, health and socio-economic activities negatively; whilst only 3% of the respondents attributed the oil pollution to reservoir/tankers related sources. Besides oil pollution, it was also gathered from discussions and interviews with the local people that the construction on pipelines in their communities has caused some damages to their cultural artefacts and sites of cultural values, for instance the Igbesu shrine at Tombia was affected in the course of constructing the Tombia-Yenagoa gas pipeline network. Also, at Okirika where the oil pipelines were left on the surface, there were complaints from the respondents that the elderly men and women found it difficult to cross those pipelines to and from the market, farm and rivers. The surface pipelines were claimed by the respondents as causing accidents (broken legs and arms) to children who see the pipelines as play grounds. However, discussions with the oil company staff showed how the staff frowned at some of these claims by the local people. The staff contended that they have often done their best to minimize the impact of pipelines on the local communities and blamed the communities for sabotage on oil facilities.

Figure 4: A chart showing causes of oil pollution as expressed by respondents

CONCLUSION AND THE WAY FORWARD

Using environmental and socio-economic data, and relating this to the literature, this paper has been able to identify, in line with the concept of environmental justice, some of the negative impacts of oil and gas pipelines activities in the Niger Delta Region of Nigeria. While some of the impacts can be categorised as short term, the majority fall into the long term category and have major impacts on the host communities and the
environment. The paper notes that at all stages of the petroleum pipeline networking; the negative externalities far outweigh the positive impacts of the pipelines on the environment and the communities. Thus, there is a call for urgent and necessary intervention by all stakeholders to harmonise their policies in order to achieve a concerted goal of protecting and sustaining the coastal settlements and the environment of the Niger Delta region of Nigeria.

Based on the findings of this study, the Niger Delta communities are faced with serious environmental degradation as a result of oil pollution caused by leakages or explosion of oil and gas pipelines. This does not solely affect the natural environment but has significantly impacted on the lives of the inhabitants of these communities.

The findings also revealed that there is great awareness regarding oil spillage occurrences and their impacts among the people in the communities studied. This could be due to the incessant occurrence of such cases, not only within these communities but also across the entire region. As such, it can be inferred that oil spill is a common phenomenon in the Niger Delta region. Although the causes of the spills have been attributed to a range of factors including facility failure, pipeline rupture and vandalism, bunkering, sabotage, and militancy, the communities ascribed most of the blame to the oil companies, because of their negligence in preventing most incidences and their failure to provide appropriate oil and gas pipeline maintenance measures, that would curtail the menace of oil pollution through pipelines in the region. This indicates the need to devise a means for ensuring the protection of the environment and people who are mostly affected at the local level by pipelines activities. This advocates for an environmental management programme that would involve all the stakeholders in the context of environmental justice for the region.

As a way forward, the paper recommends full involvement of physical planners and the local people in all stages of and decisions on pipelines networking in the region. It further calls for due recognition of the local people in the region by the government and the oil multinationals. The paper recommends a wholistic framework of environmental management for the region.

REFERENCES


EVALUATION OF THE PERFORMANCE OF BROKEN WASTE TILES AS AGGREGATE IN LIGHTWEIGHT CONCRETE


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3National Agency for Science and Engineering Infrastructure, P.M.B. 391, Idu, Abuja, Nigeria
4Department of Science Laboratory Tech., College of Arts and Tech., Elebele, Bayelsa State, Nigeria

The possibility of using broken waste tiles as Lightweight Concrete (LWC) aggregate material was investigated. Mix ratio of 1:2:4 were adopted and varying water to cement (w/c) ratio of 0.5 to 0.7 were selected depending on workability demands. A total of 198 cubes were cast, 18 cubes for each of 0 (control), 20, 30, 40, 50, 60, 70, 80, 90 and 100% waste ceramic tiles partially replacing coarse aggregates and three cube for each of 1, 3, 7, 14, 21 and 28 curing days periods. The results showed that 50% broken tiles partially replacing coarse aggregate gave the most adequate results and is generally optimal and satisfactory for compressive strength, density and water absorption of LWC.

Keywords: broken tiles, aggregates, lightweight concrete, compressive strength, density, water absorption.

INTRODUCTION

Construction industries have identified many natural and manufactured light weight aggregates (LWA) that can replace the conventional aggregates and found out that concrete made partially from recycled aggregate could be readily used in construction of low rise building, concrete paving blocks, retaining walls, approach lanes and sewerage structures (Sharma and Singh, 2009). LWC has superior performance in its reduced weight and rigidity properties and lower thermal and acoustic qualities than Normal Weight Concrete (NWC) (Sivakumar and Gomathi, 2012; Falade et al, 2010; and Bingol and Gul, 2004). Ata et al (2006) compared the mechanical properties of palm kernel shell to coconut shell concrete and reported the economy of using palm kernel shell as light weight aggregate.

BS EN 206-1:2000 defined LWC as concrete having an oven dried density of not less than 800kg/m$^3$ and not more than 2000kg/m$^3$ compared to NWC whose density ranges between 2300 to 2450 kg/m$^3$ thus, accounting for 15% of dead load or self weight reduction. For structural applications, a minimum compressive strength of 17.0MPa is recommended by (CIP, 2003) for LWC to meet ultimate and serviceability limit states criteria.

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(Hubertova and Hela, 2011) assessed the performance of expanded clay in LWC and recorded low volume weight and high strength combined with good workability, low noise emission and ease of casting. This reduction in dead load of a concrete structure allows the designer to reduce the size of beams, columns, footings and other load bearing elements (Topcu, 1997) and size reduction of structural elements translates into less reinforcement steel and reduced volume of concrete, resulting in reduced overall cost of construction (CIP, 2003 and Teo et al, 2006). Researchers have used materials like Scoria, a dark and glassy igneous rock of volcanic origin that contains many bubblelike cavities (Hossain, 2006); glass waste (Ducman, et al, 2002); sludge ash (Tay and Yip, 1989); oil palm shell (Teo, et al, 2006); Periwinkle Shells (Falade, et al, 2010) and pumice (Gunduz, 2008) as LWC aggregates with proven good engineering properties. Many materials have been proven to have good compressive strength when partially used in LWC; however, water absorption is very critical to its durability and causes a general reduction of fatigue life of concrete under tension. Kunhanandan Nambiar and Ramamurthy (2006) observed that not all pores in LWC are inter-connected, but water absorption depended on the capillary pores present in it. Tiles, being a clayey material, the work of (Pioro and Pioro, 2004) on the use of expanded clay in LWC provided the background for the research into this adaptation of broken waste tiles as LWC aggregate material.

MATERIALS AND METHODS

The work investigated the possibility of using broken waste tiles as coarse aggregate material in LWC. Tests were conducted on both fresh and hardened concrete to determine the properties. The various tests and standard codes used are as explained. Commercially available Type I Ordinary Portland cement (Dangote brand) conforming to British Standards BS12 (1996) was used. British Standard 812 (1975) was used to check the suitability of the mineral aggregates and graded using ASTM C136 (2001). The specific gravities of materials were determined by ASTM 854 (1992). Good quality water which conformed to BS3148 (1980) requirements was used to prepare various standard 1:2:4 mix ratios for 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100% tiles replacing gravel coarse aggregate whose workability are adequate according to BS 1881 (1983) criteria. Following specification of BS 8110 (1997), a total of one hundred and ninety eight (198) specimens, each measuring 150mm x 150mm x 150mm were cast. After hardening for 24hours, the cubes were demoulded and cured for 1, 3, 7, 14, 21 and 28days. They were removed and dried. The compressive strength of the specimens was determined in accordance to BS 1881 (1983). Concrete densities were determined using BS EN 206-1:2000 and its water absorption was assessed by ASTM C642:2006.

RESULT AND DISCUSSION

Compressive Strength Test of Concrete

The test was carried out using 150×150×150mm moulds according to BS 1881 (1983). The prepared concrete mix compacted into the mould in three layers. Each layer is subjected to 25 blows from a tamping rod weighing 1 kg. The cubes were removed from the moulds 24 hours after casting and cured in curing tank filled with water for the required number of test days (1, 3, 7, 14, 21 and 28 days); and surface-dried, weighed and tested. The result of compressive strength development as the cubes were cured and crushed is in Table 1.
From the plot of the result in Figure 1, the compressive strength increases as the curing days increased due to release of strength from hydration of cement binder. But there is decrease of compressive strength as the proportion tiles increases. The values of compressive strength is highest at 0% broken tile (control) which is a NWC, but the compressive strength decreased gradually more and more coarse aggregates are replaced with tiles up to 100% replacement. This decrease of compressive strength is due to decreasing density and increasing porosity of concrete as more tiles were added. At 28 days curing period, 0% to 50% broken tiles replacement meets the requirement minimum of 15N/mm² compressive strength specified by British Standard BS8110 Part 1 (1997) for reinforced concrete with lightweight aggregate. Beyond 50% to 100% tiles replacement is good for plain or mass concrete in non-intricate structural sections.

Table 1: Cube Compressive strength with Curing Age

<table>
<thead>
<tr>
<th>Broken Tiles Present (%)</th>
<th>Curing days and Compressive Strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-day</td>
</tr>
<tr>
<td>0</td>
<td>14.26</td>
</tr>
<tr>
<td>10</td>
<td>13.72</td>
</tr>
<tr>
<td>20</td>
<td>11.92</td>
</tr>
<tr>
<td>30</td>
<td>10.32</td>
</tr>
<tr>
<td>40</td>
<td>8.21</td>
</tr>
<tr>
<td>50</td>
<td>6.33</td>
</tr>
<tr>
<td>60</td>
<td>5.96</td>
</tr>
<tr>
<td>70</td>
<td>5.05</td>
</tr>
<tr>
<td>80</td>
<td>4.86</td>
</tr>
<tr>
<td>90</td>
<td>4.28</td>
</tr>
<tr>
<td>100</td>
<td>4.04</td>
</tr>
</tbody>
</table>

Figure 1: Compressive Strength against Curing Period

Concrete Density
Weight is a key factor affecting density and ultimately determines the weight class of concrete. LWC has very important applications in areas prone to earth tremor and in
high rising building where a critical factor. The density of concrete was found to be reducing with increasing tiles in the mix. Tiles, being a lighter material, have lower unit weight and increasing tiles proportion reduces the unit weight of concrete cubes. Table 2 shows the dry density of concrete cubes and their corresponding drop in density when compared to NWC. 50 to 100% tiles contents meet the requirements of 15% dead load reduction for LWC compared to NWC as recommended by BS EN 206-1:2000, but 20% and less tiles contents meet the general requirements of 2300 to 2450 kg/m$^3$ density of NWC.

Table 2: Density of Concrete Cubes and Density Reduction

<table>
<thead>
<tr>
<th>Proportion of Tiles (%)</th>
<th>Density (Kg/m$^3$)</th>
<th>Density Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2423.5</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>2359.3</td>
<td>2.6</td>
</tr>
<tr>
<td>20</td>
<td>2275.8</td>
<td>6.1</td>
</tr>
<tr>
<td>30</td>
<td>2203.9</td>
<td>9.1</td>
</tr>
<tr>
<td>40</td>
<td>2124.0</td>
<td>12.4</td>
</tr>
<tr>
<td>50</td>
<td>1998.6</td>
<td>17.5</td>
</tr>
<tr>
<td>60</td>
<td>1987.5</td>
<td>18.0</td>
</tr>
<tr>
<td>70</td>
<td>1905.4</td>
<td>21.4</td>
</tr>
<tr>
<td>80</td>
<td>1859.8</td>
<td>23.3</td>
</tr>
<tr>
<td>90</td>
<td>1749.7</td>
<td>27.8</td>
</tr>
<tr>
<td>100</td>
<td>1673.4</td>
<td>31.0</td>
</tr>
</tbody>
</table>

**Water Absorption Rate of Samples**

One of the most important properties of a good quality concrete is low permeability, especially one resistant to freezing and thawing. A concrete with low permeability resists ingress of water and is not as susceptible to freezing and thawing. Water enters pores in the cement paste and even in the aggregate and not more than 5% absorption is allowed for concrete to stand the test of durability (ASTM C642:2006). Tiles, being a porous material of clay origin allow passage of water through the cells. Table 3 presents the result of water absorption on concrete cubes. Concrete cubes having 0 to 50% tiles content meets the requirements of not more than 5% water absorption specified by (ASTM C642:2006).

Table 3: Rate of Water Absorption of Various Specimens

<table>
<thead>
<tr>
<th>Proportion of Tiles (%)</th>
<th>Weight of Cube After Immersion in Water (kg)</th>
<th>Weight of Cube After Oven-dried (kg)</th>
<th>Water absorption (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8.3</td>
<td>8.1</td>
<td>2.5</td>
</tr>
<tr>
<td>10</td>
<td>8.1</td>
<td>7.9</td>
<td>2.5</td>
</tr>
<tr>
<td>20</td>
<td>8.0</td>
<td>7.7</td>
<td>3.9</td>
</tr>
<tr>
<td>30</td>
<td>7.9</td>
<td>7.6</td>
<td>3.9</td>
</tr>
<tr>
<td>40</td>
<td>7.7</td>
<td>7.4</td>
<td>4.1</td>
</tr>
<tr>
<td>50</td>
<td>7.6</td>
<td>7.3</td>
<td>4.1</td>
</tr>
<tr>
<td>60</td>
<td>7.4</td>
<td>7.0</td>
<td>5.7</td>
</tr>
<tr>
<td>70</td>
<td>7.3</td>
<td>6.9</td>
<td>5.8</td>
</tr>
<tr>
<td>80</td>
<td>7.2</td>
<td>6.8</td>
<td>5.9</td>
</tr>
<tr>
<td>90</td>
<td>7.0</td>
<td>6.5</td>
<td>7.7</td>
</tr>
<tr>
<td>100</td>
<td>6.8</td>
<td>6.3</td>
<td>7.9</td>
</tr>
</tbody>
</table>
CONCLUSION

Based on the compressive strength, concrete density and water absorption tests conducted, the following conclusions were made:

According to grade requirements of BS8110:1997, 50% broken tiles replacement is adequate for reinforced concrete with lightweight aggregates and beyond 50% replacement could be used for plane mass concrete in non-intricate structural section with moderately mild exposure condition.

For concrete density test values, 50 to 100% tiles contents meet the range of 800 to 2000 kg/m$^3$ and 15% dead load reduction specified by (BS EN 206-1:2000) for LWC and only 0 to 10% tiles contents meet the requirements for NWC.

And for concrete susceptibility to water absorption, tiles content of 0 to 50% meet the requirement of not more than 5% water absorption specified by ASTM C642:2006.

Finally, from all the aforementioned tests comparisons to codes recommendations, 50% tiles content is considered most adequate and optimal for compressive strength, density and water absorption for LWC using broken tile as coarse aggregates.

RECOMMENDATION

Although, 50% broken tiles replacement satisfied the compressive strength, density or weight and water absorption requirements of LWC, it is further recommended to investigate fire recovery of broken tiles partially replaced LWC.

REFERENCES


Appendix 1: Extract of the Recommended Grade of Concrete (BS8110, 1997).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Characteristics strength (N/mm²)</th>
<th>Concrete Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>7.0</td>
<td>Plain concrete</td>
</tr>
<tr>
<td>10</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Reinforced concrete with lightweight aggregate</td>
</tr>
<tr>
<td>20</td>
<td>20.0</td>
<td>Reinforced concrete with dense aggregate</td>
</tr>
<tr>
<td>25</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30.0</td>
<td>Concrete with post tensioned tendons</td>
</tr>
<tr>
<td>40</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>50.0</td>
<td>Concrete with pre-tensioned tendons</td>
</tr>
<tr>
<td>60</td>
<td>60.0</td>
<td></td>
</tr>
</tbody>
</table>
EXPERT SYSTEM AND ECONOMETRIC ENTROPY-BASED MODEL FOR RESIDENTIAL BUILDING PROJECT COST ADJUDICATION

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The main aim of the study is to develop an expert system and econometric entropy-based model for residential building project cost judgment and decisions in residential building project. The study used random sampling technique to select projects completed between 2009 and 2011, the project were examined for their cost centres. As-built cost of four hundred (400) of the projects were further selected and modified with econometric factors like inflation index, cost entropy and entropy factor and were used to form and train neural network used. Probability technique was used to generate risk impact matrix and influence of entropy on the cost centres. A parametric model similar to hedonic models was generated using the utility parameters within the early and late dichotomy. The model was validated through comparative analysis of the econometric loading attributes using Monte Carlo technique of SPSS software extracting the contingency coefficient. This attributes would enable a builder or contractor load cost implication of an unseen circumstance even on occasion of deferred cost reimbursement.

Keywords: neural network, econometric, model, escalator, risk, dichotomy, adjudication, entropy.

INTRODUCTION

Decision taking about cost and cost monitoring on building project are an essential part of projects’ life cycle. It enables early detection of problem area that may hinder timely project completion. However, error of judgment on cost issues at planning state can jeopardize the expectation of clients in obtaining value on money invested (Mosaku and Kuroshi 2008). The consciousness of this fact has made client to always be down-to-earth when it comes to issue of project cost and a great deal of effort had gone into researchers evolving a system that would provide good cost estimation and adjudication system, which would harmonize needs of project participants. It has been discovered that good cost adjudication or judgment in cost allocation would ensure effective spreading of fund across all the project elements, this in turn would ensure
consistent fund availability even on occasion of delay in fund disbursements by the client (Amusan et al; 2012). However, error of judgment often arises out of use of inadequate tool in generating cost detail. Therefore a system that accommodates unforeseen intervening variables that often accounts for cost variation that could facilitate meaningful cost pattern deduction in project cost monitoring and project cost progress evaluation is highly essential (Amusan et al; 2012). It is to this end that this study developed an econometric cost judgment and decision system for office building works using expert system approach and cost entropy patterned in hedonic form. This model will make it possible for a project cost variants to be incorporated into project cost in order to buffer the effect of possible delayed payment on a project. The model developed in this context is similar to hedonic models and canonic models which uses parametric estimation method in solving problems. Hedonic models are often used, when testing parameter is heterogeneous in nature; it facilitates according individuality to constituent parameter of test variables by highlighting their utility function. Constituent parameters are often treated with respect to their contributions to the test variables; likewise environmental parameters that have potential to influence final computation of test variable are often studied within the context of their peculiarity and often factored into test variable for holistic computation. The purpose of this paper therefore is to apply the strength of parametric model to generate a model that could accommodate heterogeneous parameters such as obtainable in an econometric situation, and accord individuality to constituent parameters to generate a conventional model for cost adjudication (judgment) in building construction.

Therefore, in this study, the following interesting aspects were introduced: theory of hedonic model that formed the background of parametric estimation, bid-balancing models, application of expert system, entropy application in measuring project cost dynamic, project risk matrix and factoring of intervening variables that influences cost into the project cost main stream. The idea behind the study is to use expert system (neural network) and econometric-entropy to develop a parametric model that could be used in project cost decisions and adjudication (i.e cost issue settlement).

**REVIEW OF RELATED LITERATURES**

The uniqueness of a typical building project lies in the ergonomic interrelationship among project cost centres. Cost centre refer to project elements commonly found, in an ordered form on a typical project’s bill of quantity and bill of estimate. The cost often represents an optimal cost implication of individual elements derived through weighing different cost alternatives through a process referred to as cost adjudication or cost judgment.

Furthermore, a cost decision can be the type that favours upward or backward factoring of cost implication on project cost centres, such as those taken at bid stage of building projects, whereby the cost implications is loaded on elements scheduled to be executed towards the end of the project and at the end of project respectively. Also, since the beginning of the century, paradigm has shifted as a matter of necessity in the direction research into the art of using classical approach to curtail the negative effect of cost and payment delay on project through use of models. Review of past efforts on models developed to take decision on cost issues in construction work is presented in this section.

Some of the models include bid-balancing models, hedonic models, regression model among others. Bid balancing according to Cattel, Bowen and Kaka (2007) and Christodoulou (2008) description, is the process by which intelligent approach is used
in evenly distribution of overall project actual cost and profits among project activities without jeopardizing the total bid price for the work. For instance, Cattel, Bowen and Kaka (2008) carried out a study on application of bi-unbalancing method for lowering contractors’ financial risk and came up with a model. Bill of quantity of completed building projects was used in the study; cost centres of the projects on bill of quantity were classified into two groups and used for the analysis. The study generated three approaches to bid-balancing model generation for risk identification. The methods include: Front-end loading, Individual rate and Back-end loading method.

In a related study, Picard, Antoniou and Adré de Palma (2010) carried a study on econometric model and came up with canonic and hedonic price model. The study used regression model to generate hedonic regression model, hedonic model was used in estimating demand and value of a specific good by decomposing it into its constituent characteristics. The estimate of contributory value of the constituents was aided by hedonic regression price model.

Hedonic models are usually estimated using regression analysis, however, more generalized models, such as sales adjustment grids, are special cases of hedonic models. The strength of hedonic model lies in capacity to accommodate non-linearity, variable interaction and other complex situations. Some of application areas of hedonic model include real estate application, real estate appraisals, computation of consumer price index (CPI) and relative price index (RPI) among others. In real estate economics, hedonic model is applicable in solving problem of price determination and price adjudication (Amusan et al., 2012). The model has capacity to accommodate heterogeneous variables such as those obtainable on building projects. Building project for instance involved several heterogeneous variables which tend to possess linear and non-linear relationships; hedonic model can combine such heterogeneous variables for meaningful deductions. Hedonic model according to the study can treat the variables separately and estimate cost and prices (in case of an additive model) or elasticity in case of a log model. To this end, the econometric model developed in this study toe the line of submissions of Picard et al; (2010), the hedonic related model adopted cost entropy and econometric approach to generate a model that incorporates heterogeneous variable of residential project for price and cost judgement.

Similarly, Cattel, Bowen and Kaka (2008) developed a hedonic related econometric model which was used in unbalanced bidding. The study presents different schools of thought in the study of unbalanced-bidding in line with submissions of Stark (1972). Cattel, Bowen and Kaka (2008) described available methods as Back-end loading, Front-end loading and Individual rate loading systems. According to the study, Front-end loading method, is used to mark up of items scheduled to come up early at beginning of the project as high as possible in order to provide avenue for builders to generate as much profit as could help in further project financing. The method is described by the following mathematical model.

\[ pvj = \sum_{n=0}^{N} \left( \frac{1}{1+r} \right)^n [\alpha_{nj} + (\beta_j - \gamma_j)] \] (Cattel et al., 2008).

Back-end loading system involves marking up prices of project items that is billed to be executed later on the project (Cattel et al., 2008). It was described as method that over overcompensates a project builder or contractor for inflationary increases. Consequent upon inflationary buffer already built into the project cost package as contained in the projects’ documents. This is described by:
Amusan et al.

\[ pv_j = \sum_{n=0}^{N} \left( \frac{1}{1+r} \right)^n \ln \left( \frac{Q_j}{C_j} \right) \] (Cattel et al., 2008). Finally, the third method is Individual rate loading method. In his method, it is common practice to load profit margin high, by individually loading the project elements with additional cost to cushion negative effect of price fluctuations. It entails loading cost component of project components that has tendency to increase later as the project progresses while marking low the components that could be executed early on the project. This is described by the model below:

\[ pv_j = \sum_{n=0}^{N} \left( \frac{1}{1+r} \right)^n \ln \left( \frac{Q_j}{C_j} \right) \] (Cattel et al., 2008)

Legend: \( pv \) — present value; \( j \) --- item number; \( N \) — duration of project; \( n \) --- number of months; \( r_j \) — monthly discount rate; \( Q_j \) — Bill of quantity of an item; \( P_j \) — bill price per unit of item \( j \), \( C_j \) — unit price per unit of item.

Moreover, Rosen (1974) formulated basis for hedonic models, the study was used for simultaneous estimation of demand and supply and simulate them with market demand, the study assumes that goods are valued for their utility bearing attributes. Rosen’s hedonic model is composed of two parts, the marginal implicit price calculation unit and marginal prices and consumer socio-economic climate segment. Among other things, the model has the following assumptions: homogenous market and price flexibility to forces of demand and supply. However, the approach was opposed by Brown and Rosen (1982), the approach according to the researchers tend to impose homogeneity of characteristics across individual variables thus encounter identification problem. Brown and Rosen (1982) suggested in their submissions, incorporating of economic variants in to the model in order to accord individuality to each constituent variables of parameter being measured.

Similarly, Bajari and Benkard (2004), studied demand estimation with heterogeneous consumers and un-observed product characteristics using hedonic approach. Bajari and Benkard’s model allows for individual variable in the unit being measured to have different utility parameters but with parametric restriction on utility function. This approach provided solution to identification problem encountered by Rosen (1982) by allowing individual variables an opportunity to have different utility parameters which further consolidate the findings.

In another related study, Bajari and Kahn (2005) used hedonic approach in estimating housing demand, which is linked with racial segregation in big American cities. The study presents a three-stage nonparametric estimation procedure to recover willingness to pay for housing attributes. Local polynomial function was used in formulating stage I, stage II by first order conditions for utility maximization while, stage III estimates the distribution of household taste as a function of household demographics. The empirical model developed by the model is innovative in the sense that it added the dimension of heterogeneity to the price adjudication system.

In the context of model proposed in this study, however, theory underlined approaches presented in the reviewed submissions of Rosen (1974); Brown and Rose (1982); Bajari and Benkard (2004); and Cattel, Bowen and Kaka (2008) were adopted in generating a price adjudication model presented in this study. The model accords individuality to the constituent parameters that makes up a project. The cost centres were treated without restrictions on their utility function thereby accord them different and distinct utility parameters. This approach enables easy evaluation of the model’s
economic parameters and loading of economic variants like cost entropy margin, inflation index and exigency factor (similar to Haylet factor like those used on South African projects as discovered in Cattel et al; 2008).

RESEARCH METHOD STATEMENT

Literature search was carried out to position this study in the light of previous researches conducted in the econometric approach in model generation. Econometric approach was used to generate model in this context, it follows the order of Hedonic models presented by Rosen (1974); Bajari and Kahn (2005); Bajari and Benkard (2010); and Picard, Antoniou and Andre de Palma (2010). The model adopts hedonic style with parametric equations that incorporate and accord individuality to the project cost variables and test parameters. The As-built costs of the projects were stabilized with inflation buffer, exigency factor and risk index, and were loaded to neural network for further stabilization. Influence of elemental cost on project cost and project cost entropy was determined as well as the risk impact matrix for the selected projects. Also, the modified As-built cost of the sampled building projects was modified and processed to obtain an optimal cost, the optimal cost was used to generate the model in this study. The generated parameters (risk matrix, cost entropy, exigency factor, neural network stabilized optimum cost) were factored into the expert-system and econometric model generated, the model is similar in attribute to back-end loading hedonic model of Cattel et al; (2008).

RESEARCH METHODOLOGY

Residential building projects were randomly selected for analysis. Thirty-five residential building projects were analyzed in the following order; 2/3 –Bedroom unit (11 samples), 4-Bedroom Duplex (12 samples) and 2&3-Bedroom bungalow (12 samples). The bill of quantities’ contents was validated through content analysis, content analysis method was used to extract component cost and validate inter-cost centre relationship. Analysis was carried out on the sampled projects, the following activities were carried out: factoring of cost centre influence on total project cost; determination of monetary-entropy; risk impact matrix formulation based on entropy level; project monetary dynamics; comparative analysis of different bid-loading system and synthesization of neural network-econometric parameters-based tender adjudication system using back-end loading as base reference. Suitability of the developed neural network-econometric model was validated within the context of late constructible element cost loading and individual cost loading with the aid of contingency coefficient, Kendal Tau values and Monte-Carlo comparison techniques. Also, entropy state of the project elements was generated using probability estimation method.

Data Training Using Artificial Neural Network:

a. The Training Stage: The training data set (300 samples) of residential building projects of 400 projects having being modified with inflation index and exigency factor, was used to train the multilayered perceptron neural network selected, so as to select its parameters, the one suitable to problem at hand. Back propagation was used to train the network since it is recommended and simple to code. So also gradient descent momentum and learning rate parameters was set at the start of the training cycle (for speed determination and network stability, range of momentum 0.1 ≤ x ≤ 1, high = weight oscillation coefficient). Back propagation algorithm involves the gradual reduction of the error between model output and the target output. It develops
the input to output, by minimizing a mean square error (MSE) cost function measured over a set of training examples. The M.S.E. is given by this relation:

$$M.S.E = \left( \sqrt{\sum_{i=1}^{n} (x_i - E(i))^2} \right)/n$$

Where \( n \) is the number of projects to be evaluated in the training phase, \([X_{sub.i}]\) is the model output related to the sample, and \( E \) is the target output. The mean square error is an index of successfulness of a training exercise. The error was measured for each run of the epoch number selected; however training was stopped when the mean square error remains unchanged for a given number of epochs. This is to avoid overtraining, and technical dogmatism when presented with an unseen example (data).

b. The testing phase: Data from remain 100 samples of 400 samples were used as testing data set to produce output for unseen sets of data. A spreadsheet simulation program on Microsoft excel was used to test the generated model, according to optimized weights, comparison was made between actual cost and neural network cost, using cost percentage error (CPE) and mean estimated error (MEE).

$$CPE = \left[ \frac{|E_{nn} - Bv|}{Bv} \right] \times 100\%$$

$$MEE = \left[ \frac{1}{n} \sum_{i=1}^{n} cpe(i) \right]$$

DATA ANALYSIS and Presentation

The presentation in this section follows the following order: factoring elemental cost centres percentage influence on project cost, entropy and risk threshold perspective on project cost( cost and risk impact prediction matrix), determination of project monetary entropy within the context of late and early constructible elements’ monetary entropy for sampled residential buildings, structural component of neural network econometric modified back-end loading model, validating neural network econometric entropy-based model using comparative analysis of the econometric loading attributes and cost limit.

FACTORING ELEMENTAL Cost Centres Influence on Project Cost

Entropy is considered a measurable concept; it is the function of inverse of probability of variable in consideration (Choi and Russell 2010). This is linked to influence of cost centres on final cumulative as-built cost of a project. Quantitative analysis of cost influence on total as-built cost of selected residential accommodation was carried out and presented in Table 1.1 with a view to determining entropy state of the project cost centres.

In this section, influence of cost centre on project cost was quantified; by dividing each cost centre weight by cumulative cost of the cost centres of a particular project, this was carried out through quantitative analysis of cost component of sampled residential building projects bill of quantities. The elemental cost component used for this purpose is presented in the Table 1.1, while the approach used here is in line with presentations in Choi and Russell (2005) and Christodolou (2008).

Influence of the elements’ cost on total project cost was factored on rating scale one (1) to ten (10) using individual cost composition as base reference point. Cost of substructure for 4-Bedroom Duplex, 2/3 -Bedroom bungalow, Frame and walls were rated high on scale 10” high relative to base cost, for all building types. Finishing is ranked high on scale 10” , for 4-Bedroom Duplex, 1-Bedroom apartment, 3/4 – Bedoom on 3 Floors-24 Units and 2/3-Bedroom Bungalow. This indicates that the
The influence of this is high on the project final cost. The implication of this is that a great deal of resource is at stake on this particular element, careful management of this cost centre can determine to a very large extent the overall success of the project work. Value added Tax, Contingencies, Preliminaries, Soil drainage; Fittings were rated low on scale 4 down to 1. However, this does not mean they are the least in term of importance, they as well has contributory effect on the total project cost. Ideally, one would have been tempted to select those cost centres with high rating and high risk index as the core parameters and prorate the remaining elements; danger in this option lies in imbalance cost composition that could arise as the consequence. Therefore in bid adjudication cost of elemental components with high influence factor should be considered first and ensure adequacy since they attract higher risk. Contingency can be built around them to cushion effect of eventuality.

Table 1.1: Factoring Elemental Cost Centres Influence on Project Cost

<table>
<thead>
<tr>
<th>S/N</th>
<th>Elements</th>
<th>Cost Rating</th>
<th>On Scale (1) To Ten (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4- Bedroom</td>
<td>2/3- Bedroom</td>
</tr>
<tr>
<td>C.</td>
<td></td>
<td>Duplex</td>
<td>Bungalow</td>
</tr>
<tr>
<td>ELT1</td>
<td>Substructure</td>
<td>$10^{+4}$</td>
<td>$10^{+12}$</td>
</tr>
<tr>
<td>ELT2</td>
<td>Frame &amp; Walls</td>
<td>$10^{+9}$</td>
<td>$10^{+3}$</td>
</tr>
<tr>
<td>ELT3</td>
<td>Stair Cases</td>
<td>2</td>
<td>---</td>
</tr>
<tr>
<td>ELT4</td>
<td>Upper Floor</td>
<td>9</td>
<td>---</td>
</tr>
<tr>
<td>ELT5</td>
<td>Roofs</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>ELT6</td>
<td>Windows</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>ELT7</td>
<td>Doors</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>ELT8</td>
<td>Finishing</td>
<td>$10^{+4}$</td>
<td>$10^{+12}$</td>
</tr>
<tr>
<td>ELT10</td>
<td>Fittings</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ELT11</td>
<td>Services</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>ELT12</td>
<td>Soil Drainage</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ELT13</td>
<td>Preliminaries</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>ELT14</td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ELT15</td>
<td>Contingencies</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>ELT14</td>
<td>Value Added Tax (5%)</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: 2011 Survey

**Entropy Level and Risk Threshold Perspective on Project Cost**

The risk associated with project cost centre can be quantified in term of degree of uncertainty, (probability of occurrence and magnitude of impact i.e on project objective, quality and time). However, in simpler terms, a criterion value, ranking or status for each risk event (or set of combined events) may be established by dividing the frequency of relevant events by total number of possible events. In this section therefore. According to Amusan et al; (2012), a planner should consider both financial assignment that will minimize project risk and maximize cost and also financial assignment that will maximize profit and prevent project disarray. Therefore at tender stage, elemental components with high risk factor should be considered first since they attract higher risk. Analysis of risk distribution on three different types of projects is presented in Table 1.1 with a view to developing cost and risk impact probability matrix for the project. The risk probability value for cost centres of the
The risk range suggested here are tagged as low, medium, high and extreme cases. High and extreme is tagged as risk range between 0.5 and 0.8; medium 0.3 to 0.5, low is branded as risk between 0 and 0.2 while extreme risk falls between 0.9 and greater than 9.

When quantifying entropy state of project cost elements, in order to determine price movement pattern (entropy state) in a project collection, certain tri-partite variables should be considered keenly. The tri-partite variable refers to money, risk, and time. Entropy state of the tripartite concepts can be quantified as demonstrated in this study. Risk entropy therefore was quantified so as to know the risk activeness of the project cost centres. Cost centres of selected building projects were analyzed for risk implications. Risk is categorized into low medium and high scale as contained in Table 1.2. The risk component is presented on scale 0-20. Risk range 9-20 is regarded as Extreme, 3-5 as Medium, 6-8 as high. The following centres belong to the extreme
Cost adjudication

risk imparted class: 4-Bedroom Duplex, 2&3-Bedroom Bungalow, 1-Bedroom Apartment, 3 /4-Bedroom, 24 Units on 4 Floors. Cost centres with Extreme risk threshold includes: 14 (1.4Substructure), 15 (1.5 Finishing), 19 (1.9Frame), 7 (0.7Services), 9 (0.9Upper Floor), 7 (0.7 Roof), 20 (2.0) Finishing) and 20+ (2.0) Frame.

Entropy in the real sense of it is a measurable concept; this is regarded as a function of inverse of probability of variable in consideration. This is linked to influence of cost centres on final cumulative as-built cost of a project. Quantitative analysis of cost influence on total as-built cost of selected residential accommodation was carried out and presented in Table 1.1 with a view to determining entropy state of the project cost centres. In this section, influence of cost centre on project cost was quantified; this was carried out through quantitative analysis of cost component of sampled projects bill of quantities of some selected residential building projects, which were used in model development. The elemental cost component was used for this purpose and is presented in the Table 1.1. Influence of the elements’ cost on total project cost was factored on rating scale one (1) to ten (10) using percentage cost composition as base reference point. Cost of substructure for 4-Bedroom Duplex, 2/3 -Bedroom bungalow, Frame and walls were rated high on scale 10+ high relative to base cost, for all building types. Finishing is ranked high on scale 10+ 4-Bedroom Duplex, 1-Bedroom apartment, 3/4 –Bedroom on 3 Floors-24 Units and 2/3-Bedroom Bungalow, this indicates that the influence of this is high on the project final cost. The implication of this is that a great deal of resource is at stake on this particular element, careful management of this cost centre can determine to a very large extent the overall success of the project work. Value added Tax, Contingencies, Preliminaries, Soil drainage; Fittings were rated low on scale 4 down to 1.

However, the items rated low are not the least in importance among project elements, they as well has contributory effect on the total project cost. Ideally, one would have been tempted to select those cost centres with high rating and high risk index as the core parameters and prorate the remaining elements; danger in this option lies in imbalance cost composition that could arise as the consequence. Therefore, in some of the models studied so far, bid evaluation model cost of elemental components with high influence factor were considered first since they attracts higher risk. In this sense, contingency could be built around them to cushion effect of eventuality (Amusan et al; 2012).

1.4.3 Evaluating Project Cost monetary Entropy

Cost distribution pattern emerged in the analysis presented in Table 1.2 and 1.3. It follows a pattern of law of inverse proportions. The lower the cost variation the lower the degree of probability variations produced, and consequently the lower the entropy and vice versa. The entropy mentioned here is the index used to quantify the degree of cost restiveness on the project. The movement could be traced to incessant price changes on account of macro and micro economic variables.

The projects used in this work were executed during the economic meltdown period; this is adjudged as one of the factors that could lead to the price movement and disparity in cost-entropy obtained. The dynamic nature of price movement in a project being executed often dictates the pace of entropy magnitude. It is believed the greater the price movement and the higher the entropy that will be generated. Twenty projects were selected for illustration the cost movement pattern as discussed; Tables
1.3 to 1.4 illustrates the cost distribution with corresponding monetary entropy schedule and their implications on projects.

Table 1.3 Summary of Adjusted Projects B.O.Q Value and As-built Cost of 4-Bedroom Duplex Year 2006-2009.

<table>
<thead>
<tr>
<th>Project</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Centers</td>
<td>B.O.Q Value</td>
<td>Initial</td>
<td>As-Built Cost</td>
</tr>
<tr>
<td>Project 1-11</td>
<td>16,043,869</td>
<td>22,676,000</td>
<td>6632131</td>
</tr>
<tr>
<td>Residential</td>
<td>16,500,603</td>
<td>23,565,000</td>
<td>7064397</td>
</tr>
<tr>
<td>Building</td>
<td>16,225,501</td>
<td>24,113,000</td>
<td>7887499</td>
</tr>
<tr>
<td>2009</td>
<td>16,400,521</td>
<td>27,654,000</td>
<td>11253479</td>
</tr>
<tr>
<td>5</td>
<td>17,100,438</td>
<td>22,221,000</td>
<td>5120562</td>
</tr>
<tr>
<td>6</td>
<td>17,300,113</td>
<td>28,450,000</td>
<td>11149887</td>
</tr>
<tr>
<td>7</td>
<td>16,800,073</td>
<td>30,500,000</td>
<td>13699927</td>
</tr>
<tr>
<td>8</td>
<td>17,220,134</td>
<td>26,350,000</td>
<td>9129866</td>
</tr>
<tr>
<td>9</td>
<td>16,210,687</td>
<td>25,800,120</td>
<td>4949064</td>
</tr>
<tr>
<td>10</td>
<td>16,360,084</td>
<td>20,650,000</td>
<td>4289916</td>
</tr>
</tbody>
</table>

Table 1.4 Table Cost Schedule for 2-Bedroom Bungalow

<table>
<thead>
<tr>
<th>Project</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Centers</td>
<td>B.O.Q Value [Tender cost]</td>
<td>Initial</td>
<td>As-Built Cost</td>
</tr>
<tr>
<td>Project 1-20</td>
<td>3,085,100</td>
<td>4,236,000</td>
<td>1,150,900</td>
</tr>
<tr>
<td>Residential</td>
<td>3,171,800</td>
<td>5,800,000</td>
<td>2,628,200</td>
</tr>
<tr>
<td>Building</td>
<td>2,610,000</td>
<td>4,800,000</td>
<td>2,190,000</td>
</tr>
<tr>
<td>2009</td>
<td>3,165,000</td>
<td>4,350,000</td>
<td>1,185,000</td>
</tr>
<tr>
<td>5</td>
<td>2,145,000</td>
<td>4,325,000</td>
<td>2,180,000</td>
</tr>
<tr>
<td>6</td>
<td>3,174,953</td>
<td>4,286,350</td>
<td>1,111,397</td>
</tr>
<tr>
<td>7</td>
<td>2,750,000</td>
<td>5,850,000</td>
<td>3,100,000</td>
</tr>
<tr>
<td>8</td>
<td>2,700,850</td>
<td>5,121,000</td>
<td>2,420,150</td>
</tr>
<tr>
<td>9</td>
<td>3,150,000</td>
<td>6,265,000</td>
<td>3,115,000</td>
</tr>
<tr>
<td>10</td>
<td>2,766,000</td>
<td>5,223,000</td>
<td>2,457,000</td>
</tr>
<tr>
<td>11</td>
<td>2,510,000</td>
<td>6,371,000</td>
<td>3,861,000</td>
</tr>
</tbody>
</table>

Source: 2011 Survey
1.4.4 EARLY AND LATE CONSTRUCTIBLE ELEMENTS MONETARY ENTROPY FOR SAMPLED RESIDENTIAL BUILDINGS

Two (2) and three (3) bedroom bungalow bill of quantity was used in this context, divided into late and early constructible elements. Cumulative effect of cost influence factor and attendant risk often exerts pressure on projects monetary distribution. This concept is described as monetary entropy. Monetary entropy was defined by Cristodolou (2008) as inverse of variable probability. Entropy distribution of thirteen (13) projects of 2 & 3-bedroom bungalow and scheduled in Tables 1.4 and 1.5.

Table 1.5 Projects Particular 2&3-Bedroom Bungalow

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B.</td>
<td>Substructure</td>
<td>2,669,340</td>
<td>11,674,519.50</td>
<td>22.865</td>
<td>0.23</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Frame &amp; Walls</td>
<td>1,519,415</td>
<td>11,674,519.50</td>
<td>13.015</td>
<td>0.08</td>
<td>2.49</td>
</tr>
<tr>
<td></td>
<td>Roofs</td>
<td>1,197,000</td>
<td>11,674,519.50</td>
<td>10.253</td>
<td>0.10</td>
<td>2.47</td>
</tr>
<tr>
<td></td>
<td>Windows</td>
<td>517,650</td>
<td>11,674,519.50</td>
<td>4.434</td>
<td>0.23</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Doors</td>
<td>544,500</td>
<td>11,674,519.50</td>
<td>4.664</td>
<td>0.05</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>Finishing</td>
<td>2,541,535</td>
<td>11,674,519.50</td>
<td>21.770</td>
<td>0.05</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>Fittings</td>
<td>298,800</td>
<td>11,674,519.50</td>
<td>2.560</td>
<td>0.39</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>786,350</td>
<td>11,674,519.50</td>
<td>6.736</td>
<td>0.15</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td>Soil Drainage</td>
<td>274,000</td>
<td>11,674,519.50</td>
<td>2.347</td>
<td>0.43</td>
<td>2.14</td>
</tr>
<tr>
<td></td>
<td>Preliminaries</td>
<td>500,000</td>
<td>11,674,519.50</td>
<td>4.283</td>
<td>0.24</td>
<td>2.33</td>
</tr>
<tr>
<td></td>
<td>Contingencies</td>
<td>270,000</td>
<td>11,674,519.50</td>
<td>2.313</td>
<td>0.43</td>
<td>2.14</td>
</tr>
<tr>
<td></td>
<td>Value Added Tax</td>
<td>555,929.50</td>
<td>11,674,519.50</td>
<td>4.762</td>
<td>0.21</td>
<td>2.37</td>
</tr>
</tbody>
</table>

Samples of 2 & 3 bedroom bungalow project were analyzed based on cost centres; relative probability and entropy were quantified for each cost centres. Doors and finishing work have highest entropy value of 2.52 followed by frame and walls of 2.49 while Roofs has 2.0. The reason for high cost value of doors and finishings could be responsible for seasonal nature of the material supply and doors items that are often imported. Items with lowest entropy are soil and drainage including contingencies.

Stabilizing Cost Centres for an Optimum Cost Using Neural Network.

The training data set (300 samples) of 400 residential building projects selected, having been modified with inflation index and exigency factor, was used to train the multilayered perceptron neural network selected, so as to select its parameters, the one suitable to problem at hand. Back propagation was used to train the network since it is recommended and simple to code. So also gradient descent momentum and learning rate parameters was set at the start of the training cycle (for speed determination and
network stability, range of momentum $0.1 \leq x \leq 1$, high = weight oscillation coefficient). The output is presented in Table 1.6.

Cost of four hundred selected residential building projects initiated and completed within 2009 and 2011 and processed with artificial neural network is presented in Table 1.6. The tender cost and as-built cost of the projects were adjusted with economic variants such as inflation index and exigency escalator buffer. The inflation index data of period of six month was factored into the as-built cost of the project. The modification will enable adequate coverage of intervening variables that impact cost and ensures continual validity of the developed model whenever deployed. The modified costs were loaded on back propagation neural network with Levenberg Marqua and multilayer of input and output. The cost inputs were trained over 1000 training epoch and stopped when consistent output was produced to avoid technical dogmatism.

### Table 1.6  Project Cost and Corresponding Neural Network Based-Entropy 2&3-Bedroom Bungalow

<table>
<thead>
<tr>
<th>Project</th>
<th>Tender Cost</th>
<th>Tagged Cost</th>
<th>Neural Output</th>
<th>Relative Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prj 1</td>
<td>3085100</td>
<td>4236000</td>
<td>5,272,837</td>
<td>0.60</td>
</tr>
<tr>
<td>Prj 2</td>
<td>3171800</td>
<td>5800000</td>
<td>7,219,654</td>
<td>0.44</td>
</tr>
<tr>
<td>Prj 3</td>
<td>2610000</td>
<td>4800000</td>
<td>5,974,886</td>
<td>0.44</td>
</tr>
<tr>
<td>Prj 4</td>
<td>3165000</td>
<td>4350000</td>
<td>5,535,606</td>
<td>0.57</td>
</tr>
<tr>
<td>Prj 5</td>
<td>2145000</td>
<td>4325000</td>
<td>5,455,724</td>
<td>0.39</td>
</tr>
<tr>
<td>Prj 6</td>
<td>3174953</td>
<td>4286350</td>
<td>5,454,607</td>
<td>0.59</td>
</tr>
<tr>
<td>Prj 7</td>
<td>2750000</td>
<td>5850000</td>
<td>7,392,422</td>
<td>0.37</td>
</tr>
<tr>
<td>Prj 8</td>
<td>2700850</td>
<td>5121000</td>
<td>6,516,743</td>
<td>0.42</td>
</tr>
<tr>
<td>Prj 9</td>
<td>3150000</td>
<td>6265000</td>
<td>7,972,545</td>
<td>0.40</td>
</tr>
<tr>
<td>Prj 10</td>
<td>2766000</td>
<td>5223000</td>
<td>6,669,763</td>
<td>0.42</td>
</tr>
<tr>
<td>Prj 11</td>
<td>2510000</td>
<td>6371000</td>
<td>8,107,435</td>
<td>0.31</td>
</tr>
<tr>
<td>Prj 12</td>
<td>3268000</td>
<td>6250000</td>
<td>7,953,456</td>
<td>0.41</td>
</tr>
<tr>
<td>Prj 13</td>
<td>2,250,325</td>
<td>5675000</td>
<td>7,177,588</td>
<td>0.32</td>
</tr>
<tr>
<td>Prj 14</td>
<td>3520000</td>
<td>6600000</td>
<td>8,347,503</td>
<td>0.42</td>
</tr>
<tr>
<td>Prj 15</td>
<td>2100000</td>
<td>5125000</td>
<td>6,481,963</td>
<td>0.32</td>
</tr>
<tr>
<td>Prj 16</td>
<td>3173000</td>
<td>5652000</td>
<td>7,148,498</td>
<td>0.45</td>
</tr>
<tr>
<td>Prj 17</td>
<td>3173000</td>
<td>7650000</td>
<td>9,675,515</td>
<td>0.34</td>
</tr>
<tr>
<td>Prj 18</td>
<td>2580315</td>
<td>6131000</td>
<td>7,754,324</td>
<td>0.33</td>
</tr>
<tr>
<td>Prj 19</td>
<td>2420500</td>
<td>5643000</td>
<td>7,112,028</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Source: 2011 Survey.

The outcome of network trained optimized cost is presented in Table 1.5. However, average sum of the neural network generated output was factored differentially into the elemental components of each project category and used as sample for the econometric based model.

The loading result of the elemental cost, loaded onto the three types of bid-balancing loading system, revealed that the econometric-modified system presented in this study, yields the best output in term sequential difference. There tends to be a close
margin between the Econometric-Neural-based generated model cost output and tender sum used for the award of the projects. The implication of this discovery is that the model presents the Net Present Value (NPV) of the elements in an upward manner (futuristic) in terms of period ‘n’ in consideration. The model is used in achieving this feat. Therefore in determining the worth of an element at a period ‘n’, the project could be factored through incorporating inflation index, exigency escalator and inflation buffer. The neural network context was used to generate a consistent pattern of cost; the optimized cost is accepted as the generalized cost using desired modified econometric parameters as demonstrated in this study.

THE EXPERT SYSTEM AND ECONOMETRIC ENTROPY-BASED MODEL FOR RESIDENTIAL BUILDING PROJECT COST ADJUDICATION.

The expert system and econometric entropy-based model for residential building project cost adjudication is presented in this section. Three techniques were used to determine cost benchmark for each of the component of project elements. The early constructible element loading, late-constructible element loading and individual rate loading. This toed the line of submissions of Cattel et al., (2008) of front end loading, back-end loading and individual loading.

Structural Component of Neural Network Econometric Modified Back-End Loading Approach

The expert system and econometric entropy-based model for residential building project cost adjudication is presented in this section. Three techniques were used to determine cost benchmark for each of the component of project elements. The early constructible element loading, late-constructible element loading and individual rate loading. This toed the line of submissions of Rosen (1974); Brown and Rose (1982); Bajari and Benkard (2004); and Cattel, Bowen and Kaka (2008) of front end loading, back-end loading and individual loading.

\[
P_{jec} = \sum (1 - r)^n \left( \{ C\lambda_{nj} [\gamma_{nj} Exf - C^1]\} + \lambda_{nj} [ Q_j + Q_i][\gamma_{nj} Exf_j - C^1] \right)
\]

where \( r \) --- Monthly Discount rate ;
\( n \) --- Period in Consideration;
\( C^1 \)---Actual Increase in Cost of Items;
\( \lambda_{nj} \) --- Proportion of Elements;
\( Q_j, Q_i \) --- Bill Cost of Item i, j;
\( \gamma_{nj} \) --- Adjustment for Cost Escalation(risk factor) ;
\( Exf \)---Exigency Factor( project entropy = 2.36) and \( C^1 \) --- unit cost of project element

\( P_{jec} \) – Project Element Cost.

The modified model was applied on 2&3-bedroom projects, the output of the model compared alongside with other front-end and individual rate loading. It was discovered that the values of the modified -econometric model is consistent in structure, the detail is presented in Table 1.7, from the table, the modified models’ output is closed to the bill of quantity sums, the model has incorporated escalaor
buffer and inflation factor over a period of 6 (six months), which makes the assigned cost to the elements on the bill to be valid for six (6) months. For instance, the cost of substructure on the bill of quantities is ₦2,669,340 while after loaded with escalator buffer and inflation factor, ₦2,939,503.9. Once there is no incidence of inflation, contractor or builder will tend to save cost from onset while no effect of inflation will be felt on occasion of inflation during the course of the work execution. The econometric model output can then be used as tender sum for the elements at tender stage, since effect of project variants has been taken into consideration.

VALIDATING NEURAL-NETWORK ECONOMETRIC ENTROPY-BASED MODEL USING COMPARATIVE ANALYSIS OF THE ECONOMETRIC LOADING ATTRIBUTES

Strong positive relationship exist between cost limit of 1-bedroom duplex and 2/3-bedroom bungalow with Pearson coefficient of 0.905, also there is very weak relationship with Pearsons correlation coefficient of 0.45 that exist between the cost limit of 3-bedroom on four floors and 1-bedroom bungalow.

Table 1.7 Econometric Factor Adjusted-Project Elements (2&3-Bedroom Bungalow).

<table>
<thead>
<tr>
<th>Element</th>
<th>Tender Cost[₦]</th>
<th>Tagged Project Cost[₦]</th>
<th>Front-end Loading</th>
<th>Individual-rate loading</th>
<th>Back-end Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELT1 Substructure</td>
<td>2,669,340</td>
<td>11,674,519.50</td>
<td>3,012,567.00</td>
<td>737,298.40</td>
<td>2,939,503.90</td>
</tr>
<tr>
<td>ELT2 Frame &amp; Walls</td>
<td>1,519,415</td>
<td>11,674,519.50</td>
<td>3,397,217.00</td>
<td>419,672.62</td>
<td>1,673,190.00</td>
</tr>
<tr>
<td>ELT3 Roofs</td>
<td>1,197,000</td>
<td>11,674,519.50</td>
<td>3,505,064.80</td>
<td>987,525.00</td>
<td>1,318,148.40</td>
</tr>
<tr>
<td>ELT4 Windows</td>
<td>517,650</td>
<td>11,674,519.50</td>
<td>3,726,665.30</td>
<td>142,980.11</td>
<td>570,041.41</td>
</tr>
<tr>
<td>ELT5 Doors</td>
<td>544,500</td>
<td>11,674,519.50</td>
<td>3,726,665.30</td>
<td>150,396.40</td>
<td>599,609.10</td>
</tr>
<tr>
<td>ELT6 Finishing</td>
<td>2,541,535</td>
<td>11,674,519.50</td>
<td>3,058,058.00</td>
<td>701,997.38</td>
<td>2,798,763.80</td>
</tr>
<tr>
<td>ELT7 Fittings</td>
<td>298,800</td>
<td>11,674,519.50</td>
<td>3,818,925.70</td>
<td>82,531.60</td>
<td>329,041.60</td>
</tr>
<tr>
<td>ELT8 Services</td>
<td>786,350</td>
<td>11,674,519.50</td>
<td>3,726,665.30</td>
<td>217,198.00</td>
<td>865,936.80</td>
</tr>
<tr>
<td>ELT9 Soil Drainage</td>
<td>274,000</td>
<td>11,674,519.50</td>
<td>3,726,665.30</td>
<td>75,681.54</td>
<td>301,731.54</td>
</tr>
<tr>
<td>ELT10 Preliminaries</td>
<td>500,000</td>
<td>11,674,519.50</td>
<td>3,726,665.30</td>
<td>138,105.00</td>
<td>550,605.00</td>
</tr>
<tr>
<td>ELT11 Contingencies</td>
<td>270,000</td>
<td>11,674,519.50</td>
<td>3,818,567.90</td>
<td>153,553.30</td>
<td>612,195.20</td>
</tr>
<tr>
<td>ELT12 Value Added Tax (5%)</td>
<td>555,929.50</td>
<td>11,674,519.50</td>
<td>3,722,838.70</td>
<td>153,553.30</td>
<td>612,195.20</td>
</tr>
</tbody>
</table>

Source: 2011 Survey

However, from Table 1.7 averagely strong relationship is recorded as well in mapping 2/3-bedroom duplex with 4-bedroom duplex the analysis came up with Pearsons correlation coefficient of 0.787. Similarly, an average strong relationship occurred between 1-bedroom bungalow and 4-bedroom duplex; 3 bedroom on 4-floors and 2/3-bedroom bungalow with Pearsons coefficient of 0.764 and 0.586 respectively. Econometric value analysis of the three different methods is presented in Tables 1.7 and 1.8; there is weak correlation in the Individual-rate loading and Back-end loading when mapped with Front-end loading while positive correlation exists in mapping of Individual rate loading with Back-end loading this indicates closeness in the attribute as a result of incorporation of inflation buffer in the structure of the two models. However, the Econometric Back-end loading contingency coefficient from Table 1.8
is high with 0.967 and Kendall’s tau coefficient of 1.00 at 99% confidence interval using Monte Carlo technique and closely followed by Individual-rate loading contingency coefficient of 0.957 and Kendall’s coefficient of 0.909. This indicates better output as obtained from the generated econometric model whose weights are neural network modified.

ECONOMETRIC FACTOR ADJUSTED PROJECT ELEMENTS (2&3-BEDROOM BUNGALOW)

Table 1.8 Cost Limit Component Validations

<table>
<thead>
<tr>
<th>Elements and Statistical Parameters</th>
<th>4-bedroomduplex</th>
<th>2/3-bdmbunglw</th>
<th>1-bdmbung</th>
<th>3-bdmbungfloors</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-bedroomduplex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearsons Corr.</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.(2-tailed)</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/3-bdmbunglw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearsons Corr.</td>
<td>0.787</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.(2-Tailed)</td>
<td>0.001</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-bdmbunglw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearsons Corr.</td>
<td>0.764</td>
<td>0.905</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Sig.(2-Tailed)</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.9 Econometric Loading Attributes

<table>
<thead>
<tr>
<th>Monte Carlo Technique</th>
<th>99% Confidence Interval</th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. Sig.</th>
<th>Sig. Boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual-rate Loading</td>
<td>Contingency Coefficient</td>
<td>.957</td>
<td>.233</td>
<td>1.00</td>
<td>.000</td>
</tr>
<tr>
<td>Kendall’s tau-c</td>
<td></td>
<td>.909</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Econometric Contingency - Front-end Loading</td>
<td>Contingency Coefficient</td>
<td>.95</td>
<td>.233</td>
<td>1.00</td>
<td>.000</td>
</tr>
<tr>
<td>Kendall’s tau-c</td>
<td></td>
<td>-1.00</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Econometric Back-end Loading</td>
<td>Contingency -Coefficient</td>
<td>.967</td>
<td>.233</td>
<td>.233</td>
<td>1.00</td>
</tr>
<tr>
<td>Kendall’s tau-c</td>
<td></td>
<td>1.00</td>
<td>.233</td>
<td>.233</td>
<td>.000</td>
</tr>
</tbody>
</table>

Source: 2011 Survey

CONCLUSIONS

This study has developed an econometric model that incorporates neural network generated parameters, builders and contractors can therefore use the econometric-neural network based model in determining the magnitude of the cost implication of the elements to be able to prepare and submit a valid bid at procurement stage of building project. The model describes different dichotomies obtainable in a typical bill of quantities vis-à-vis early constructible element and late constructible elements. Sub-structural elements up to initializing elements of superstructure are regarded as early constructible elements while those billed to be executed later as project
progresses are termed late constructible elements. Gleaning facts from data analyzed Sub-structural works which are often scheduled to be executed early on project carries high cost N2,939,503 followed by Frame and Roofs with N1,673,190 and N1,318,148 respectively. A builder can bill the component with their actual cost having being guaranteed of early released of fund for project execution. Meanwhile, elemental works often scheduled to come later on the project for execution should not be treated in this way, however there should be an anticipated cost loading on their elemental cost to cushion the effect of occurrence of uncertainties that may arise before execution, therefore model that incorporates an economic index will be most desirable for good effect.

Econometric model like the one generated in this study will therefore accommodate factoring of upward lading time dependent factors on the elements. This takes account of present value of the cost using period ‘n’ in consideration as a base for reference, for instance, services and soil drainage that are often billed to occur later on project, which has tender cost of N786, 350 has a relative cost of N865, 938.80 produced by econometric model having being factored upward for period of six (6) months. Speculated period was used in context of this analysis, this will therefore provide a builder an opportunity to load a cost implication of unseen circumstance even if the money would be reimbursed later. This fact thus situates the neural network modified model as a tool that could be used in cost prediction over a specified period.

REFERENCES


Cost adjudication


EXPLORING THE BENEFITS OF E-TENDERING FOR INFRASTRUCTURE PROJECT PROCUREMENT IN NIGERIA

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³Due Process and Project Monitoring Bureau, Jigawa State, Nigeria

Assessments of public infrastructure procurement systems in most of the developing countries have consistently indicated weaknesses in the used of manual tendering processes. The use of this manual tendering technique is perceived to be labour intensive and dominated by paper work thereby making it costly and inefficient. However, studies revealed that information technology system could engender efficient tendering method that can provide the foundation for cost reduction and transparency in infrastructure project procurement. Despite these relative advantages, the use of e-tendering in Nigeria is influenced by several factors such as: poor state of electricity power supply, lack of established procedures, and legal issues surrounding its application. Though, the motivation for this paper stemmed from identifying an immediate opportunity for Nigeria to actively participate in and be instrumental in developing e-tendering in infrastructure project procurement. It is based on this premise this report on a study that explores the relative benefits of e-tendering. Data used in the study were sourced from the literature reviewed and a survey that was conducted among major participants in infrastructure project development in Nigeria. The main findings of the study show the major benefits of e-tendering in order importance: reduce cost and time; effective tender processing; provides transparency and accountability; and improve communication and knowledge sharing. These factors/benefits formed a clear reflection of the good achievement of e-tendering application. Furthermore, the study would serve as a way of sensitizing public sector towards embracing the application of e-tendering capable of eliminating the high tendering costs in infrastructure project procurement in Nigeria.

Keywords: construction, e-tendering, infrastructure, procurement, Nigeria.

INTRODUCTION

The construction industry has experienced significant changes especially as the transition from conventional tendering procedures to electronic tendering (e-tendering) is becoming an international trend in various parts of the World (Lou and Alshawi, 2009). World Bank (2004) asserts that the emergence of the internet has revolutionised the way governments do business. It is based on this trend that the World Bank implemented a methodology on how to measure the performance and the standard of national procurement systems as well as follow up on how such standards develop over time (World Bank, 2004).

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In Nigeria, little success has been recorded by introducing Public Procurement Act to further efficient construction procurement systems. However, the operation of this procurement system is still manual and this ultimately slows down the management of the supply chain. Lack of well-structured and efficient procurement systems coupled with tender evaluation information systems have led to the use of e-tendering. Other motivating factors include; increased use of technology within the construction industry, its ability to exchange large numbers of documents and information between various parties, ease of use, and speed of submission of tender have also led to the development of e-tendering in public infrastructure procurement (Oyediran and Akintola, 2011). e-tendering, in its simplest form, is described as the electronic publishing, communicating, accessing, receiving and submitting of all tender related information and documentation via the internet, thereby replacing the traditional paper-based tender processes. Adebanjo (2011), asserts that corruption and gross malpractices in the existing procurement system in Nigeria manifests itself in the inside dealings, bribery, wrong computation of costs by evaluation teams leading to shoddy commodities and goods. Manual tender and procurement systems, if well managed, could be efficient but are subject to a lot of influence and fraud from third parties. Information processing arising out of tender document evaluation usually takes a long time and is very resource consuming.

The electronic technology need to be adopted in public infrastructure procurement should be geared towards cost reduction and time so that efficient procurement will be realized. Procurement is such a rigorous process that involves tendering and efficient decision making. This work therefore, explores the likely benefits to be achieved in the use of e-tendering in centralizing procurement procedures in government ministries and agencies toward reducing the high tendering cost in the development of public infrastructure projects in Nigeria.

**E-TENDERING APPLICATION FOR INFRASTRUCTURE PROJECT PROCUREMENT**

The rapid pace of electronic technological advancement over the past three decades has transformed the construction industry. Today businesses and governments rely heavily on information and communication technology (ICT) for communication. Growing confidence in the use of the internet for commercial transactions has encouraged Nigerian Government entities to take advantage of the efficiencies offered by electronic business systems and establish electronic tendering systems for procuring numerous building and infrastructure contracts (Oyediran and Akintola, 2011).

e-tendering is increasingly being adopted in both developed and developing nations throughout the world. The techniques, in its simplest form, is described as the electronic publishing, communicating, accessing, receiving and submitting of all tender related information and documentation via the internet, thereby replacing the traditional paper-based tender processes, and achieving a more efficient and effective tendering process for all parties involved in infrastructure development. Although, one of the challenges in developing any e-tendering system is in converting the functionality of the traditional paper-based system to an electronic environment while maintaining legal compliance. As a consequence the law has not developed sufficiently to provide certainty of enforcement for electronic transactions in Nigeria. While an e-tendering system is more efficient and cost effective, the shift to an electronic environment presents several legal hurdles, mainly because the law that
governs electronic transactions is under-developed and lags behind the technology. However, as the tendering process is governed by the public procurement Act (Bureau of Public Procurement Act, 2007) the various gaps in the Act could be remedied by explicit and detailed conditions of tender.

**TENDERING PROCEDURES FOR INFRASTRUCTURE PROJECT DEVELOPMENT**

The tendering procedure in the construction sector is deemed to be the most critical and important throughout the lifecycle of the construction project (Vee and Skitmore, 2003). Based on traditional contracting approach, the tendering procedure starts when the drawings and tender documents are completed. Compilation and analysis of project data is gathered through the stages of strategic briefing, outline and final proposals, production information, statutory approvals, building contracts and others (Lou and Alshawi, 2009). This procedure constitutes information intensive and heavy paperwork. Tender documents comprise of the invitation to tender, form of tender, architectural drawings, bills of quantities, health and safety agreements and others. These documents are paper intensive, not portable, expensive, tedious and troublesome to produce (Lou, 2006). Once the tender documentation is prepared, it is ready to be distributed to interested bidders. Often, problems arise during this process. Among them are human errors in document production – incomplete information or tender document, possible mix up of documents, insufficient copies, possible leakage of restricted information, problems in issuing of addendums and voluminous tender documents (Du et al., 2004; Egan, 1998; Pavlov and Aleksandrova, 2003; Worthington, 2002).

However, the introduction of electronic documentation (e-documentation) could address most of the aforementioned problems (Weippert et al., 2001). e-tendering is a process which replaces the traditional paper tendering system in the development of public infrastructures and is a means of electronically notifying, involving, vetting and selecting construction bidders.

**BENEFITS AND CHALLENGES OF E-TENDERING**

Successful implementation and application of e-tendering offers numerous benefits to both public and private sector organisation. e-tendering, from an economic stand point, enhances efficiency through transaction cost savings and reduced direct procurement costs (Oyediran and Akintola, 2011). According to Bardon, and Lavelle (2009), benefits of e-tendering include the ability to improve certain procurement activities significantly, increase in tender processing and enabling faster and more efficient information exchange within the contractual transactions. Application of e-tendering enhances significant time reduction and provides greater sharing of information among stakeholders. Similarly, application of e-tendering also lowers costs by reducing paperwork and minimizing costs for both coordinating and processing transactions (Eadie et al, 2007). It also reduces inventory levels and inventory costs by enhancing integration information systems, which allows shorter order cycles and higher inventory turnovers (Bardon and Lavelle, 2009). e-tendering as well reduces transaction related costs of coordination between contracting firms via a standardization of tasks and communication between chain members (Gupta et al, 2009), and reduces data entry costs and purchase order costs (Magutu et al, 2010). Application of e-tendering further maintains efficiency while reducing lead time giving the company the capability to smooth out the peaks and valleys in the normal production cycle (Kaliannan et al, 2009). The transmission of e-tendering transactions
takes less time than comparable manual transactions such as fax machines, improves accuracy and timeliness of the flow of information (Cooperative Research Centre for Construction Innovation (CRCCI), 2006) and therefore enables efficiency improvements (RICS Guidance notes, 2005). Consequently, fewer items will be lost, returned or required from back order. Utilization of e-tendering also enables access to external complementary resources which may be critical to make innovation a successful strategy for the government (Pieprzyk and Wang, 2009). Besides these, e-tendering application enables innovation, because it makes consultations with construction professionals’ mandatory leading to expanded knowledge base capable of providing a fertile environment for the much needed innovation.

Certainly, construction firms with strong innovation capabilities are also found to engage in more technical alliances (Kajewski and Weippert, 2004). This could be to complement and supplement the government’s innovative resources. e-tendering application as well enables timely response. This is because of the speed in which the stakeholders receive and incorporate the information into their systems. For this reason, e-tendering can be an important component of just in time production systems. Government’s ministries and agencies including construction firms that apply e-tendering also benefit from improved information accuracy (Corsi et al, 2006). This is possible because, with e-tendering there is minimum human intervention in the information flow since it eliminates the need to rekey documents on the destination side. e-tendering application also enables standardization of programs and procedures and consequently helps to deliver an efficient tendering procedure that meets government expectations with regard to price and time frame. Standardization of programmes and procedures also allow data to be controlled more easily (Lou and Alshawi, 2009). Besides these, e-tendering provides a varied number of documents which are standardized across construction industry that can enhance competitive capacity through a win-win partnership fostered by e-tendering linkages (Oyediran and Akintola, 2011). It has also been shown that e-tendering application ensure more accurate and streamline tender processes (Pieprzyk and Wang, 2009). Likewise, applying e-tendering in the construction industry will improves public and private sectors relationship and also helps to keep the environment clean and healthy. Professionals within the construction industry generally agree that the implementation of an automated e-tendering process enhances the overall quality, timeliness and cost effectiveness of a tender process, and provides a more streamlined method of receiving, managing, and submitting tender documents than the traditional paper based process (Corsi et al, 2006; Pieprzyk and Wang, 2009; RICS Guidance notes, 2005).

On the one hand, there are many barriers challenging the successful implementation and adoption of an e-tendering system. Researchers have also identified a range of challenges and perceptions that seem to hinder the uptake of this innovative approach to tendering (Weippert et al, 2001). A central concern seems to be that of security. This is when industry organisations have to use the internet for electronic information transfer. As a result, when it comes to tendering, industry participants insist these innovative tendering systems are developed to ensure the utmost security and integrity (CRCCI, 2006).

According to the study by Oyediran and Akintola (2011), factors limiting the application of e-tendering in Nigeria include: poor state of electricity power supply, lack of established procedures, high complexity and skills required, couple with legal issues surrounding its application and lack of awareness of e-tendering benefits.
Similarly, in the study by Magutu et al., (2010) key challenges that were identified pertain to the lack of e-tendering awareness, confounding standards, low transaction volume, technical complexity and data security concerns. Likewise, Azar et al., (2011) had identified the major problems of e-tendering implementation and application in Northern Ireland. These included difficulties in quantifying the return on e-tendering investment, high volume of transactions needed to benefit from e-tendering, high implementation costs, lack of top management commitment, selection of a message standard, impacts on the organization, and legal issues. Additionally, studies undertaken by CRCCI (2006) on e-tendering evidently show that there are various types of barriers to e-tendering success which were classified as: managerial leadership, costs and benefits, technical, human resources management, trading partner relationships, security and legal issues.

RESEARCH METHODOLOGY

To achieve the desired objectives of the study, detailed literature review and inputs from professionals that actively involved in the development of public infrastructure projects (Architects, Quantity Surveyors, Civil/Building engineers, and Contractors) were used to obtain the relevant data. A total of twenty five (25) benefits of e-tendering were shortlisted from the reviewed literature. The questionnaire was designed to determine the most important benefits and was later divided into two (2) parts. The first part was aimed at personal and organizational information of the respondent (for example the highest qualification, years of experience, designation, volume of projects undertaken, firm’s expertise). In second part of the questionnaire asked the respondents to rate the factors/benefits in order of their importance. In addition, respondents were also encouraged to cite additional factors thought to be important to the application of e-tendering.

A total of 66 questionnaires (16 Architects, 17 Quantity Surveyors, 18 Civil/Building engineers, and 15 Contractors) were returned out of the 90 distributed from Abuja and Lagos, which represents 73% effective response rate. The respondents to the questionnaire were asked to rank the identified benefits on a scale of 1 (very unimportant) to 5 (very important). The responses that were received from the survey participants were tabulated and analysed individually using relative importance index. This calculation puts the factors in rank order and indicates how much the top ranked is more important than the next and so on (Kometa et al., 2007). The five-point scale mentioned earlier was transformed to relative importance indices for each factor, using the above method, to determine the ranks of the different factors. The relative importance index (RII) was evaluated using the following expression:

Relative importance index (RII) = \[ \Sigma \frac{w}{(A \times N)} \times - - - - , \] where \( w \) = weighting given to each factor by the respondents and ranges from 1 to 5 where 1 is not significant and 5 is extremely significant, \( A = \) highest weight (i.e. 5 in this case), and \( N = \) total number of respondents (i.e. in this case 66). Before asking to rate the given factors, every respondent was asked to mention the key benefits of e-tendering. More or less all the mentioned factors were later found in the given list, indicating a comprehensive literature review and input from the major participants of public infrastructure projects development.

FINDINGS AND DISCUSSION

Table 1 shows respondents’ view of the most important benefits of e-tendering for public infrastructure development in the Nigerian construction industry. Benefits of e-
tendering have been identified and ranked based on the rating of respondents. Top ten factors are shown in Table 1. Reduction of tendering costs significantly came out as the leading benefit with a highest relative importance index of 0.9771. This factor was followed by an emerging factor of reduction in time and efficiency in tender processing having RII value of 0.9758 and 0.9694 respectively. Achieve best value for money scored 0.99645, while transparency and accountability scored 0.9642. The others include: selection of reliable & competent bidder (0.9632), enhances sustainability (0.9588), reduces the high level of corruption (0.9500), increase accuracy of production capacity (0.9493), and improve communication among the parties in the tendering transaction (0.9461).

Table 1. Most important benefits of e-tendering for public infrastructure projects development

<table>
<thead>
<tr>
<th>Benefits of e-tendering for public infrastructure procurement</th>
<th>RII</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce tendering cost significantly</td>
<td>0.9771</td>
<td>1</td>
</tr>
<tr>
<td>Reduce time of tender processing</td>
<td>0.9758</td>
<td>2</td>
</tr>
<tr>
<td>Enhances efficiency in tender processing</td>
<td>0.9694</td>
<td>3</td>
</tr>
<tr>
<td>Achieve best value for money</td>
<td>0.9645</td>
<td>4</td>
</tr>
<tr>
<td>Provides transparency and accountability</td>
<td>0.9642</td>
<td>5</td>
</tr>
<tr>
<td>Select reliable &amp; competent bidder</td>
<td>0.9632</td>
<td>6</td>
</tr>
<tr>
<td>Enhances sustainability</td>
<td>0.9588</td>
<td>7</td>
</tr>
<tr>
<td>Reduce the high level of corruption</td>
<td>0.9500</td>
<td>8</td>
</tr>
<tr>
<td>Increase accuracy of production capacity</td>
<td>0.9493</td>
<td>9</td>
</tr>
<tr>
<td>Improve communication</td>
<td>0.9461</td>
<td>10</td>
</tr>
<tr>
<td>Easy to use</td>
<td>0.9399</td>
<td>11</td>
</tr>
<tr>
<td>Speedy exchange of information</td>
<td>0.9358</td>
<td>12</td>
</tr>
<tr>
<td>Generate knowledge sharing</td>
<td>0.9306</td>
<td>13</td>
</tr>
<tr>
<td>Reduce administrative cost</td>
<td>0.9294</td>
<td>14</td>
</tr>
<tr>
<td>Enhances administrative benefits</td>
<td>0.9221</td>
<td>15</td>
</tr>
<tr>
<td>Significant reduction in errors associated with tender</td>
<td>0.9194</td>
<td>16</td>
</tr>
<tr>
<td>Enhances the overall quality of tender process</td>
<td>0.9157</td>
<td>17</td>
</tr>
<tr>
<td>Ensure accurate &amp; streamline tender processes</td>
<td>0.9016</td>
<td>18</td>
</tr>
<tr>
<td>Faster and more efficient tender evaluation</td>
<td>0.9008</td>
<td>19</td>
</tr>
<tr>
<td>Reduces inventory levels and inventory costs</td>
<td>0.8995</td>
<td>20</td>
</tr>
<tr>
<td>Enables strong innovation capabilities</td>
<td>0.8977</td>
<td>21</td>
</tr>
<tr>
<td>Improve information accuracy</td>
<td>0.8965</td>
<td>22</td>
</tr>
<tr>
<td>Promotes environmental friendliness</td>
<td>0.8924</td>
<td>23</td>
</tr>
<tr>
<td>Promote competitive capacity in contract</td>
<td>0.8912</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>0.8904</td>
<td>25</td>
</tr>
</tbody>
</table>

Significant cost reduction in tender processing (Table 1, RII value of 0.9771) was discovered as the most important benefit likely to be obtained from the use of e-tendering. This shows that respondents have collectively emphasized on the significance of e-tendering in terms of cost reduction in tendering processing that usually led to the overall reduction of the procurement cost. The outcome of this finding is in line with numerous research findings in terms of the significant cost reduction attached to e-tendering application (Gupta et al., 2009; Oyediran and Akintola, 2011; Magutu et al., 2010). Therefore, e-tendering is one of the aspects of the procurement process where information technology is used to reduce the associated cost of the procurement processes. Moreover, e-tendering can empower construction industry professionals with the means to take more control over
procurement cost of public construction projects by providing improved and secure access to tender information to construction industry practitioners.

Most of the respondents agreed that time reduction and efficiency in tender processing often demonstrates their significance to the overall benefits of e-tendering (RII value of 0.9758 and 0.9694). This has corroborated with previous findings of several researchers (Lou and Alshawi, 2009; Kaliannan et al, 2009) that maintaining efficiency and significant time reduction in the use of e-tendering implementation is the most common benefit usually obtained. Achievement of best value for money (0.9645), transparency and accountability (0.9642), were discovered as the strategic importance of e-tendering benefits that enhances the overall quality of method of receiving, managing, and submitting tender documents. The system also enables efficiency improvements that shortened tender period, a secured method of sending and receiving tenders and a more systematic and progressive method of achieving best value for money.

**CONCLUSIONS**

The study has evidently shows that e-tendering application could provide many benefits to both public and private sector organization. Even though, the system cannot guarantee the success of public infrastructure procurement in all conditions. Therefore, a well planned and executed e-tendering implementation and application process is necessary for its successful application. Additionally, the findings from this study suggested that applying e-tendering in Nigeria receive benefits from its application. Such benefits include: reduced tendering cost and time, enhances efficiency in tender processing, achieve best value for money, and promote transparency and accountability. The other benefits established in the study include selection of reliable & competent bidder, sustainability, reduces the high level of corruption, increase accuracy of production capacity, and improve communication among the parties involved in the tendering transaction. Despite these benefits discovered, the study also shows that there is low level of awareness and it is against this background that, there is need to develop a capacity building knowledge backbone to drive the adoption of e-tendering. The extent of e-tendering basic and applied knowledge being shared in training construction industry professionals in tertiary institutions has not been fully determined. However, these findings would serve as a way of sensitizing public sector towards embracing the application of e-tendering capable of eliminating the high tendering costs in public infrastructure procurement in Nigeria.

**REFERENCES**


FACTORS AFFECTING THE IMPLEMENTATION OF BUILDING REGULATIONS (L.I.1630) IN GHANA

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The National Building Regulation (L.I. 1630) was enacted in 1996 in Ghana to regulate the erection of buildings, alteration of building structures and execute works or install fittings in connection with any building. Although, this regulation has been enacted, its implementation is questionable. The aim of this research therefore is to identify factors affecting the implementation of the Building Regulations in Ghana.

Interview and questionnaire survey were the two principal methods used to elicit data from 180 respondents. Three (3) key groups of respondents were targeted for the study, namely local authority staff, building practitioners and building owners. The research findings indicated that the most important factors affecting the implementation of the Building Regulations in Ghana are: corruption; bureaucratic procedures; lack of public education about the building regulations; inadequate resources for implementers; and political interference. The paper therefore recommends that the implementation system should be restructured to identify implementers who compromise the regulations as a result of their selfish interest. Such persons should be sanctioned to deter others from compromising with the regulations. Local authorities should streamline the implementation procedure such as the procedure for obtaining building permits to reduce the bureaucracy. Local authorities and government agencies must also formulate programs to educate and sensitize the public about the purpose and importance of the National Building Regulations and the need to cooperate with implementers. There is the need to establish or set aside a special fund by all local authorities to provide resources for the implementation of the National Building Regulations.

Keywords: national building regulation, implementation, local authorities, Ghana

INTRODUCTION

Building regulations exist to ensure building work satisfies minimum constructional standards, energy conservation requirements and also ensure the health and safety of people occupying the building (Vonweller, n.d.). In Ghana, the national building regulations (L.I. 1630) was enacted in 1996 to regulate the erection of buildings, alteration of building structures and execute works or install fittings in connection with any building.

The perennial flooding, fire outbreaks and occasional collapse of buildings in Ghana in recent times have often been attributed to the fact that the building regulation was not been followed and normally buildings were developed without a secured approved development and building permits. According to Orgen (2010) there is haphazard

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development of building structures in reserved spaces, waterways and low lying areas or marshy areas without development and building permits. It should be recognized that building regulations are generally the silent protector to the general public and are generally not well recognized (Vonweller, n.d.). According to Dadzie and Coles (2011), the National Building Regulations (NBR) has not made the needed impact due to its poor adherence. Generally building regulations becomes important after large/serious event or disaster (collapse of structures, flooding and fire outbreaks) occurs with extensive life loss.

The aim of this research therefore is to identify significant factors that affect the implementation of the Building Regulation in Ghana. The result of this research will aid government, local authorities, practitioners, builders and policy makers, to identify the actual and significant factors affecting the implementation of the NBR which will in turn influence them to formulate relevant policies. The recommendations of this research if complied with will go a long way to mitigate the issue of collapse of structures in Ghana. The issue of domestic fire outbreak will also be curtailed and finally, it will reduce the incidence of flooding especially in the cities.

OVERVIEW OF THE NATIONAL BUILDING REGULATIONS (L.I. 1630)

The national building regulation (L.I. 1630) is a legislative instrument made on the 27th day of September, 1996. This regulation is set of rules and standards that must be followed to satisfy the minimum acceptable levels of safety for buildings and non-building structures. The NBR is applicable to the erection, alteration or extension of any building. L.I. 1630 consists of nineteen (19) parts and one hundred and eighty seven (187) regulations. The District Planning Authority (DPA) is mandated by L.I. 1630 to implement the regulations on behalf of every local authority. The DPA comprises of heads of relevant departments of the local authority e.g. District Town and Country Planning Manager, Head of District Works Department, District Environmental Health Officer, District Fire Officer, Electricity Company of Ghana District Manager, Ghana Water Company Ltd District Manager etc. The DPA appoints a qualified building inspector who oversees and inspects daily work on buildings, erection and installations to ensure compliance with the requirements of these regulations.

The nineteen parts of the regulations involve: Application of regulations and building plans; Plot development; Site Preparation and landscape; Materials for building; Structural stability; Structural fire precautions; Access accommodation; Air movement and ventilation; Thermal insulation; Hearths, Chimneys and heat – producing appliances; Sound insulation; Pest control and protection against decay; Drainage; Sanitary conveniences; Refuse disposal; Water supply; Lighting and electrical installations; Special requirements for rural building and; Miscellaneous provisions.

RECENT INCIDENTS INVOLVING COLLAPSE OF BUILDINGS AND FIRE OUTBREAKS IN GHANA

Over the last few years, Ghana as a nation has recorded major catastrophes from collapsed buildings and fire outbreaks (Nyan & Koffie, 2012). Some recent incidents involving collapsed of buildings in Ghana are listed below:

On the 7th November 2012 – Achimota, Accra: A six-storey building which houses Melcom collapsed, trapping a number of people. After the rescue efforts, 81 persons were retrieved and 14 died.
On the 5th January 2011 – Dormaa Ahenkro, Brong Ahafo: Two persons died on the spot and three others seriously injured, when a two-storey building under construction collapsed on them at Antwirifu, near Dormaa-Ahenkro, in Brong Ahafo Region.

On the 5th June 2010 – Spintex Road, Tema: A four-storey building situated along the Spintex Road, near Tema, collapsed-stirring conflicting reports on the number of casualties. While some eyewitnesses said as many as six persons, including a four-year-old boy, could have been buried under the debris, officials of the National Fire Service said only two masons, sustained injuries and had to receive treatment at the Sakumono Hospital.

On the 31st January 2010 – Tarkwa, Western Region: Three persons were killed when part of a five-storey hotel building under construction collapsed on some workers in Tarkwa.

On the 9th October 2009 – Ashaiman, Accra: Four persons lost their lives when an uncompleted two-storey building collapsed on them at Zenu, a suburb of Ashaiman.

On the 14th August 2008 – Kejetia, Kumasi: Pandemonium broke out at Kejetia Terminal in Kumasi on Thursday when the middle section of a two-storey building suddenly collapsed. The incident which happened in the afternoon affected 40 stalls and shops. Although there were no casualties, all merchandise in stock were destroyed.

On the 6th March 2008 – Danyame, Kumasi: A 27-year-old man died on the spot when a two storey building which he and his colleagues were constructing collapsed at Danyame, a suburb of Kumasi.

On the 15th December 2006 – Asafo, Kumasi: A four-storey office building complex with car park under construction at the O&A Travel and Tour terminal at Asafo-Labour collapsed around midnight.

On the 13th December 2002 – Accra: Four-storey Building Collapsed in Accra. An observant fire officer saved hundreds of lives in Accra by evacuating a four-storey building moments before it collapsed. The collapsed of the uncompleted building, located near the Central Post Office could have resulted in several deaths and injuries if the fire officer had not organized the evacuation.

On the 23rd April 2000 – Madina, Accra: Two people were reported missing and 16 others injured, eight of them were serious, when a three storey building they were working on, suddenly collapsed on them at Madina.

In terms of fire outbreaks, Statistics for the first quarter indicated that from January to March, 2012, the Ghana National Fire Service recorded 704 fire outbreaks nationwide and domestic fires were the highest with 206 representing 36.93 per cent (Korli, 2012).

The facts on the collapse of structures and fire outbreaks enunciated above corroborate the fact that the NBR are not being implemented effectively.

**RESEARCH METHODOLOGY**

Questionnaire survey and interview were used to elicit the views of local authority staff, building practitioners, and building owners towards the factors affecting the implementation of the NBR in Ghana. Questionnaires were sent to selected local authority staff in eight districts in the eastern region and building practitioners whereas interview was used to elicit the views of building owners with building
development permits. 120 questionnaires were distributed among local authority staff and building practitioners whereas interview was conducted among 60 building owners with development permits. In all, 180 respondents participated in the study. The details are in Table 1.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Questionnaires Distributed/Interviews Conducted</th>
<th>Responses Returned</th>
<th>Percentage of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Authority Staff</td>
<td>55</td>
<td>54</td>
<td>98.18%</td>
</tr>
<tr>
<td>Building Practitioners</td>
<td>65</td>
<td>62</td>
<td>95.38%</td>
</tr>
<tr>
<td>Building Owners</td>
<td>60</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>176</td>
<td>97.78%</td>
</tr>
</tbody>
</table>

Table 1: Percentage of questionnaire distributed/interview conducted and responses received

The respondents were asked to indicate, based on their experience the level of importance of each one of the identified factors affecting implementation of the NBR on a five-point Likert scale as: not important, slightly, moderately, very, and extremely important. The respondents in the group of the local authority staff were coordinating directors, planning officers, town and country planning managers, engineers, technician engineers and building inspectors with average experience of 14 years. The respondents in the group of building practitioners were construction project managers, architects, civil/structural engineers, and private builders with average experience of 18 years in the construction industry.

The factors believed to affect the implementation of the NBR were considered in this study based on a preliminary questionnaire survey and interview conducted amongst experienced local authority staff; building practitioners; and building owners. The purpose of the preliminary survey and interview was essentially to validate a preliminary set of implementation factors from some connoisseurs and to determine from their experience other factors which affect the implementation of the NBR in Ghana. To ensure a balanced view, the survey and interview consisted of 10 each of local authority staff, building practitioners and building owners. This approach was adopted for the reason that literature in this domain was lacking. This phase resulted in the identification of the factors affecting the implementation of the NBR. The second stage involved the development of questionnaire and interview guide incorporating the implementation factors identified.

The relative importance index method (RII) was used herein to determine local authority staff, building practitioners’, and building owners with building development permits’ perceptions of the relative importance of the identified factors affecting implementation of the NBR. The RII was computed as:

$$RII = \frac{\sum W}{A X N}, \quad \text{............................................. (1)}$$

Where:
RII = Relative importance index;
W = the weight given to each factor by the respondents and ranges from 1 to 5;
A = the highest weight = 5;
N = the total number of respondents (Enshassi, Mohamed, & Abushaban, 2009).
To determine whether there is a significant degree of agreement among the 3 groups of respondents (local authority staff, building practitioners and building owners), Kendall's coefficient of concordance is used as a measure of agreement among raters. Kendall's coefficient of concordance indicates the degree of agreement on a zero to one scale, and is computed by the following equation (2):

\[ W = \frac{12U - 3m^2n(n - 1)^2}{m^2n(n - 1)}, \]  

Where:

\[ U = \sum_{i=1}^{n}(\sum R)^2, \]

n = number of factors;
m = number of groups;
i = the factors 1, 2… N (Frimpong, Oluwoye, & Crawford, 2003; Enshassi, Mohamed, & Abushaban, 2009).

Null hypothesis: H0: There is significant degree of agreement among local authority staff, building practitioners and building owners.

Alternative hypothesis: H1: There is insignificant degree of agreement among local authority staff, building practitioners and building owners.

RESULTS AND DISCUSSION

Relative Importance Index

Table 2 illustrates the significant factors affecting the implementation of the NBR in Ghana. It can be inferred from this table that the 5 most important factors according to the perception of local authority staff, building practitioners, and building owners are:

- corruption;
- bureaucratic procedures;
- lack of public education about the building regulations;
- inadequate resources for implementers; and
- political interference.

Corruption has the highest average rank among all the factors. It has been ranked by the building owners' respondents in the first position with relative importance index (RII) equal to 0.953. It has been ranked by building practitioners' respondents in the first position with RII equal to 0.948 and has been ranked by the local authority staff respondents in the fourth position with RII equal to 0.906. Building Owners and building practitioners believe that the most important factor that affects the implementation of the NBR is corruption. It is encouraging to note that building owners interviewed admitted that application for building permit is at times delayed as a result of kickback not being paid to some implementers. According to the
respondents, there are situations where the kickback paid is more than the official money paid with receipt. This practice thwarts the smooth implementation of the NBR.

Table 2: Relative Importance Index and Rank of Implementation Factors according to the 3 Groups

<table>
<thead>
<tr>
<th>Factors (Affecting Implementation)</th>
<th>Local Authority RII</th>
<th>Rank</th>
<th>Building Practitioners RII</th>
<th>Rank</th>
<th>Building Owners RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of public education about the national building regulations</td>
<td>0.963</td>
<td>3</td>
<td>0.939</td>
<td>3</td>
<td>0.900</td>
<td>4</td>
</tr>
<tr>
<td>Bureaucratic procedures</td>
<td>0.898</td>
<td>5</td>
<td>0.945</td>
<td>2</td>
<td>0.937</td>
<td>2</td>
</tr>
<tr>
<td>Corruption</td>
<td>0.906</td>
<td>4</td>
<td>0.948</td>
<td>1</td>
<td>0.953</td>
<td>1</td>
</tr>
<tr>
<td>Factors (Affecting Implementation)</td>
<td>Local Authority RII</td>
<td>Rank</td>
<td>Building Practitioners RII</td>
<td>Rank</td>
<td>Building Owners RII</td>
<td>Rank</td>
</tr>
<tr>
<td>Political interference</td>
<td>0.970</td>
<td>2</td>
<td>0.919</td>
<td>5</td>
<td>0.837</td>
<td>6</td>
</tr>
<tr>
<td>Inadequate knowledge of the regulations by implementers</td>
<td>0.696</td>
<td>10</td>
<td>0.848</td>
<td>11</td>
<td>0.783</td>
<td>9</td>
</tr>
<tr>
<td>Inadequate resources for implementers</td>
<td>0.978</td>
<td>1</td>
<td>0.926</td>
<td>4</td>
<td>0.873</td>
<td>5</td>
</tr>
<tr>
<td>Unavailability of highly experienced personnel</td>
<td>0.607</td>
<td>12</td>
<td>0.900</td>
<td>7</td>
<td>0.910</td>
<td>3</td>
</tr>
<tr>
<td>Lack of qualified personnel</td>
<td>0.630</td>
<td>11</td>
<td>0.887</td>
<td>8</td>
<td>0.793</td>
<td>8</td>
</tr>
<tr>
<td>Inadequate personnel</td>
<td>0.870</td>
<td>6</td>
<td>0.906</td>
<td>6</td>
<td>0.807</td>
<td>7</td>
</tr>
<tr>
<td>Ambiguities of some part of the national building regulations</td>
<td>0.801</td>
<td>7</td>
<td>0.858</td>
<td>10</td>
<td>0.660</td>
<td>12</td>
</tr>
<tr>
<td>Lack of commitment by local authorities</td>
<td>0.767</td>
<td>9</td>
<td>0.842</td>
<td>12</td>
<td>0.670</td>
<td>11</td>
</tr>
<tr>
<td>Lack of commitment by central government</td>
<td>0.793</td>
<td>8</td>
<td>0.868</td>
<td>9</td>
<td>0.687</td>
<td>10</td>
</tr>
</tbody>
</table>

As indicated in Table 2, bureaucratic procedures have been ranked by building owners’ respondents in the second position with RII equal to 0.937. It has been ranked by building practitioners’ respondents in the second position with RII equal to 0.945 and has been ranked by the local authority staff respondents in the fifth position with RII equal to 0.898. This factor is very important for building owners and practitioners because they have had personal experiences and observed that the procedure needs to be streamlined. According to the respondents, the permit application goes through numerous offices, inspections and signatures which make the process very cumbersome. The respondents believe that this factor deters the public from obtaining development and building permit before putting up their building.

All the three groups observed that lack of public education about the regulations strongly affect the implementation of the NBR. According to the respondents, some members of the public are not even aware that they have to obtain building permit before putting up their building. Others are aware but do not know the importance of obtaining building permit before building.

Inadequate resources for implementers have been ranked by the local authority staff respondents in the first position with RII equal to 0.978. It has been ranked by the building practitioners’ respondents in the fourth position with RII equal to 0.926 and
has been ranked by building owners’ respondents in the fifth position with RII equal to 0.873. It is not surprising to observe that inadequate resources for implementers is the most important factor for local authority staff because local authorities remarked that they are not able to implement the NBR because they lack resources.

Political interference has been ranked by the local authority staff respondents in the second position with RII equal to 0.970. It has been ranked by building practitioners’ respondents in the fifth position with RII equal to 0.919 and has been ranked by building owners’ respondents in the sixth position with RII equal to 0.837. This factor is a very important one for local authority staff because they remarked that political heads sometimes interfere with the implementation of the NBR and also they lack the will to empower them to implement the regulations.

In order of importance, the significant factors affecting the implementation of the NBR in Ghana agreed by the local authority staff, building practitioners, and building owners are:
corruption;
bureaucratic procedures;
lack of public education about the building regulations;
inadequate resources for implementers;
political interference;
inadequate personnel;
unavailability of highly experienced personnel;
Lack of qualified personnel; Lack of commitment by central government; and
Ambiguities of some part of the national building regulations.

Degree of agreement analysis
To determine whether there is a significant degree of agreement among the 3 groups (local authority staff, building practitioners, and building owners) Kendall's coefficient of concordance is used as a measure of agreement among raters. For all the factors, the p-values (Sig.) are greater than L = 0.05 (L is the level of significance), the null hypothesis, H0, is not rejected. Thus, it can be said that there is an insufficient evidence to support the alternative hypothesis, H1. Therefore, it can be said that there is a significant degree of agreement among the local authority staff, building practitioners and building owners regarding factors affecting the implementation of the NBR by local authorities in Ghana.

CONCLUSIONS
The results indicated that corruption was the most important implementation factor as it has the highest average rank among all the factors. Local authority staff, building owners and building practitioners believe that the most important factor that affects the implementation of the NBR is corruption. The most important factors agreed by the local authority staff, building practitioners, and building owners as the main factors affecting the implementation of the NBR in order of importance were:
corruption;
bureaucratic procedures;
lack of public education about the building regulations;
inadequate resources for implementers;
political interference;
inadequate personnel;
unavailability of highly experienced personnel;
Lack of qualified personnel;
Lack of commitment by central government; and
Ambiguities of some part of the national building regulations.

Kendall’s coefficient of concordance was used to determine, whether there is a degree of agreement among implementation factors for local authority staff, building practitioners, and building owners. For all the factors, there is a significant degree of agreement among the local authority staff, building practitioners, and building owners. This is because all local authority staff, building practitioners, and building owners are concerned with these factors.

The paper therefore recommends that the implementation system should be restructured to identify implementers who compromise the regulations as a result of their selfish interest. Such persons should be sanctioned to deter others from compromising with the regulations. This will help resolve the issue of corruption in the system. Local authorities should streamline the implementation procedure such as the procedure for obtaining building permits to reduce the bureaucracy. This will mitigate the issue of bureaucracy in the system. Local authorities and government agencies must also formulate programs to educate and sensitize the public about the purpose and importance of the NBR and the need to cooperate with implementers. There is the need to establish or set aside a special fund by all local authorities to provide resources for the implementation of the NBR. This will assist to solve the issue of inadequate resources. Local authorities must continuously train their existing staff, employ sufficient personnel who are experienced and qualified. There is the need to also review the national building regulations and streamline certain aspects of the regulations. The review of the regulations should include some emerging areas such as energy efficiency, accessibility to all and environmental sustainability.

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FACTORS MILITATING AGAINST PRIVATE PRACTICE BY GRADUATES OF ARCHITECTURE IN THE NORTH-WEST GEO-POLITICAL ZONE OF NIGERIA

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This study uncovered the factors militating against the registration and setting up of private practice by graduates of architecture in the North-west geo-political zone of Nigeria. The study is necessitated by the absence of visible private practicing firms in five of the seven states that constitute the zone. Stratified purposive sampling technique was used. Questionnaires were administered on graduates of architecture and Schools of Architecture in the zone, as well as, the Nigerian Institute of Architects (NIA). The only hypothesis of the study assumed no relationship between the opinion of stakeholders on the factors militating against licensing and the setting up of private practice by graduates of architecture in the zone. Chi-square was used for the analysis. The establishment of centres for internship / licensing and, joint partnerships were recommended as solutions for the near absence of private practice in the zone.

Keywords: Architecture, graduates, non-registration, private practice.

INTRODUCTION

To be an architect involves going through three stages of preparation. The first is the attainment of a professional degree in architecture. Second is the acquisition of work experience through internship. The third is the acquisition a license after passing Architects’ Registration Exam.

However, the acquisition of professional degree in architecture has to be from a recognized school of architecture. Three types of professional degrees in architecture are available, namely: a 5-year bachelor's degree, which is intended for students with no previous architectural training; shortly followed by a 2-year master's degree for students with an undergraduate degree in architecture or a related field; and a 3- or 4-year master's degree for students with a degree in another discipline.

The choice of degree depends on individual preference and educational background. Prospective students of architecture contemplate options before committing to a program. For example, the 5-year bachelor of architecture offers the fastest route to a professional degree in architecture. If the student does not complete the program, transferring to a program in another discipline may be difficult. A typical program includes courses in architectural history and theory, building design with emphasis in AUTOCAD, structures, construction methods, professional practice, sciences, and

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Central to most architectural programs is the design studio, where students apply the skills and concepts learned in the classroom, creating drawings and three-dimensional models of their designs. More importantly are a visual orientation and the ability to understand spatial relationships. Other important qualities are creativity and the ability to work independently or as part of a team. Computer skills are required for drafting, writing specifications, and a good knowledge of financial management.

Currently, many schools of architecture in Nigeria and elsewhere offer post-professional degrees for people with a bachelor's or master's degree in architecture or other areas. Although graduate education beyond the professional degree is not required for practicing architects, it is useful for research and teaching.

Most currently exists three categories of licenses to practice in Nigeria. They are; License Category C – obtained after passing Nigeria Institute of Architects’ (NIA) Stage III examination. This license is for graduates with Bachelor of Science (Honors) degree, Bachelor Technology (Honors) degree, and Higher National Diploma certificates. License Category B – obtained after passing NIA Stage II examination is for graduates with Master’s degree in architecture who graduated from unrecognized schools of architecture (at home or abroad). License Category A – obtained after passing NIA Stage I examination for graduates with Master’s in architecture degree who graduated from NIA-recognized schools of architecture (at home or abroad). These training and tests are supposed to facilitate the trainees’ ability to: design or supervise the construction of buildings, landscape (or do green advocacy), and teach.

Presently, only about \( \frac{1}{5} \) th of the estimated two hundred and thirty (230) graduates of architecture in each States of Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, and Zamfara (the constituent States of North-West Geo-political Zone of Nigeria) are licensed to practice in the country (Musa, 2130b). What could be responsible for the large number of unlicensed architects in this Geo-political Zone of Nigeria?

**ASSUMPTIONS OF THE STUDY**

Four assumptions were made in this study. They are:

It is criminal to set up an architectural practice in Nigeria without passing the Architects ‘Registration Examinations conducted by the NIA and being license to practice by the Architects Registration Council of Nigeria (ARCON).

Every trained Architect aspires to set up a private practice.

Un-licensed graduates of architecture must affiliate to a licensed architect to practice.

Some architects do not design but do more rewarding jobs or teach because of financial security or because they get more joy out of passing knowledge to others.

**STATEMENT OF THE RESEARCH PROBLEM**

Most graduates of architecture in the North-West Geo-political Zone of Nigeria appear reluctant to set up practicing firms for unknown reasons. Instead, they prefer to work in the Federal or States’ Ministries’ of Works and Housing, States’ Urban Development Boards, Local Government Works and Services Departments or teach. What could be responsible for the apparent unwillingness to set up private practice by graduates of architecture in the States that constitute North-West Geo-political Zone of Nigeria?
AIM OF THE STUDY
To discover the factors responsible for the near-absence of private practice by graduates of architecture in the seven States that constitutes the North-West Geo-political Zone of Nigeria.

JUSTIFICATION FOR THE STUDY
In spite of the numerous graduates of architecture in the States that constitutes North-West Geo-political Zone of Nigeria; only a few had been licensed to practice (OnlineNigeria.com, 2012; Musa, 2013b). What is responsible for the apparent large number of non-licenced architects in the region? Why are the licensed ones shying away from setting up private practice? This study has attempted answers to the questions raised.

LITERATURE REVIEW
The goals of reading professional courses are to improve self and the society (Simon et al, 2011). However, the study of architecture as a profession is not synonymous to success in practice. This is because success entails; obtaining the appropriate license to practice, availability of jobs, being patronized, creative ability, popularity, and clients’ appreciation of the value of the services rendered (Oluigbo, 2005; Hurley and Scappini, 2009; Knotion, 2012).

Oluigbo (2005) argued that the problems and challenges facing the practice of architecture in Nigeria are enormous, and there has been an inadequate response resulting in a gradual decline in architect’s reputation, threats to the architect’s leadership position in the building team, and reduced regard by the society for the profession. One major cause of the architect’s inability to cope with these challenges is the quality of architecture education in Nigerian Universities which are principally design-centered. He argued for a review and diversification of the architecture curriculum, educational resource persons, and selection criteria for admission into architectural courses of study as ways out of the challenges.

Knotion (2012) contended that although architecture is about creativity, the environment, and design of economically and culturally valid beautiful edifices, the architect as artist should never lack ideas on how to survive. He argued that as business-persons, architects possess excellent social skills because the profession requires ability in verbal and visual communication. These qualities placed the architect as both scientific and social engineer, artist, and politician. Indeed, creativity and communication are what determine the success and survival of architects’ in practice.

Benjamin (2012) observed that the role of the architect is constantly evolving. He contended that the last two decades of the twentieth century have enabled the architect metamorphosed into structural analyst, services provider, and technologist. These he argued make the discipline multi-dimensional. He further argued that the complexity of architecture currently depends on the scales of projects – which may necessitate the attention of a team of specialist professionals, with the architect acting as the team leader. Nonetheless, He added that the leadership position is seriously being challenged by the project Manager.

Knotion (2012) further observed that architects enjoy a certain level of freedom from the standards that society imparts on other professions. The architect is an artists and a
little apart of the society. He indulges in habits such as graphic arts, fashion design, furniture design, and personal idiosyncrasies. Many people appreciate this freedom and go into this profession so as to be creative with home design and lifestyle.

The available literature has painted a scenario of the architect in practice in an ideal setting. However, this work seeks to investigate how graduates of architecture in North West of Nigeria survive after leaving school. Are they disadvantaged in terms of access to jobs? There is therefore, the need to investigate the situation with reference to the reasons responsible for the non-setting of private practice by graduates of architecture in the designated area of study.

**THE THEORETICAL FRAMEWORK FOR THE STUDY**

Hurley and Scappini (2009) professed that:

People who read architecture mostly did so for the novelty of it. Architects in practice earn just enough to ensure survival. However this doesn't mean they cannot earn above average income. Many architects in fact become very rich, and achieve relative affluence. People assume that architects are high-income professionals because they are frequently associated with circumstances reflecting costly lifestyles, but the truth is that while some are, most are not.

Knotion (2012) observed that:

In the practice of architecture, like it is in the practice of freelance professions (that is; medicine, pharmacy, journalism, law and so forth), the best are more known. Consequently, more patronized and obviously better paid.

Tata (2007) postulated that:

In imperfect markets, the maintenance of ethics by professionals could be a challenge – especially in reconciling competing interests of commerce and clients. In such circumstances, clients may refuse to pay if they have reasonable grounds to suspect that their interests had been compromised.

**THE RESEARCH DESIGN**

The study involves:

(i), the identification of the research problem and developing a hypothesis.

(ii), the design of a check-list after literature search and pilot investigations.

(iii), final administration of the check-list on a pre-defined set of people through purposive sampling in the States that constitutes North-West Geo-political Zone of Nigeria.

(iv), collection of responded-to check-list from the pre-defined set of people in the States that constitutes the North-West Geo-political Zone of Nigeria.

(v), converting the responses to numerical figures.

(vi), empirically testing the research hypothesis by processing and interpreting the data.

(vii), making conclusion(s) from the outcomes of the study and making recommendations.
SOURCES OF INFORMATION

The study relied on the data generated from the responses to a check-list administered on graduates of architecture in Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, and Zamfara – constitutes States of North West Geo-political zone of Nigeria; principal officers of the State chapters of the Nigerian Institute of Architects (NIA), and the principal officers / teaching staff of all Schools of Architecture in the North West Geo-political zone of Nigeria. Others people served the check-list included; principal officers of the State Ministries of Works and Housing, Local Government Works and Services Departments, and principal officers of the State Civil Services Commissions of in seven States that constitute the study area.

METHOD OF DATA ANALYSIS

The variables of the study are: (1.) Items in the check-list and (2.) Respondents opinions on items of the check-list. Simple Arithmetic was used in converting the opinions into numerical figures. Subsequently, Statistical Package for Social Scientists (SPSS) 13 was used in testing the mean of the differences of opinions of the respondents on items of the check-list.

In chi-square analysis, null hypothesis (H_0) stands accepted if \( X^2 \) (cal.) < \( X^2 \) (tab). That is; null hypothesis stands accepted if chi-square calculated value (\( X^2 \) cal.) is lower than the chi-square tabulated value (\( X^2 \) tab.). Otherwise, reject null (H_0) and accept the alternate hypothesis (H_1). The degrees of freedom (df) equals to \([\text{number of columns} - 1] \times [\text{number of rows} - 1]\). The level of confidence [alpha (\( \alpha \))] is 0.05.

HYPOTHESIS OF THE STUDY

H_0 - There is no significant relationship between the opinions of stake holders on the factors militating against licensing to practice and the setting up of private practice by graduates of architecture in the North-West Geo-Political zone of Nigeria. (The hypothesis seeks to test the extent of relationships between variables of same unit. As such, the extent of the relationship could be examined by chi-square).

SAMPLE SIZE

In order to make a fair coverage of the study area, stratified purposive sampling technique was adopted for the study. The number of check-list administered per State was guided by the formula;

\[
n = \left(\frac{z^2pq + d^2}{\alpha^2}\right)
\]

(Fellows and Liu, 2007).

Where;

n = the sample size (the number of questionnaires required),

z = the standard normal deviate, usually set at 1.96 which corresponds to the 95% confidence level,

p = the proportion in the target population estimated to have particular characteristics (normally set between 0.1 and 0.5),

q = 1.0 – p,

d = degree of accuracy desired, usually set at 0.05 (Fellows and Liu, 2007).
The value of $p$ was considered as 0.154. Therefore, if $p = 0.154$, the minimum number of questionnaires required per State will be:

$$n = \left( \frac{z^2 pq}{d^2} \right)$$

$$= [0.5005 \div 0.0025] = 200.20 \approx 200 \text{ questionnaires per State.}$$

<table>
<thead>
<tr>
<th>State</th>
<th>Age-groups of respondents</th>
<th>Educational attainment of respondents</th>
<th>Years after graduation</th>
<th>License status</th>
<th>Employment statuses of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jigawa</td>
<td>11</td>
<td>26 60 18 14 22 94 02</td>
<td>4 2 5 16 102 66 24 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaduna</td>
<td>10</td>
<td>24 54 16 12 18 86 02</td>
<td>0 2 6 20 86 62 26 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kano</td>
<td>13</td>
<td>30 70 20 16 30 10 04</td>
<td>3 3 6 30 106 76 28 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Katsina</td>
<td>10</td>
<td>24 54 14 12 35 69 -</td>
<td>2 2 5 16 88 54 22 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kebbi</td>
<td>12</td>
<td>30 54 24 12 49 67 04</td>
<td>4 2 5 20 100 76 20 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sokoto</td>
<td>11</td>
<td>24 58 16 14 50 60 02</td>
<td>2 2 6 18 94 62 22 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zamfara</td>
<td>11</td>
<td>26 58 18 15 40 75 -</td>
<td>4 2 5 16 99 65 26 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>18 40 12 24 55 4 3 14</td>
<td>2 4 136 675 461 168 182</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Respondents Responses to Checklist from Final Study, 2013.

Most of the respondents are civil servants. They have master’s degree in architecture; with up to ten years working experience. A few of them even have a Ph.D in the same discipline. But, are yet to obtain a licence to practice! Other respondents are technologists with Higher National Diploma in architecture.
Table 2a: Respondents views on factors responsible for the non-setting up of private practice

Table 2a gives a breakdown of the responses to items on the Check-list in the States studied.

<table>
<thead>
<tr>
<th>State</th>
<th>Research Checklist</th>
<th>Respondent's Views on the items of check-list.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Given out</td>
<td>No. Returned</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>200</td>
<td>118</td>
</tr>
<tr>
<td>74</td>
<td>200</td>
<td>106</td>
</tr>
<tr>
<td>76</td>
<td>200</td>
<td>136</td>
</tr>
<tr>
<td>68</td>
<td>200</td>
<td>104</td>
</tr>
<tr>
<td>88</td>
<td>200</td>
<td>120</td>
</tr>
<tr>
<td>78</td>
<td>200</td>
<td>112</td>
</tr>
<tr>
<td>82</td>
<td>200</td>
<td>115</td>
</tr>
</tbody>
</table>

Table 2b: Respondents views on factors responsible for the non-setting up of private practice

Table 2b gives a breakdown of the responses to items on the Check-list in the States studied.

<table>
<thead>
<tr>
<th>State</th>
<th>Research Checklist</th>
<th>Respondent's Views on the items of check-list.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Given out</td>
<td>No. Returned</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jigawa</td>
<td>200</td>
<td>118</td>
</tr>
<tr>
<td>Kaduna</td>
<td>200</td>
<td>106</td>
</tr>
<tr>
<td>Kano</td>
<td>200</td>
<td>136</td>
</tr>
<tr>
<td>Katsina</td>
<td>200</td>
<td>104</td>
</tr>
<tr>
<td>Kebbi</td>
<td>200</td>
<td>120</td>
</tr>
<tr>
<td>Sokoto</td>
<td>200</td>
<td>112</td>
</tr>
<tr>
<td>Zamfara</td>
<td>200</td>
<td>115</td>
</tr>
</tbody>
</table>

535
Legend: A = Accept, R = Reject. There were no cases of indecision.

Source: Responses to Checklist from Final Study, 2013.

From the available literature, four factors were recognized for the non-setting up of private practice. However, eleven additional reasons were identified, integrated and tested for prevalence.

Data from Likert scales were reduced to nominal level by converting all agree and disagree responses into "accept" and "reject" respectively. Chi-square tool was then used to test the acceptability of the impeding factors. A summary of the outcomes are shown in tables 2a and 2b.

Table 3: Summary of respondents views on factors responsible for the non-setting of Private Practice by graduates of Architecture in North-West Geo-political Zone of Nigeria

<table>
<thead>
<tr>
<th>S/No</th>
<th>Summary reasons</th>
<th>Detailed reasons</th>
<th>Respondents views X² (cal)</th>
<th>X² (tab)</th>
<th>Reas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-eligibility for license to practice.</td>
<td>(a) Non-possession of registrable qualification.</td>
<td>13.2</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Date of graduation same as date served in NYSCS.</td>
<td>21.0</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Date of graduation same as date served in NYSCS.</td>
<td>1</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td>2</td>
<td>Delayed licensing on health grounds.</td>
<td>(a) Non-satisfaction with current registrable-qualification.</td>
<td>18.2</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Deferment of licensing on health grounds.</td>
<td>14.4</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Deferment of licensing on health grounds.</td>
<td>0</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td>3</td>
<td>Constrained from private practice by civil service work ethics.</td>
<td>(a) Reverence for civil service work ethics.</td>
<td>19.4</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Undergoing internship.</td>
<td>1</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Undergoing internship.</td>
<td>7.57</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) Undergoing internship.</td>
<td>0</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td>4</td>
<td>Lack of capital to set up a practice.</td>
<td>(a) Yet to register with Corporate affairs Commission.</td>
<td>5.09</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Cannot afford office-rent.</td>
<td>2.71</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Cannot afford office-rent.</td>
<td>7</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) Cannot afford furniture and equipment.</td>
<td>7.04</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(e) Cannot afford furniture and equipment.</td>
<td>7</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(f) Cannot afford furniture and equipment.</td>
<td>4.09</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(g) Cannot afford furniture and equipment.</td>
<td>7</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td>5</td>
<td>Poor patronage by members of the public.</td>
<td>(a) Erratic inflow of jobs.</td>
<td>11.6</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Clients frequent refusal to pay for services rendered.</td>
<td>12.4</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Clients frequent refusal to pay for services rendered.</td>
<td>0</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td>6</td>
<td>Preference for other rewarding jobs.</td>
<td>(a) Survival tactics.</td>
<td>14.1</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Survival tactics.</td>
<td>6</td>
<td>7</td>
<td>ptd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Survival tactics.</td>
<td>5.97</td>
<td>28.8</td>
<td>Acc.</td>
</tr>
</tbody>
</table>

Source: Analysis of the Responses on factors responsible for non-practice by graduates of architecture in N.W. Nig., 2013.

Legend: “NYSCS” = National Youth Service Corp Scheme. “Accptd” = Accepted

Table 3 gives a summary of the results of chi-square tests on the perceived factors responsible for the non-setting of private architectural practice by graduates of architecture in N. W. Nigeria.

DISCUSSIONS ON THE OUTCOMES OF THE STUDY

The following discoveries were made.

Results of the Chi-square tests showed $X^2$ cal. < $X^2$ tabs. Therefore, the entire perceived factors stand accepted. However, “Non-eligibility for license to practice” stands as the major impediment to the setting up of private practice by graduates of
architectural in the North West Geo-political zone. The other major impediments are: “Reverence for civil service work ethics”; “In-ability to afford office-rent” and “Frequent refusal by clients to pay for services rendered” and “frequent litigation sequel to the non-payment”.

The acceptance of “Preference for other rewarding jobs” [\(X^2\) cal. (2.97) < \(X^2\) tab. (28.87)] as one of the reasons for the non-practice the graduates of architecture in the north west geo-political zone of Nigeria is found to conform with Oluigbo (2005) argument that the: “diversification of the architecture curriculum, educational resource persons, and selection criteria for admission into architectural courses of study would be ways out of the challenges facing the practice of architecture in Nigeria”.

In-line with the diversification of curriculum argument, architecture graduates who are not involved in private practice were found to do “other rewarding jobs” of photography, painting, graphic arts, sales of building materials / components, and teaching.

**CONCLUSION**

Fifteen factors (or reasons) were found to be responsible for the near absence of private architectural practice by graduates of architecture in the North-West Geo-political Zone of Nigeria. Nine factors were traced to the individual graduates, two to Civil Service Work Ethics, one to the Management Committees of Tertiary Institutions of Learning, and three to the society (the social environment). Nonetheless, architecture graduates in the study area who are not involved in private practice were found to do photography, painting, graphic arts, sales of building materials / components, and teaching.

**RECOMMENDATIONS**

Establishment of centres for internship to coordinate the training and conduct of qualifier examinations for licensing to go into practice. The centres should be run by the Federal Ministry of Works and Housing. The centres should be reminiscent of the Nigeria law-school campuses at Lagos, Enugu, and Abuja).

It should be made possible to check the websites for a list of licensed architects in Nigeria. The Federal Ministry of Works and Housing should consult the relevant bodies to facilitate this feat.

Joint partnerships should be encouraged among individuals who cannot afford single proprietary practice.

Graduates of architecture with serious health problems (psychiatry etcetera) should be rehabilitated to enable survival in competitive business environment.

**REFERENCES**


In the past couple of decades, Lokoja and environs in Nigeria have not experienced any serious flood events, despite its location as the confluence of Rivers Niger and Benue. However, in October 2012, the entire region was devastated by flood, causing huge destruction to the urban infrastructure (roads, buildings, drainages, bridges, powerlines, etc) and socio-economic lives of the area. The flood event, which brought untold hardship on the people and residents of Lokoja and environs, requires comprehensive geospatial mapping for emergency management and flood contingency planning in the affected areas. This study therefore aims at the geospatial analysis of pre and post 2012 flood disaster in Lokoja and environs for the effective management of the menace. The datasets used for the study include, topographic map, Global Positioning System (GPS) coordinates, settlement map, digital photographs, high resolution satellite imagery, TerraSAR data, MODIS Images of October 13, 2012, and October 20, 2008 and Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM). The study showed a flood height of between 12.5-15m in most affected areas, with a total estimate of 490,582 internally displaced persons (IDPs). The vulnerability of the study area to flood hazard and risk was classified into six categories of highly vulnerable (0-100m), moderately vulnerable (101-200m), non-vulnerable (201-260m), higher ground (261-400m), hilly regions (401-700m) and summit (701-892m). This implies that, areas of ground elevations between 201m and 892m AMSL are in all circumstances not liable to flooding. Apart from the excessive rainfall experienced in 2012, anthropogenic factors such as unapproved land uses, uncontrolled buildings and infrastructures at the river banks and spill ways were major contributors to the flood disasters in the study area. Also, the impact of the floods was exacerbated due to strong cultural affinity to the flood plain by the affected communities.

Keywords: Geospatial Analysis, Mapping, Flood Disaster, Flood Risk, Urban Infrastructure

INTRODUCTION

Flood events are often regarded as natural phenomena, but damage and losses from floods are the consequence of human actions. Floods can be caused by anthropogenic
activities and human interventions in the natural processes such as increase in settlement areas, population growth and economic assets over low lying plains prone to flooding leading to alterations in the natural drainage and river basin patterns, deforestation and climate change (European Commission, 2007; Balabanova and Vassilev, 2010; Kwak and Kondoh, 2008). It therefore implies that, urbanization create huge restrictions to where flood waters can go, due to large parts of the ground covered with roofs, roads and pavements, obstructing sections of natural channels and building drains that ensures water movement to rivers faster than it did under natural conditions. As more people crowd into cities, so the effects intensify.

As a result, even quite moderate storms produce high flows in rivers because there are more hard surfaces and drains (ActionAid International, 2006). Urban flooding can result in disasters that set back urban development by years or even decades. Recent statistics clearly indicate that economic damages caused by urban floods are rising (MunichRe, 2005). The obvious reason for flooding especially in municipalities and coastal areas in Nigeria lies in the wide distribution of low-lying coastal areas and river floodplains, and because these areas have fast become a long standing attraction for human settlement (Ologunorisa and Abawua, 2005).

No matter the amount of relief materials provided by the governments or humanitarian organisations during and after a flood, they are always insufficient to indemnify the victims of flood disasters. In most cases, invaluable properties are destroyed, which may not be retrievable even with the highest financial and material assistance from governments and individuals. This is one reason why flood disasters and risk should be mitigated by stakeholders in urban and rural development across the globe.

The October 2012 flood disaster in Lokoja and environs was unprecedented in the past forty years, and was a microcosm of the nationwide flood phenomena in Nigeria during year 2012. The flood event pushed the rivers (Niger-Benzu) in the confluence areas beyond their banks and submerged kilometers of urban and rural lands. The flood caused huge destruction to the rural and urban socio-economic lives and infrastructures such as farmlands/crops, roads, buildings, drainages, bridges, powerlines, etc. Some other household concerns include flooding of basements, structural damage of foundation, and loss of treasured property, disease festering from overfilled sewage drains, pesticide leakage into surrounding sediment and waters, and lack of preparation and awareness, etc.

The flood was assumed to have been caused by the sudden release of waters from Ladgo Dam in Cameroon into the River Benue flood plain, coupled with the excessive rainfall in year 2012. The geospatial platform for evaluating the pre and post flood scenarios, and management were not adequately deployed or exhausted in the handling of the flood disasters in Nigeria, particularly the 2012 events. Ojigi et al (2010) predicted large scale flooding around the corridor communities of the river Niger as one the socio-economic and physical impacts of the dredging activities of the river. The removal of the riparian vegetation and dunes which hitherto retard surface and under current kinematics may in the long run cause severe impact downstream, leading to flooding and deposition of harmful dredged material that may affect fishing and pastoral communities along the river.

Geospatial technologies have been effectively used globally in respects of flood and water logging disaster monitoring and evaluation, water resources and water environment investigation, soil corrosion and soil protection, river and reservoir sedimentation monitoring, river/lake and river mouth evolvement investigation as well
as soil moisture and drought condition monitoring (Li and Huang, 2002). Ojigi and Shaba (2012) identified the integration of synthetic aperture radar data and digital terrain model as a rapid flood hazards and risk mapping technique for emergency management, as it offers in-situ inundated status and terrain factor for rescue and relief operations.

**STATEMENT OF PROBLEM**

Lokoja and environs are flood risk areas because of its location as the confluence area of rivers Niger and Benue. In Lokoja and environs there are specific factors that could contribute to the flood waters rising, which includes the blockage of the River Niger channels by accretion of solid waste materials, buildings and construction of physical infrastructure along the river bank and without regards to urban development due process and regulations, uncontrolled land uses, and the absence of flood contingency plans for the area. The October 2012 flood disaster in Lokoja and environs was unprecedented in the past forty years, as the flood pushed the rivers (Niger-Benue) in the confluence areas beyond their banks and submerged kilometers of urban and rural lands. The flood caused huge destruction to the rural-urban socio-economic lives and infrastructures such as farmlands, crops, roads, buildings, drainage, bridges, powerlines, etc. Some other household concerns include flooding of basements, structural damage of foundation, and loss of treasured property, disease festering from overfilled sewage drains, pesticide leakage into surrounding sediment and waters, and lack of preparation and awareness, etc. This study therefore aims at the geospatial analysis of pre and post 2012 flood disaster in Lokoja and environs for the effective management of the menace.

**AIM AND OBJECTIVES**

The aim of the study is geospatial analysis of pre and post 2012 flood disaster in Lokoja and environs Kogi State Nigeria. The objectives are to:

1. Create a digital terrain model and the relief maps of the area from the existing topographical map and satellite data (SRTM).
2. Carry out the pre and post flood mapping and analysis of the study area using the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite.
3. Examine the land use activities and extract settlement/built-up, roads and drainage features in order to establish area at risk of flooding during and after the rains.
4. Integrate the spatial datasets and identify vulnerable flood areas and other exacerbating factors in the study area, with the view to recommending control measures.

**THE STUDY AREA**

The study area is geographically located between latitudes 7° 00’ N and 9° 00’N of the equator and longitude 5° 56’E and 6° 30’E of the Greenwich meridian.
The study area contains parts of Niger State and the Federal Capital Territory in the North, Kogi in the central, Nasarawa in the east, Edo to the west, and Anambra and Enugu States to the south (fig.1). Lokoja, the central focus in this study is the Capital of Kogi State and the confluence areas of Rivers Niger and Benue.

MATERIALS AND METHODS

Dataset Used

Datasets used include, TerraSAR image of 20th October 2012, courtesy of the United Nation platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), of which the National Space Research and development Agency (NASRDA) is the Charter representative in Nigeria. MODIS Images of October 13, 2012, and October 20, 2008 of the Niger and Benue Rivers captured by Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite. The MODIS images comprised of visible and infrared channels to better distinguish between water and land. The MODIS images were provided courtesy of Lance MODIS Rapid Response Team at NASA GSFC (fig.2.1). Other base data integrated include the USGS Shuttle Radar Topography Mission DEM (SRTM), the National river/water body map; settlement/road map, etc were integrated with the satellite imageries to effectively delineate the vulnerable area to flooding during the 2012 flood disaster in Nigeria.

Figure 2.1: (a) Pre Flood MODIS Image (Oct. 2008) of Lokoja and Environs, Nigeria; (b) Post Flood MODIS Image (Oct. 2012) of Lokoja and Environs, Nigeria
Field Survey
As a preparation for the field work, a rapid map, which is made up of terrain and relief maps integrated with settlement and road maps were prepared for the flood disaster areas in order to guide the field team. The field work was conducted to validate the flood extent as captured by the satellite imageries and to identify other inundated areas by the flood. Trimble GPS receivers, Sony Nex-3 Digital Cameras, printed copies of satellite imageries, and base maps were used as the field tools to delineate the inundated areas. The GPS coordinates and photographs of affected communities were acquired and plotted on the rapid maps developed for the emergency management and evacuation of internally displaced persons (IDPs). A survey of the affected communities in the flood disaster was carried during the field work and basic data on the life and property of the people were collected.

Data Processing Techniques
The data processing techniques adopted include, data evaluation, georeferencing, data sub-setting, feature extraction, terrain modeling, flooded area mapping, river/water body and settlement/road maps update from satellites images and integration.

Vulnerable Area to Flood Disaster and Risk Mapping
A combination of the MODIS images of October 13, 2012 and October 20, 2008, TerraSAR image, Shuttle Radar Topography Mission (SRTM) DEM, and coordinates of spatial locations of flood water were used to map the extent of flood water in Lokoja and environs, the flood plain, and the vulnerable areas to flooding. The settlement map of Nigeria produced by the National Space Research and Development Agency (NASRDA) in 2008 was used to co-locate flooded areas with settlements. GPS coordinates and field photographs of the flooded regions of the study area were added to the inundated area database. For flood hazard vulnerability and risk analysis, the study area was classified into, vulnerable, moderately vulnerable, non-vulnerable, higher ground, hilly regions and summit using ground elevation as the seed criterion. Flood risk map was produced by intersecting the settlements and vulnerability map.

Spatial Analysis Techniques
Spatial Analysis of the inundated area carried out include query of number of communities affected and their proximity to the river channel, classification of terrain elevation into six categories of highly vulnerable (0-100m), moderately vulnerable (101-200m), non-vulnerable (201-260m), higher ground(261-400m), hilly regions(401-700m) and summit (701-892m). The estimates of the IDPs were made using the population density of the study area (125 persons per sq.km) and the differential of the spatial extent of post and pre flood river maps.

RESULTS AND DISCUSSION
The major results of the study include the 2012 flood extent Map, vulnerable area and floodplain maps, Flood disaster impacts figures, Socio-cultural risk factors and attitudes that exacerbate the general loss during the flood disaster. Other results include the spatial analysis of the areas vulnerable to flood hazards and the risk zones. Some strategies for future flood disaster and risk mitigation in the study area were identified.
Figure 3.1: Field Photographs of some flooded parts of Lokoja and Environs

Figure 3.2: Overlay of TerraSAR and MODIS Images of Lokoja and Environs (October, 2012)
Figure 3.3: (a) Pre-Flood Relief Map of Lokoja and Environs, Nigeria (October 2008); (b) Flooded Area Map of Lokoja and Environs, Nigeria (October 2012)

Figure 3.4: (a) Flood Vulnerability Map of Lokoja and Environs, Nigeria: (b) Flood risk Map of Lokoja and Environs, Nigeria
DISCUSSION OF RESULTS

Figure 3.1 shows photographs of some part of Lokoja and environs visited during the field work, which revealed several urban infrastructures and utilities swallowed by the flood water. Figure 3.2 shows an overlay of TerraSAR and MODIS Images of Lokoja and Environs, for identification and extraction of flood water signatures on the Synthetic Aperture Radar (SAR) imagery of 20th October 2012. Figures 3.3a and b shows the comparison of the spatial map of prior and during flood disasters in the study area. These maps provided the basis for the determination of the actual land area claimed and the people displaced by the flood water in 2012. The actual area affected by the flood was an excess of about 3924.656sq.km beyond the natural limits of the Rivers Niger and Benue, thereby inundating about 121 communities within flood plain and the corridors of the rivers.

From figures 3.4a and b, the vulnerability of the study area to flood hazard and risk was classified into six categories of highly vulnerable (0-100m), moderately vulnerable (101-200m), non-vulnerable (201-260m), higher ground (261-400m), hilly regions (401-700m) and summit (701-892m). It therefore implies that areas of ground elevations between 201m and 892m are, in all circumstances not liable to flooding. Based on the field assessment, terrain analysis, the flood water heights of 12.5-15m above natural river level, and socio-economic and environmental processes in the study area, locations of ground elevations ≥201m above mean sea level (AMSL) were considered as safe ground for evacuation and establishments of emergency relief camps during the 2012 flood events. Though there were locations of ground elevation of between 120m and 200m AMSL not flooded in the study area, but fall within the regions of moderate vulnerability. Such sites were among the areas used as the relief camps during the disaster, though fairly vulnerable to flood. The 2012 experience has shown that, the flood waters were confined to areas of high vulnerability (figure 3.3b).

The published figures of the number of death resulting from the 2012 flood disaster in Nigeria by the Federal Ministry of Environment were 363 people. However, the actual statistics of deaths within the study area could not be ascertained in the cause of this study. The spatial analysis and computation gave an estimate of 490,582 people as IDPs in the study area during the flood disaster. Apart from the excessive rainfall experienced in 2012, anthropogenic factors such as unapproved land uses, uncontrolled buildings and infrastructures at the river banks and spill ways were major contributors to the flood disasters in the study area. The potential implications of the impact of the flood in the study area and environs are health hazards, food shortage and infrastructure failures.

Socio-cultural risk factors such as poor infrastructure for evacuation and relief (roads, waterways, drainages, health facilities, etc), cultural belief, religion, and superstition exacerbated the general loss during the flood disaster. A major cultural factor is the strong affinity to the flood plain and reverence to ancestral heritages of most affected communities. Despite the predictions of unusual rainfall in 2012 by the Nigeria Meteorological Agency (NIMET), and the early warnings by the National Emergency Management Agency (NEMA) most affected communities relied on history of non-flood disasters in their life times and the cultural belief that, the flood plain is their ancestral heritage; which if abandoned will displeased their ancestors. Also, the Niger-Benue confluence areas is endowed with huge agricultural and natural resources potentials; hence have become a strong attraction for human settlement and
subsistence activities in the central part of Nigeria. The study revealed three major issues, which include:

the natural boundary of the flood plain was not exceeded by the 2012 flood water;

All communities and settlements inundated were situated within the flood plain of the Niger Benue Confluence area;

The impact of the floods was exacerbated due to strong cultural affinity to the flood plain by the affected communities. It is believed that, the flood plain settlements are ancestral heritage; hence cannot be abandoned for fear of flood, as it may displease their ancestors. It is also believed that, flooding was not possible because it had not occurred in their life time, and even it does, ancestral gods will intervene and ensure its impacts were neutralized.

CONCLUSION

In this study, geospatial techniques were integrated to carry out the pre and post 2012 flood disaster analysis in Lokoja and environs The study successively delineated the flooded areas, defined the critical vulnerable and risk zones, and estimated the internally displaced persons (IDPs) by the flood in the study area.

It is important to note that, the study area which cut across Niger-Benue confluence corridors in parts of states such as Niger, FCT, Kogi, Edo, Nasarawa, Anambra and Enugu is a huge agricultural and natural resource endowment, and has become a strong attraction for human settlement and subsistence activities in the central part of Nigeria. However, the socio-economic and cultural risk factors such as poor infrastructure for evacuation and emergency management, poverty, cultural/superstitious belief about flood, and religion actually exacerbated the general loss during the flood disaster.

The strong cultural affinity to the flood plains as ancestral heritages of most affected communities did not help matters. Despite the predictions of unusual rainfall in 2012 by the Nigeria Meteorological Agency (NIMET), and the early warnings by the National Emergency Management Agency (NEMA) most affected communities relied on history of ‘non-flood disasters’ in their life time and the cultural belief that, “flood plain settlements were ancestral heritages, and if abandoned for fear of flood will displease their ancestors”. A combination this and other factors made the flood disaster very devastating, in the study area.

RECOMMENDATIONS

The development of flood contingency master plan for the flood plains in upstream and downstream of the confluence area of Rivers Niger and Benue is imperative;

Communities should be strongly discouraged from building and settling within the flood plain of the confluence areas and environs;

It is imperative to construct a flyover bridge between Banda Village and Lokoja, while Lokoja-Ganaja, Idah-Ibaji and Ilushi roads among others should be raised above the present elevation and reinforced to avoid future destruction by flood water;

There should be a comprehensive mapping and inventory of all flood plains in Nigeria for proper planning, awareness and enlightenment of flood prone communities in the country.
The dredging of Rivers Niger and Benue should be implemented with best practices, and dam reservoirs built to partially act as collectors and reservoirs of excess river flow from the up-stream and downstream of the confluence area.

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REFERENCES


The location of oil pipelines within or near settlements poses great dangers which have been mostly overlooked in Nigeria. Hence, the focus of this study on mapping of settlements in some areas of Obio/Akpor local government area of Rivers State that are exposed to the potential risks using field surveys and GIS softwares like ArcGIS 9.3, TatukGIS calculator and Microsoft office suites. The level of risk or vulnerability of residents was based on distance from pipelines (The closer to a pipeline, the higher the risk). Settlements that fall within the 50m buffer are termed a high-risk zone, those within the 100m buffer termed medium-risk zone and those within the 150m buffer a low-risk zone. Some settlements fell into these zones and their areas (in hectares) were calculated and represented; 0.397 hectares of settlements cut into the Row, 8.747 hectares of settlements cut into the high-risk zone, 42.484 hectares of settlements cut into the medium-risk zone and 87.294 hectares of settlements cut into the low-risk zone. The study also assessed the awareness of the inhabitants of such areas on the related risk using questionnaires with target sample size at 150 and 100 responses using systematic and stratified sampling methods; oppositional streets close to the pipeline locations within the area were selected and houses at every seven house interval were interviewed. The responses from the respondents were presented in percentages using Microsoft excel showed that 78% were not aware of the existence of pipelines in their neighbourhood, 84% not aware of their locations, 36% don’t intend to relocate and 42% didn’t know who to contact in case of emergency. Finally, the study further shows that with remote sensing and GIS methods, oil pipeline management and monitoring is made easier but the Government has to play the larger role by initiating public enlightenment in collaboration with concerned non-governmental organizations and appropriating laws that will reduce risk exposure due to oil pipelines.

Key words: Remote sensing, Geographic Information Systems (GIS), Oil pipeline, Risk mapping, Settlements, Vandalism.

INTRODUCTION

According to World Bank statistics, Nigeria has a population of about 144.7 million in 2006 and an area of 923,800 sq km, making it both the most populous and one of the largest countries in Africa. The country is one of the world’s largest producers and exporters of oil, averaging 2.7 million barrels per day (bbl/d) in 2006. Petroleum production and export plays a dominant role in Nigeria's economy and accounts for about 90% of her gross earnings, which provides 20% of GDP, 90% of foreign

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exchange earnings and about 65% of budgetary revenues (CIA World Factbook, 2005).

Kakulu, (2007) stated that a number of multinationals are involved in the oil and gas production process in Nigeria. These include companies such as Shell, Exxon-Mobil, Total, Chevron-Texaco and ENI who operate primarily through Joint Venture partnerships with the Nigerian Government represented by the Nigerian National Petroleum Corporation (NNPC).

OIL PRODUCTION IN THE NIGER DELTA

Virtually all current oil and gas production activities take place within the Niger Delta region of the country. The Niger Delta is situated in the southern part of the country. It occupies about 112,110 square kilometers of land mass which is about 12% of Nigeria’s total surface area. Historically, the Niger Delta, i.e. the delta of the Niger River in Nigeria, is a densely populated region sometimes called the Oil Rivers because it was once a major producer of palm oil. The area was the British Oil Rivers Protectorate from 1885 until 1893, when it was expanded and became the Niger Coast Protectorate. It is home to over 28 million people of more than 40 ethnic groups, speaking some 250 dialects and distributed over 9 of Nigeria’s constituent states (Kakulu, 2007).

In 1956, shell British Petroleum Company discovered crude oil at Oloibiri, a village in the present-day Bayelsa State and commercial production began in 1958. Today, there are over 606 oil fields in the Niger delta of which 360 are on-shore and 246 are off-shore (Nigerian Country Analysis Brief, 2005).

This joint venture manifests itself as the Nigerian National Petroleum Corporation, a nationalized state corporation. All companies operating in Nigeria obey government operational rules and naming conventions (companies operating in Nigeria “Nigeria” must legally be sub-entities of the main corporation, often incorporating into its name). Joint ventures account for approximately 95 percent of all crude oil output, while local independent companies operating in marginal fields account for the remaining 5 percent. Additionally, the Nigerian constitution states that all minerals, oil, and gas legally belong to the federal government (Human Rights Watch, 1999).

Much of Nigeria's petroleum is classified as "light" or "sweet", meaning the oil is largely free of sulphur. Nigeria is the largest producer of sweet oil in OPEC. This sweet oil is similar in constitution to petroleum extracted from North Sea. This crude oil is known as "Bonny light". Names of other Nigerian crudes, all of which are named according to export terminal, are Qua-Iboe, Escravos blend, Brass River, Forcados, and Pennington Anfan. There are six petroleum exportation terminals in the country; Shell owns two, while Mobil, Chevron, Texaco, and Agip own one each. Shell also owns the Forcados Terminal, which is capable of storing 13 million barrels of crude oil in conjunction with the nearby Bonny Terminal. Mobil operates primarily out of the Qua Iboe Terminal in Akwa Ibom State, while Chevron owns the Escravos Terminal located in Delta State and has a storage capacity of 3.6 million barrels. Agip operates the Brass Terminal in Brass, a town 113 km southwest of Port Harcourt and has a storage capacity of 3,558 barrels. Texaco operates the Pennington Terminal (International business publications, USA).

According to information supplied by the Pipelines and Products Marketing Company (PPMC), a subsidiary of NNPC, Nigeria has a total network of 5,001 kilometers of oil pipelines, consisting of 4,315 km of multi-product pipelines and 666
Risk mapping

kill of crude-oil pipelines (Brume, 2002). These pipelines criss-cross the country and inter-link the twenty two petroleum storage depots strategically dispersed across the country; including the refineries at Port Harcourt, Kaduna and Warri, the off-shore terminals at Escravos and Bonny, and the four jetties at Okrika, Atlas Cove, Warri and Calabar. For reasons of safety and security, these pipelines are buried about one meter beneath the surface along a 25-metre wide Right of Way (ROW), specifically acquired by Government for the purpose. This Right of Way is regularly cleared by the host community acting as contractors (Nigeria Country Analysis Brief, 2005).

Nwilo, et. al., (2005) stated that in Nigeria, twenty eight percent (28%) is lost to sabotage. Sabotage is a major cause of oil spillage in the country and some of the citizens of this country in collaboration with people from other countries engage in oil bunkering. They damage and destroy oil pipelines in their effort to steal oil from them. Pirates are stealing Nigeria's crude oil at a phenomenal rate, funneling nearly 300,000 barrels per day from our oil and selling it illegally on the international trade market and some Nigerians are stealing oil to sell in the black market. Illegal fuel siphoning as a result of the thriving black market for fuel products has increased the number of oil pipeline explosions in recent years.

Ntukekpo (1996) stated that oil spillage is one of the ways the environment is being degraded. Oil spillage is categorized into four groups: minor, medium, major and disaster. Minor spill takes place when the oil discharged is less than 25 barrels in inland waters or less than 250 barrels on land, offshore or coastal waters, that does not pose a threat to the public health or welfare. In the case of the medium, the spill must be 250 barrels or less in the inland water or 250 to 2,500 barrels on land, offshore and coastal water while for the major spill, the discharge to the inland waters is in excess of 250 barrels on land, offshore or coastal waters. The disaster refers to any uncontrolled well blowout, pipeline rupture or storage tank failure which poses an imminent threat to the public health or welfare.

This study concerns the risk associated with pipeline in terms of safety of people, damage to the environment and loss of income due to oil pipeline failures and vandalism in the Niger delta area of Nigeria and this has been a major concern to pipeline integrity managers. Sources of failure include Structural problem 40%, Operator error 6%, others 25%, outside force damage 27% and lastly Control problems 2% (Agbaeze K. N, 2000).

Therefore the aim of this study is to map out and assess the potential risk of the settlements in some areas of Obio/Akpor Local Government Area of Rivers state close to oil pipeline locations using geospatial techniques by Mapping and characterizing the oil pipelines and communities around suburb Obio/Akpor areas of Rivers State, Producing Risk/vulnerability maps of possible areas to be affected in case of any oil pipeline related disaster and Assessing the households around oil pipeline locations’ awareness on the risks involved and their vulnerability.

**CONTEXT OF THE STUDY**

The study area located within Obio/Akpor LGA, Rivers State lies between latitudes 4° 50’ 08.24” N and 4° 52’ 20.49” N and longitudes 7° 02’ 18.48” E and 7° 06’ 05.20” E as shown in fig. 1 Obio/Akpor is a Local Government Area in the metropolis of Port Harcourt, one of the major centers of economic activities in Nigeria, and one of the major cities of the Niger Delta, located in Rivers State. Obio/Akpor has its headquarters at Rumuodomaya and was created on the 3rd of May, 1989 out of the
Port Harcourt City Local Government of Rivers State by the Military Administration of President Ibrahim B. Babangida. The Council Area shares boundaries with Emohua, Ikwerre, Etche, Oyigbo, Eleme, Okrika and Port Harcourt Local Government Areas of Rivers State. It is mainly constituted by the people of Ikwerre Ethnic Nationality, but due to its Urban Status and the hospitality of the people. There is influx of other nationalities to the Local Government Area. The Local Government Area covers 260 km² and at the 2006 Census held a population of 464,789 (obioakporembassy.com).

![Map of Obio/Akpor, Rivers State, Nigeria.](image)

Fig. 1: Map of the Study area, Obio/Akpor, Rivers State, Nigeria.

4. Methodology

**Nature and Sources of Data:** Data used are secondary data; the study area, Obio/Akpor local government area of Rivers State image (acquired 19/2/2008) was obtained from Google Earth using the following coordinates; latitudes 4° 50’ 08.24” N and 4° 52’ 20.49” N and longitudes 7° 02’ 18.48” E and 7° 06’ 05.20” E, in jpeg format to extract the land use/land cover of the area and topographic map of the area was be overlaid on the image to acquire pipeline network.

**Projection/Coordinate System:** Since the study area cuts across two geographic zones (31 N and 32 N), the geographic coordinate system was used (WGS_1984).

**Field Work Data Collection:** The site was visited to collect GPS (global positioning system) readings to georeference and identify features on the image. Another method adopted in the field survey was Social Survey approach. Questionnaires were distributed to the residents of these areas to assess their awareness of risks and the vulnerability of living around such areas. The target sample size was set at 150 in order to obtain an adequate number of responses so that the findings are generalizable. However, only 100 residents responded. Systematic and stratified sampling was used to manage cost and time; oppositional streets close to the pipeline locations within the area were selected and houses at every seven house interval were interviewed. Usually the head of the house hold or the woman of the house helped in responding to the questions. The responses from the respondents in the questionnaire of sixteen questions which was divided into four sections were presented in percentages using Microsoft excel.
**Softwares Used:** The softwares used in the preparation and analysis of the data includes; TatukGIS calculator, Microsoft office suites and ArcGIS 9.3.

**GIS Operations:** The following GIS operations were carried out; geo-referencing, editing, digitizing, and overlaying (to produce a landuse map of the area).

**Geo-referencing:** The obtained image and topographic map were both geo-referenced using the ArcGIS 9.3 software. This was done in order to tie the image and map to their true ground coordinates using known ground control points (GCP’s).

**Digitizing and Editing:** The image obtained was transformed into vector layers to be used in various GIS analyses by digitizing using the platform of ArcGIS 9.3 GIS software. The topographic map served as a base map for extracting the oil pipeline (SPDC) network. The map features were converted from raster to vector layers through the process of on-screen digitizing. A digital map that consists of vector layers representing thematic information from the image that is recognized by the computer in a GIS environment was the end-product of this exercise.

**Overlay:** Overlay was performed to identify areas that meet all the set criteria and to show areas that do not meet the criteria. GIS can overlay different pieces of information. It helps in understanding the association between network analysis and specific geographic features. Various land-use/land cover layers of the study area map were overlaid.

**Spatial Analyses:** Features of interest were extracted from the image by digitizing. It was saved as input for data analysis. Spatial analysis was performed using the buffer and intersection operations, buffering (25 (ROW), 50, 100 and 150m) and intersection (to extract the risk zones). These operations were used to determine the topology and proximity of the pipeline to other land uses.

**Buffering:** A buffer is a map feature that represents a uniform distance around a feature. The buffer operation creates a new polygon data set, where a specified distance is drawn around specific features within a layer. The distances can either be constant or can vary depending upon attribute values. The buffers will be merge together which may result in overlap. This analysis included the creation of multiple buffer zones of 25m (normal ROW), 50m, 100m, and 150m around the oil pipelines. The areas of the settlements that fall with the risk zones (ROW, 50m, 100m and 150m buffers) were calculated in hectares using the attribute tables in ArcGIS 9.3.

**Intersection:** This is an analysis tool in ArcGIS 9.3 which allows the fusing of two overlapping layers together to create a new shapefile that includes the attributes of both layers for the area in which the layers overlap. The buffered zones were intersected get settlements that are within the risk zones; these are presented in maps.

**RESULTS AND DISCUSSIONS**

**Land Use identification and Characteristics of Obio/Akpor Areas of Rivers State**

Results from the digital analysis of the satellite image showed that the predominant land cover of the study area is settlements. The Settlements covers about 53.76%. Vegetation covers about 18.76%, Water body about 9.95% and Bare ground about 17.524% of the total land use. The length of the pipeline in the study area is 15.373863km; the river is 4.843287km while the digitized road network which
included national highways (15.940021km) and major roads (9.591636km) covers 25.531657km (See Fig. 2).

**Fig. 2: Map showing land use and oil pipelines traversing the area.**

**Risk Mapping of the Oil Pipelines in the Area**

The spatial relationship of the oil pipelines on neighbouring communities was analyzed using the buffer operation. In the study area, buffer of varying distance was set around the mapped oil pipeline to determine the spatial relationship of settlements the oil pipelines, to check encroachment into the normal Right Of Way (ROW) and categorize risk zone based on distances from the oil pipelines.

Although the Oil Pipelines Act Chapter 338 Laws of the Federation of Nigeria 1990 provides, among other things, for the rights and obligations of the holder of a license, a payment of compensation for economic crops and property damaged payment of survey fees and other miscellaneous matters and the National Environmental Policy on Environment (4.14) have certain policies to ensure environmental safety, there are rarely federal laws or regulations to state the actual distance that houses and commercial buildings are constructed away from pipelines except for the normal Right Of Way (25m)(Fig. 3-5). Therefore, the choice of buffer distances serves as an identification of the level of risk or vulnerability of residents (The closer to a pipeline, the higher the risk). Settlements that fall within the 50m buffer are termed a high-risk zone, those within the 100m buffer termed medium-risk zone and those within the 150m buffer a low-risk zone (Fig. 3-5).
Fig. 3: Buildings encroached into Rumuepke pipeline ROW.

Fig. 4: Buildings encroached into New-Ebubu pipeline ROW
Fig. 5: Buildings encroached into the Non-tagged SPDC pipeline ROW

Fig. 6: Map showing the intersection of settlements within the 50m buffer (high-risk zone)
Fig. 7: Map showing the intersection of settlements within the 100m buffer (medium-risk zone).

Fig. 8: Map showing the intersection of settlements within the 150m buffer (low-risk zone).

**Area Calculation of Risk Zones**

Below are the results in areas of the settlements that fall with the risk zones (ROW, 50m, 100m and 150m buffers) tabular and statistical forms.

Table 1: Area of settlements within buffers (risk zones).

<table>
<thead>
<tr>
<th>Designation</th>
<th>Pipeline Name</th>
<th>25m intersect (ha)</th>
<th>50m intersect (ha)</th>
<th>100m intersect (ha)</th>
<th>150m intersect (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Non-tagged SPDC</td>
<td>0.301</td>
<td>5.732</td>
<td>26.796</td>
<td>60.872</td>
</tr>
<tr>
<td>B</td>
<td>Nkpoku to New Ebubu</td>
<td>0.092</td>
<td>2.959</td>
<td>15.083</td>
<td>24.527</td>
</tr>
<tr>
<td>C</td>
<td>Rumuekpe to Nkpoku</td>
<td>0.0004</td>
<td>0.056</td>
<td>0.605</td>
<td>1.895</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>0.397</td>
<td>8.747</td>
<td>42.484</td>
<td>87.294</td>
</tr>
</tbody>
</table>
The results for the above analyses showed that there were encroachments into the normal Right of Way (25m). The Rumuekpe pipeline ROW had been encroached with 0.001 hectares of settlement (Fig 3), the New-Ebubu pipeline ROW had been encroached with 0.092 hectares of settlement (Fig. 4) and the Non-tagged SPDC pipeline ROW encroached with 0.301 hectares of settlement (Fig. 5). Settlements that fell within the 50m buffer were termed a high-risk zone and it covered a total area of 8.747 hectares (Table 1), those within the 100m buffer covered a total area of 42.484 hectares (Table 1) and was termed a medium-risk zone (Fig. 7) and those within the 150m buffer covering a total area of 87.294 hectares (Table 1) a low-risk zone.

**Oil Pipeline Risk Awareness of Residents**

Sixty questionnaires were administered to randomly selected residents of the Elelenwo, Rumuokrushi, Oil mill and Umurolu areas of Obio/Akpor Local Government Area of Rivers State, and only fifty of them were recovered.

Analyzing the statistical results from the four-sectioned questionnaires, shows that in general 68% of the respondents were male and 32% female, 52% of the respondents fell within the 31–45 years age grade; which indicates maturity in our responses, 50% of our respondents live in bungalows, 30% in storey buildings and 20% in duplexes with 60% of houses having between 0–5 inhabitants; this estimation gives an averagely populated area.

In the location section, 78% of the respondents didn’t know of the existing pipelines in the area, 84% didn’t know their locations and 88% didn’t know the live close to the pipelines meaning they might not be aware of their vulnerability. 48% have lived in the area between 0 to 2 years, 20% between 3 to 5 years, 12% between 6 to 10 years and 20% more than 10 years; only 12% of the respondents knew the distance of the pipelines away from their houses.

In the risk awareness section, 98% of the respondents knew that there were risks related to living close to an oil pipeline and 64% intends to relocate while 36% don’t. 21% of the respondents admitted to incidents of vandalisation and fire outbreak, 69% said there had not been any incidents while 10% didn’t know.

The management section shows that 100% of the respondents didn’t know the pipeline operators, therefore had no knowledge of specification, age of monitoring methods of the pipelines; 42% didn’t know who to contact in case of emergency, this increases their level of vulnerability, 20% said they will contact the police, 16% will contact NEMA (National Emergency Management Agency) and 22% the Fire Service. Lastly,
44% of the respondents have had forms of public enlightenment while 56% had not; this shows a higher percentage of ignorance that requires more effort from the government and other related organizations.

CONCLUSION
This study used GIS integrated standard methodology for mapping out areas risk zone in the study area in term of the level of their vulnerability. The study has demonstrated the use of a geospatial technology to provide a decision support system for her management. It has shown that some of the communities have intruded into the pipeline corridor, making them vulnerable, mapping of oil pipelines makes it possible to identify the settlements within and nearest to the Right of Way (ROW) and therefore makes it possible to identify where more security should be concentrated.

Though GIS based methodology is a highly sophisticated and standard; its success depends on the proper and careful application of it, so adequate attention is required for data management to ensure the perfection of the decision based on the methodology. Despite all remote sensing and GIS technologies used for oil pipeline monitoring and management, we lack most of these technologies in Nigeria. GIS experts have put in so much into research, but it mostly depends on the administrators and policy makers to pay more attention and embrace these to minimize loss of lives, property, flora, fauna, pollution of water and air and millions of naira lost from waste of the petroleum products which is the backbone of our economy.

RECOMMENDATIONS
From the study carried out it is apparent that there is an urgent need for proper monitoring of the oil pipelines in the area since most of them are accessible to minimize sabotage, vandalism and theft.

It is also recommended that residences that fall within the Right Of Way (ROW) of 25m should be demolished and occupants advised to relocate.

Additional design and operational precautions should be taken on the pipeline network at potentially vulnerable locations, such as road or rail crossings, to reduce the likelihood of pipeline failure at these places.

Pipeline operating companies should establish safety management systems covering the organization and arrangements for preventing, controlling and mitigating the consequences of major accidents on major accident hazard pipelines. Emergency procedures should be included in an emergency plan prepared by each pipeline operator which will dovetail with the local authority emergency plan.

Relevant government agencies and concerned non-governmental organizations should indulge more in workshops, adverts and campaigns on must-know about oil pipelines and their related hazards especially in areas where pipelines are located for public enlightenment and awareness.

Lastly, corruption should be tackled; there should be entrenchment of good governance and reduction of poverty/unemployment in the country.

REFERENCES

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GO-AHEAD ELEMENT OF DOMESTIC ARCHITECTURE: SOCIO-ECONOMIC AND CULTURAL CHARACTERISTICS OF THE RESIDENTS IN BENIN

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The domestic architecture of a traditional settlement is greatly influenced by the socio-economic and socio-cultural characteristics of its residents. Benin City which is the focus of the paper is a case of a traditional settlement undergoing Domestic Architectural evolution with the changing times influenced by factors of growth and development. The paper has examined the effect of socio-economic and socio-cultural characteristics as factors that partly determine the design, style, pattern, space use, organization, location and meaning as well as land use of the Domestic Architecture of Benin. The study employed the use of questionnaire administered to residents across the cross-section of the city. In the end, descriptive frequency tables were used to analyse the data collected from the residential zones in Benin. The research has been able to corroborate the theory that socio-economic and socio-cultural factors are some of the determinants/elements of domestic architecture of a people.

Keywords: Go-Ahead Element, Domestic Architecture, Socio-Economic and Socio-Cultural Characteristics

INTRODUCTION

The residential character of a city or domestic settlement is determined by the locational behaviour and decisions of individuals and families. Consequently, our examination of how residents’ socio-economic and cultural characteristics impact on domestic architecture in the Benin would require, that we consider what is being employed in this paper as the defining criteria within the concept of residential areas. According to Gbakeji and Rilwani (2009) the bases used in identifying residential areas have been grouped into two major classes, which includes: Environmental characteristics of residential areas, and Socio-economic and cultural structure of residential areas. The study, however, concentrates on the Socio-economic and cultural structure of residential areas as the go-ahead element of domestic architecture. House is considered to be more than merely the dwelling unit. It is a complex product made up of a combination of services, indoor living spaces, land utilities, locational situations, outdoor living spaces, and relationships to neighbours, family members and friends (Onokerhoraye 1984). It protects, provides them privacy and security (Omuta 1988). A house includes several internal and external facilities and services that make living more meaningful and fulfilling to the majority of people (Gbakeji and Rilwani, 2009). The concept of spatial Preference for house-type to live in is obviously important to an analysis of residents’ characteristics. Other factors that

influence residents’ preferences include assessment of housing costs, family sizes, qualitative housing units and environment.

Furthermore, preferences could also be influenced by the economic, social, professional or educational background of respondents. Benin City has always been a state capital from the early days of mid-western state to Bendel state and now to Edo state. The city has always accommodated all state/federal ministries and Parastatals making Benin City a Civil Service City. This explains the very slow economic activities due to the low incomes earned from the ministry, except for some few professionals’, artisans and craftsmen, traders and commercial vehicle operator. And since the City is a central point that connects to all the different part of Nigeria (south, north, east and west) road transporters benefit from the position of the Benin immensely (Ekhaese, 2011). The City has rich religious and cultural systems from the beginning, hence cultural activities are well entrenched in the life of the people. The import of all these on the residents’ characteristics is low and average socio economic activities while the socio-cultural activities are high. Therefore, the residents of the City are predominantly low and medium income earners, their socio-economic lifestyle is constrained, but their cultural life is very buoyant, this invariably determines the house-types found across Benin City. The Domestic residential Architecture that dots the landscape of the entire city is determined by the socio-economic and socio-cultural characteristics of the residents in the City.

In order to properly understand the socio-economic and socio-cultural structure of the studied area, there is need to first of all examine the socio-economic and socio-cultural characteristics of the households covered by this study. Socio-economic and socio-cultural class may be defined as relatively permanent and homogeneous divisions in a society into which individuals or families sharing similar values, life styles, interests and behaviours can be categorized (Engel 1978; Moughalu 1982). The general concept of social status is ancient. Social scientists have not found it easy identifying one particular variable of social status; hence use is often made of proxy variables such as income, occupation, education, workplace and marital status, to measure socio-economic status. This study has also adopted this method in the assessment of the socio-economic characteristics of residential zones in Benin metropolis.

**STUDY AREA**

Benin City is located at latitude 06°19IE to 6°21IE and longitude 5°34IE to 5°44IE with an average elevation of 77.8 m above sea-level. Benin City is a pre-colonial city, the capital of defunct Bendel State and the present day Edo State. Benin City is underlain by sedimentary formation of the Miocene-Pleistocene-age often referred to as the Benin formation (Odemerho, 1988). The city is located in the humid tropical rainforest belt of Nigeria with a population of 762,717 according to the 1991 national population census with a projected population of 1.3 million by 2010 at 2.9% growth rate. Benin City belongs to Af category of Koppen’s climatic classification. The rainy season in Benin begins in March/April and ends in October/November. Rainfalls are of high intensity and usually double maxima with a dry little spell in August usually referred to as ‘August Break’. Apart from demographic transmutation, Benin City has witnessed rapid territorial expansion mainly due to rapid rural-urban migration. Since Benin City is the capital of Edo State of Nigeria. Edo State could be defined as a collection gathering of people of united yet diverse identity, who are mostly located in the mid-western part of Nigeria, West Africa (Omoigui, 2005). Edo State was created in 1991 out of the then Bendel State of Nigeria and subsequently divided into Edo and
Delta States (UNDP Human Development Reports – 2003 and 2004). According to USAID reports in 2002, Edo State was estimated to have a population of 2.86 million; (in 1991, it had 2.1 million, of which 64.47% live in Benin City, that is about 1,035,995 inhabitants) making it almost similar in size to Jamaica with a population of (2.74 million), and bigger than Botswana, (1.6 million) and Trinidad and Tobago with a population of (1.1 million). Edo State has eighteen (18) Local Government Areas, The Edos are cultural in their perspective and approach to life, regardless of the level of education. Therefore, the bonding of the Edo people is their strong belief in their traditions and various forms of worship, which have given a spiritual and temporal authority to the royal leadership in the State. The traditions and forms of worship are systematically being diluted by a move towards modern religious faiths with an underlying rejection of the traditional forms of worship. This has influenced the domestic architecture in Benin, contemporary architectural style are emerging along the peripheries and the new expansions of the City. The people of Benin are called Edo and the population is found mostly in and around Benin City shown in Fig. 1 The map in Fig. 1 shows Benin City and its inner wall, covering four Local Government Area namely; Oredo, Ikpoba-Okhan, Egor and Ovia South-West.

IDENTITY AND SOCIAL STRUCTURE OF EDO SOCIAL SYSTEM

There was an existence of well-defined social structure, based on the government of elders before the emergence of monarchical system. But developments which resulted in transformation of traditional values and customs may have endeared the Edos to a sense of history and tradition as a ways of life. The social system which developed in Benin City as shown is figure 2, has its origin in this kind of historical consciousness.
to always think of developments that are firmly rooted in the past but which will not endanger the future (Osadolor, 2001).

When the seat of monarchy evolved, the settlement was a cluster of thirty-one villages with a sense of common identity based on history, tradition and beliefs of the society. The villages were aggregates of family units, as families came into working relationships, their adaptation resulted in socio-cultural change, upon which features of social and political organization began to emerge. This developmental pattern characterized all the village settlements at different phases of their transformation. In the study of Benin as an urban Centre, two major factors were involved in its development (Bradbury, 1973). The first was the natural environment supporting human settlements; and the second factor was the integration of the political systems (Onokerhoraye, 1995). This resulted in Edo socio-political structure which exists at the central and provincial level and is hinged upon the Oba and his royal court. The hierarchical ladder in Benin has the Oba as the spiritual/temporal head, having hereditary accession and succession by principle of primogeniture. The administrative agencies are tied up with structured chieftaincy and guild systems (Ndubuisi, 2006). The seven Uzama (‘King Maker’) are next to Oba in hierarchy. In addition is Eghaevos, instituted to weaken the position and authority of the Uzamas, as shown figure 2. They are the Eghaebo n’Ore (town chief) led by chief Iyase (prime minister) and the Eghaevo n’Ogbe (palace chiefs/Oba’s personal councilors) headed by chief Uwangue, see figure 2. Immediately followed are the royal guilds (craftsmen) serving the physical and spiritual needs of the Oba, they are Owina (guild of craftsmen/artisans), Ewaise (guild of religious functionaries) and the palace Iwebo, Iweguae and Ibiwe. They reside in a specific area carved out in the palace prior to the British expedition in 1897. Due to the palace reduction and subsequent dispersal of chiefs after the expedition, the guilds were reorganized and made to spread out, thus

Fig 2: Benin Council in Nineteen Century (2000)
Domestic architecture

affecting the land-use across the city from the core to the planned estate. This is why the core is inhabited by Oba and royal lineage and houses here retain the old pattern showing resilience to change. In the intermediate zone where the Eghaevbos are, some houses are resilient to transformation (i.e. some spaces have transformed, but the architectural style remains). But in the suburban where the royal guilds and nobles occupy, some form of resilience and adaptation has occurs in the houses.

STUDY METHODOLOGY

Since the study is examining go-ahead element, it would be good to situate it in the proper context. Go-ahead element of domestic architecture means dynamic determinants/ changing determinants of domestic architecture, according to Rapoport, in his book “House Form and Culture” he talked about factors that determine the domestic architecture of a people, place and time’ and called these factors “Architecture Determinants” or “Architectural Elements” of which Socio-Cultural and Socio-Economic are amongst several other determinants. Therefore because these ‘determinants’ / ‘elements’ are dynamic and changing then it can be called “go-ahead element”

A total of 1054 questionnaires were distributed across the entire Benin City in order to determine the socio-economic and socio-cultural characteristics of residents in Benin, Nigeria. The questionnaires distributions were designed in such way that requires thirty (30) research assistants to cover the entire Benin City. Each research assistant was to cover a particular area of the four residential zones as shown as Fig 2. Every residential zone was supposed to have at least between 4-8 researches assistants depending on the size of the zone. These research assistants were drawn from post graduate and under-graduate students of architecture as well as other from the allied building professions.

The questionnaire was so structured that the research assistant must administer the questionnaire one on one to the head of each household, help tick the boxes provided in the questionnaire and thereafter sketch the house plan. The variables were expressed in the question form to elicit information on its subject. The questionnaire was written in English and was expressed in simple sentences so as to ensure possibility to give clarity of intention. The questions were of both open-ended and closed types. They were pre-coded with alternative responses provided; this procedure afforded the respondents the choice of responses.

The data collected for this study were analysed using both descriptive and inferential statistics. In the treatment of data, descriptive data were presented using the tables, frequency counts, percentages, mean and charts. The analyses of data relied on appropriate statistical operations and the result were drawn from the household income, occupational structure, age and sex, marital status and household size, ethnic composition, educational background tenure and status of respondents to determine the socio-economic characteristics, but the socio-cultural characteristics was drawn from mainly religion and number of household.

Benin City into four residential zones - 52,850 houses in Benin City in 2009, The core zone-5,020, Intermediate zone-17,980, Suburban zone-22,950 and Planned Estate zone-7,900, and 2% of the residential houses - 1054 used for the study, with details as shown in table 1.
Table 1: Numbers of Selected Residential Houses in the Four Zone of Benin

<table>
<thead>
<tr>
<th>CITY/TOWN</th>
<th>Four Residential Zones (Location Of Houses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin City (Total No. Of Residential Houses)</td>
<td>Core Zone</td>
</tr>
<tr>
<td></td>
<td>104 (100%)</td>
</tr>
</tbody>
</table>

Residential Zones in Benin-City

A study carried out in 1994-95 divided Benin City into four residential zones and documented them as: Core Area, Intermediate Area, and Suburban Area and planned estate Settlement Area as shown in Fig 3 below.

![Fig 3: Map showing residential zone in Benin-city](source: Ogu (1995))

The core and intermediate residential areas of Benin are the oldest part of the City having the oldest architecture or residential spaces. The core area by its planning and arrangement is assigned to the royal families. At the centre of the core residential area is the Oba’s Palace, deliberately and strategically located at the king’s square (ring road) which connects all major roads to other parts of the city. Also in core, there are; the Ogbe Quarter (Residential Area of the Palace Chiefs) and Ore Nokhua (residential area of the Town Chiefs) and the former Ogiso Palace located within the inner wall. The city core is today the administrative hub of state, having the house of assembling complex, Oba market, the museum, Orukpota hall, central hospital, the Benin prison and so many other parastatals.

While the intermediate residential area accommodates six of the Uzamas’ residences (Oliha, Edohen, Ezomo, Oloton, Ero, and Eholo n’Ere) which are located outside the inner wall, the Queen Mother (i.e. seventh member of the Uzama) and the Edaiken, (i.e. the heir-apparent) are outside the outer wall. The inner walls enclose the core residential area, but the outer wall is inside the intermediate residential area (see Fig 4). The government reservation area (GRA), government house and other government quarters are located in the intermediate residential area. The suburban area and the
unplanned settlement part of the City accommodate the residential areas of other families in Benin City. Here there are the different housing estates in the city, the government civil servants estate, the privately own estates, the public estate, the public-private partnership owned estate etc. and other institutions.

Fig 4: Plan of Benin City Showing the Core Area and Intermediate Area

Therefore a cross-section through the residential areas of the entire City reveals a chronological growth from the core residential area where the oldest form of architecture can be found. Closely following is the intermediate residential area, and then the suburban residential area and the planned settlement area where most of the contemporary architecture are built.

In other words, a cross-sectional study through Benin reveals an historical evolution of house-types in the core residential area (i.e. the residential palace of the monarch and the royal families residential areas) to the most contemporary house-types in the planned residential area of the city, apart from the Oba’s family and the other royal family members (i.e. the Ogbe Chiefs and Town Chiefs), every other family in Benin migrated from villages around the City (Ezra, 1992).

This further shows that a cross-sectional study will give the necessary historical perspective of growth of the ancient City of Benin. Table 2 shows a cross section of house types across the Benin City.
### Table: The House-Types As Identified During the Field Survey

<table>
<thead>
<tr>
<th>House types in Benin</th>
<th>Location (zones)</th>
<th>Plan form characteristics</th>
<th>Categories of types in each zone in Benin</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The Palace Compound House-Types “Eguei Oto-Eghodo”,</td>
<td>Core residential zone</td>
<td>Three (3) house types</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>2 The Family Compound House-Types. “Owa Eken”</td>
<td>Core residential zone</td>
<td>142</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 The modified traditional courtyard house-type</td>
<td>Core residential zone</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 The Adapted Family-Compound Benin House,</td>
<td>Intermediate residential zone</td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>5 The hybrid Family-Compound Benin House</td>
<td>Intermediate residential zone</td>
<td></td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>6 The Common Central Corridor House-Types (Face Me I Face You),</td>
<td>Intermediate and planned estate residential zone</td>
<td>225</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 The Detached Bungalow House-Types (“Owa Eken’ebo”)</td>
<td>Intermediate, suburb and planned estate residential zone</td>
<td>165</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 The Semi-Detached Flats of Single Floor House-Types</td>
<td>Intermediate and suburb and planned estate residential zone</td>
<td>132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 The Semi-Detached Flats of Double Floor House-type</td>
<td>Intermediate and suburban residential zone</td>
<td>77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 The Detached Double Floor Villa House-Types.</td>
<td>Planned estate residential</td>
<td>Four (4) house types</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>11 The detached double floor Duplex house-types</td>
<td>Planned estate residential</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>ELEVEN (11) HOUSE-TYPE IN BENIN CITY</strong></td>
<td></td>
<td>1054</td>
</tr>
</tbody>
</table>

### SOCIO-ECONOMIC CHARACTERISTICS OF RESIDENTS

**a. Household Income**

Usually, a household utilises its income to take care of the housing, feeding, clothing, education, transportation and medical expenses, among many other competing needs. Thereafter, it may consider savings. Household income plays a very crucial role in the house-types and residential zone preferences of residents. If the income is low, the household may rent an apartment, but as the income increases, it may then decide to
own one, either by building or buying from the housing market. In this study, household incomes were classified into three socio-economic groups, namely low, medium and high income groups. Those in the low-income category have annual incomes not exceeding #500,000, while those earning between #500,001 and #1,000,000 are in the medium income group. The high-income group comprises those whose annual incomes are in excess of #1,000,000. Table 2 shows the distribution of household incomes per annum of the respondents across the four residential zones in the Benin metropolis. The low-income group constituting about 31.7 per cent of our total population across the four residential zones with total percentages of 27.9 in the core, 32.0 in the intermediate, 28.6 in the sub-urban and 44.8 in the planned estate respectively. On the other hand, medium income group makes up 12.5 per cent of the total population. Residential zone with high concentrations of medium income earners include core and sub-urban residential zones. The high income group are about 8.3 per cent of the sample populations. These groups of income earners are predominantly in the sub-urban residential zone. The last group in this category is the non-salary group (i.e. they are traders, self-employed, students, and applicants). These set of persons don’t earn salary from governments, yet classifying them based on their annual income, they could still fall into the categories listed above. They make the remaining percentage which is about 47.1 per cent.

Table 2: Income per Annum of the Respondents

<table>
<thead>
<tr>
<th>Core Zone</th>
<th>Intermediate Zone</th>
<th>Sub-Urban Zone</th>
<th>Planned Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than 100,000</td>
<td>46 13.1</td>
<td>55 12.0</td>
<td>41 30.1</td>
</tr>
<tr>
<td>100,001-500,000</td>
<td>29 27.9</td>
<td>66 18.9</td>
<td>20 14.7</td>
</tr>
<tr>
<td>500,001-1,000,000</td>
<td>45 43.3</td>
<td>29 8.3</td>
<td>12 8.8</td>
</tr>
<tr>
<td>1,000,001-5,000,000</td>
<td>16 15.4</td>
<td>4 1.1</td>
<td>31 6.8</td>
</tr>
<tr>
<td>5,000,001 and above</td>
<td>1 1.0</td>
<td>2 .6</td>
<td>22 4.8</td>
</tr>
<tr>
<td>Non Salary Group</td>
<td>13 12.5</td>
<td>202 57.7</td>
<td>229 49.9</td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>350 100.0</td>
<td>459 100.0</td>
</tr>
</tbody>
</table>

In the core residential zone majority of the respondents, about 43.3% earn between the range of 500,001-1,000,000 while majority of the respondents in the other three residential zone fall under the category of non-salary group obviously because they are business owners/traders. This result shows that the various income levels will create economic differentials for respondents across the residential zone. Majority of respondents in the core zone about 89.4% are owner occupiers. Therefore the level of the income of people determines the tenure status of the occupiers and also determines the house-type to be constructed.

**b. Occupational Structure**

The occupational distribution of the respondents reflects the economic base of the study residential zones. It is evident from Table 3 that a sizeable proportion of the residents is made up of businessmen/traders, teachers, self-employed persons, civil servants, professionals, artisans, farmers and others, i.e. managerial experts and skilled
production personnel in both the private and public establishments, majority of whom have their employment spread across the entire City (core, intermediate, suburban and planned estates areas) of Benin. The pattern of the occupational distribution of residents in the City equally explains their income levels per annum.

The majority of the respondents were businessmen and women and traders accounting for 35%, professionals 17%, civil servants 15%, teachers 13%, artisans 5%, farmers 4% and others 11%. These businessmen and women and traders cut across the residential zone evenly, revealing that the respondents were economically independent.

Table 3: Occupations of the Respondents

<table>
<thead>
<tr>
<th></th>
<th>Core Zone Frequency &amp; Valid Per cent</th>
<th>Intermediate Zone Frequency &amp; Valid Per cent</th>
<th>Sub-Urban Zone Frequency &amp; Valid Per cent</th>
<th>Planned Estate Frequency &amp; Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Servants</td>
<td>19 (18.3)</td>
<td>50 (14.2)</td>
<td>73 (15.9)</td>
<td>16 (11.9)</td>
</tr>
<tr>
<td>Teachers</td>
<td>12 (11.5)</td>
<td>34 (9.7)</td>
<td>79 (17.2)</td>
<td>11 (8.1)</td>
</tr>
<tr>
<td>Business/Trade</td>
<td>22 (21.2)</td>
<td>111 (31.5)</td>
<td>180 (39.2)</td>
<td>52 (38.5)</td>
</tr>
<tr>
<td>Artisans</td>
<td>11 (10.6)</td>
<td>28 (8.0)</td>
<td>6 (1.3)</td>
<td>8 (5.9)</td>
</tr>
<tr>
<td>Professionals</td>
<td>19 (18.3)</td>
<td>61 (17.3)</td>
<td>64 (13.9)</td>
<td>36 (26.7)</td>
</tr>
<tr>
<td>Farmers</td>
<td>18 (17.3)</td>
<td>12 (3.4)</td>
<td>15 (3.3)</td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Others</td>
<td>3 (2.9)</td>
<td>56 (15.9)</td>
<td>42 (9.2)</td>
<td>10 (7.4)</td>
</tr>
<tr>
<td>Total</td>
<td>104 (100.0)</td>
<td>352 (100.0)</td>
<td>459 (100.0)</td>
<td>135 (100.0)</td>
</tr>
</tbody>
</table>

c. Age and Sex

The age structure in the study residential zones indicates a very active population, with high tendencies for productivity and a correspondingly high propensity for work. Table 4 shows the age distribution of respondents by residential zones in Benin indicates that 24.3, 27.0, 25.8 and 22.1 per cent of the respondents, respectively, are in the age brackets of 26-35, 36-45, 46-55 years and 56 and above.

Table 4: Ages of the Respondents

<table>
<thead>
<tr>
<th></th>
<th>Core Zone Frequency &amp; Valid Per cent</th>
<th>Intermediate Zone Frequency &amp; Valid Per cent</th>
<th>Sub-Urban Zone Frequency &amp; Valid Per cent</th>
<th>Planned Estate Frequency &amp; Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-35</td>
<td>110 (31.7)</td>
<td>97 (21.2)</td>
<td>49 (36.0)</td>
<td></td>
</tr>
<tr>
<td>36-45</td>
<td>86 (24.8)</td>
<td>161 (35.2)</td>
<td>37 (27.2)</td>
<td></td>
</tr>
<tr>
<td>46-55</td>
<td>91 (26.2)</td>
<td>110 (24.0)</td>
<td>32 (23.5)</td>
<td></td>
</tr>
<tr>
<td>56 and above</td>
<td>60 (17.3)</td>
<td>90 (19.7)</td>
<td>18 (13.2)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>104 (100.0)</td>
<td>347 (100.0)</td>
<td>458 (100.0)</td>
<td></td>
</tr>
</tbody>
</table>

On the other hand, 67.7 and 32.2 per cent of the sample population are made up of males and females respectively as shown in Table 5
The majority of the respondents in the sample were males. They accounted for 713 representing 68% and 339 females accounted for 32%. The ages of the respondents as presented in table 3 revealed that 26-35 years were 256 representing 25%. 36-45 years were 284 representing 27%; 26 per cent were 46-55 years and 56 years and above were 22%.

Table 5: Gender of the Respondent

<table>
<thead>
<tr>
<th></th>
<th>Core Zone</th>
<th>Intermediate Zone</th>
<th>Sub-Urban Zone</th>
<th>Planned Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
</tr>
<tr>
<td>Male</td>
<td>101  97.1</td>
<td>217  61.5</td>
<td>304  66.2</td>
<td>91  66.9</td>
</tr>
<tr>
<td>Female</td>
<td>3  2.9</td>
<td>136  38.5</td>
<td>155  33.8</td>
<td>45  33.1</td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>353 100.0</td>
<td>459 100.0</td>
<td>136 100.0</td>
</tr>
</tbody>
</table>

d. Marital Status and Household Size

Analysis of the marital status of our sample population shows that 761 (72%) are married, while 208 (20%) are single. Thirty-six (3.4%), 35 (3.3%) and 12 (1.1%) were separated or divorced, widowed and widowers respectively. The household sizes of the respondents across the residential zones also show a remarkable pattern. Two hundred and seventeen (217) households, representing 20.6 per cent of our sample population, have household sizes of 1-5 persons. The corresponding figures for the 6-10, 11-15, 16-24, 25-30, 31-40, 41-50, 51-60, 61-70, 71-80 categories are 297 (79.3%) and 84 (.7%) respectively. Apart from the singles, and in some cases the widowed, which mainly report one person per household, the married in most of the study residential zones have a modal family size of between 3 and 10 persons.

Table 6: Marital Status of Respondent

<table>
<thead>
<tr>
<th></th>
<th>Core Zone</th>
<th>Intermediate Zone</th>
<th>Sub-Urban Zone</th>
<th>Planned Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
</tr>
<tr>
<td>Single</td>
<td>102 28.9</td>
<td>62 13.5</td>
<td>44 32.4</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>100 96.2</td>
<td>229 64.9</td>
<td>355 77.3</td>
<td>77 56.6</td>
</tr>
<tr>
<td>Divorced</td>
<td>7 2.0</td>
<td>8 1.7</td>
<td>6 4.4</td>
<td></td>
</tr>
<tr>
<td>Separated</td>
<td>6 1.7</td>
<td>7 1.5</td>
<td>2 1.5</td>
<td></td>
</tr>
<tr>
<td>Widow</td>
<td>6 1.7</td>
<td>25 5.4</td>
<td>4 2.9</td>
<td></td>
</tr>
<tr>
<td>Widower</td>
<td>4 3.8</td>
<td>3 .8</td>
<td>2 .4</td>
<td>3 2.2</td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>353 100.0</td>
<td>459 100.0</td>
<td>136 100.0</td>
</tr>
</tbody>
</table>

The marital status revealed that single respondents were 208, representing 20%, married respondents were 761, representing 72% and divorced respondents were 21 representing 2%, separated 1%, widowed 4%. This shows that across the four residential zones, married respondents had the largest percentage; this again validates...
the fact that they are socially responsible; this has had an effect on the house-type they occupy/build.

e. Ethnic Composition

A critical examination of the distribution of ethnic grouping and respondents’ state of origin by residential zone reveals that the ethnic structure of Benin is very heterogeneous. The Edo are the major ethnic group, totalling 798 (75.7%) of our sample population. They are followed by the Esans with 46 (4.4%), while the Urhobos are 44 (4.2%). The rest of the sample population is made up of respondents from other States of the Federation. We discovered, in the course of field survey, that there is a very good mix of the various indigenous and non-indigenous groups in the residential zones across the city. This apparently explains very clearly and accounts for the cosmopolitan nature and structure of the Benin. It also clearly defines the city as traditional cities in Nigeria, like Zaria or Kano where the natives live in separate parts of the city.

Table 7: Number of Persons in the Household of the Respondent (Household Size)

<table>
<thead>
<tr>
<th></th>
<th>Core Zone</th>
<th>Intermediate Zone</th>
<th>Sub-Urban Zone</th>
<th>Planned Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td></td>
</tr>
<tr>
<td>1.00-5.00</td>
<td>4 (3.90)</td>
<td>50 (14.1)</td>
<td>120 (26.2)</td>
<td>43 (31.6)</td>
</tr>
<tr>
<td>6.00-10.00</td>
<td>40 (38.5)</td>
<td>139 (39.2)</td>
<td>215 (46.9)</td>
<td>57 (41.8)</td>
</tr>
<tr>
<td>11.00-15.00</td>
<td>43 (41.3)</td>
<td>83 (23.5)</td>
<td>95 (20.7)</td>
<td>29 (21.5)</td>
</tr>
<tr>
<td>16.00-24.00</td>
<td>16 (16.5)</td>
<td>53 (15.0)</td>
<td>25 (5.5)</td>
<td>6 (4.4)</td>
</tr>
<tr>
<td>25.00-30.00</td>
<td>17 (4.8)</td>
<td>4 (.8)</td>
<td>1 (.7)</td>
<td></td>
</tr>
<tr>
<td>31.00-40.00</td>
<td>7 (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.00-50.00</td>
<td>1 (.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51.00-60.00</td>
<td>1 (.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61.00-70.00</td>
<td>1 (.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71.00-80.00</td>
<td>1 (.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81.00-85.00</td>
<td>1 (.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>104 (100.0)</td>
<td>353 (100)</td>
<td>459 (100.0)</td>
<td>136 (100.0)</td>
</tr>
</tbody>
</table>

f. Educational Background of Respondents

Table 8 showing the educational background of respondents by residential zones reveals a very high level of literacy among the sample population. For example, 828 respondents (78.6%) have been educated above the primary school level. Specifically, 336 (31.9%) have secondary education, while 492 (46.7%) are educated to the tertiary level (polytechnic, monotechnics and university levels). People of high educational attainment are highly status conscious. Besides, these people often seek for residential locations that satisfy their desires for prestigious dwellings and residential zone comparable to their jobs, their incomes as well as their personality.
Table 8: Educational Background of Respondents

<table>
<thead>
<tr>
<th>Zone</th>
<th>Core Zone</th>
<th>Intermediate Zone</th>
<th>Sub-Urban Zone</th>
<th>Planned Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
</tr>
<tr>
<td>No Formal Education</td>
<td>25 24.0</td>
<td>11 3.1</td>
<td>14 3.1</td>
<td>5 3.7</td>
</tr>
<tr>
<td>Completed Primary School</td>
<td>16 15.4</td>
<td>58 16.4</td>
<td>48 10.5</td>
<td>12 8.8</td>
</tr>
<tr>
<td>Completed Secondary School</td>
<td>21 20.2</td>
<td>161 45.6</td>
<td>110 24.0</td>
<td>44 32.4</td>
</tr>
<tr>
<td>Completed Tertiary School</td>
<td>42 40.4</td>
<td>105 29.7</td>
<td>273 59.6</td>
<td>72 52.9</td>
</tr>
<tr>
<td>Others (Specify)</td>
<td>18 5.1</td>
<td>13 2.8</td>
<td>3 2.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>353 100.0</td>
<td>458 100.0</td>
<td>136 100.0</td>
</tr>
</tbody>
</table>

From the general frequencies run for the variables, we can draw some inferences concerning the different objectives: for example analysing the socio-economic and cultural characteristics of the residents in Benin across the entire City Table 8 shows that the majority of the respondents were predominantly literate with 47 per cent having completed tertiary education; 32 per cent having completed secondary and 13 per cent having completed primary school. Only 55 representing 5% had no formal education. 50% of the respondents without formal education are the core zone; this will go a long way in describing their socio-economic status which in-turn determines the class of house-types they occupy/build.

g. Tenure Status of Respondents

Table 9 showing the tenure status of respondents by residential zones reveals that more than half of the population of the respondents are actually owners of the houses they occupy. For instance, 551 of the population sample (52.3%) are the owner of the houses they live in; a total 389 respondents (36.9%) are tenants while 111 (11.6%) are free-Houser.

Table 9: Tenure Status of Respondents

<table>
<thead>
<tr>
<th>Zone</th>
<th>Core zone</th>
<th>Intermediate Zone</th>
<th>Sub-urban Zone</th>
<th>Planned Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
<td>Frequency &amp; Valid Per cent</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>93 89.4</td>
<td>146 41.5</td>
<td>241 52.5</td>
<td>71 52.2</td>
</tr>
<tr>
<td>Tenant</td>
<td>1 1.0</td>
<td>164 46.6</td>
<td>167 36.4</td>
<td>57 41.9</td>
</tr>
<tr>
<td>Free-Houser</td>
<td>10 9.6</td>
<td>42 11.9</td>
<td>51 11.1</td>
<td>8 5.9</td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>352 100.0</td>
<td>459 100.0</td>
<td>136 100.0</td>
</tr>
</tbody>
</table>

The table 9 shows that in the core zone, majority of the respondents are owners of their houses, which is 93 out of the 104 respondents own the houses, this accounted for 89.4%, 10 (9.6%) respondents are free-Houser. Only 1 respondent is a tenant. This explains the fact that all the houses in the core are oldest in the city; it means the houses were family compound inherited.

In sum, the socio-economic characteristics of residents, as spatial variables in the residential location have been studied more closely and are linked to the structural
theories of city patterns. It would therefore, be necessary to conclude that socio-economic characteristics of residents play a vital role in evolving house-types across the City. It is an incontrovertible fact that the residential character of a city or residential zone is functionally related to the locational behaviour and decisions of individuals and families. In this paper, we examine in some detail the socio-economic characteristics of residents in all the study residential zones and the discussions of the results of our analysis amply demonstrate the significant relationship that exists between socio-economic characteristics of residents and transformation of domestic space.

SOCIO-CULTURAL CHARACTERISTICS OF RESIDENTS

In considering the cultural characteristics of the resident, beliefs, traditions, norms and values play a pivotal role. But for the purpose of the analysis and considering the variables available, religion (i.e. beliefs) and number of households (i.e. traditions) have been used.

a. Religion

The respondents were predominantly religious with 88% practicing Christianity, 4% Muslim, 5% traditional religion and 3% free thinker. Only 4 representing 0.3% fall into the category of others. The analysis show that because the respondents are a religious people, implies that they are a cultural people and these cultural characteristics has definitely affected their domestic spaces and their house-types (i.e. domestic spaces) across the City.

Table 10: Religion of the Respondents

<table>
<thead>
<tr>
<th></th>
<th>Core Zone Frequency &amp; Valid Per cent</th>
<th>Intermediate Zone Frequency &amp; Valid Per cent</th>
<th>Sub-Urban Zone Frequency &amp; Valid Per cent</th>
<th>Planned Estate Frequency &amp; Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christianity</td>
<td>103 99.0</td>
<td>287 81.3</td>
<td>422 91.9</td>
<td>112 82.4</td>
</tr>
<tr>
<td>Muslim</td>
<td>23 6.5</td>
<td>6 1.3</td>
<td>9 6.6</td>
<td></td>
</tr>
<tr>
<td>Traditional Religion</td>
<td>1 1.0</td>
<td>25 7.1</td>
<td>18 3.9</td>
<td>9 6.6</td>
</tr>
<tr>
<td>Free-Thinker</td>
<td>18 5.1</td>
<td>10 2.2</td>
<td>5 3.7</td>
<td></td>
</tr>
<tr>
<td>Others (Specify)</td>
<td></td>
<td>3 .7</td>
<td>1 .7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>104 100.0</td>
<td>353 100.0</td>
<td>459 100.0</td>
<td>136 100.0</td>
</tr>
</tbody>
</table>

b. Number of Households

Table 11: Number of Household

<table>
<thead>
<tr>
<th>Core Zone Frequency &amp; Valid Per cent</th>
<th>Intermediate Zone Frequency &amp; Valid Per cent</th>
<th>Sub-Urban Zone Frequency &amp; Valid Per cent</th>
<th>Planned Estate Frequency &amp; Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 – 2.00</td>
<td>67</td>
<td>331</td>
<td>328</td>
</tr>
<tr>
<td>2.00 – 5.00</td>
<td>64.5</td>
<td>93.8</td>
<td>71.5</td>
</tr>
<tr>
<td>6.00 -10.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.00 -15.00</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>101</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>78.7</td>
</tr>
</tbody>
</table>

The numbers of households occupying each of the buildings across the four residential zones were presented. 78.7% of the house-type in planned estates were being occupied.
by between 1-2 persons, while 93.8% and 71.5% were being occupied between 2-5 persons in intermediate and sub-urban residential zones respectively, also 64.5% of the buildings in the core residential zones were occupied by 6-10 persons and 28.9% of the buildings were occupied by 11-15 persons.

**CONCLUSION**

The analysis done so far on the socio-economic and cultural characteristics of the residents, shows that the characteristic of residents determine to a large extent the domestic architecture in the city. From the income of the household in city, the low, medium and high income groups are distributed across the four residential zones (core, intermediate, sub-urban and planned estate zones) in Benin as shown in fig 3, there is no specific residential zone earmarked for the poor. From Table 2 about 44.8% are in the planned estate, this is so because, the planned estate which is supposed to contain the most recent houses owner by government and are built for all categories of income earners (low, medium and high) including the cleaners and gardeners in the ministries and parastatals, the occupational structure show all the different types of occupations are spread all across the city. But most of the elite class and well-to-dos own and live around the government reservation areas (GRA) which spread across the intermediate and suburban zones of the city. Looking at the age distribution in the city across the four residential zones shows that the oldest houses are found in the core areas because it the oldest part of the city and also most of the houses are inherited. There were usually 3-4 generations of families living in the houses which imply that most of the household-head are very old and as such there are hardly any young men that are a household-head in the core residential zone see Table 4. The distribution of household size shows that the largest households are found also in the oldest part of the city which is the core and intermediate residential zones. This emphasises that fact that family compounds are mostly found in the above two residential zones. Although the educational backgrounds of the respondents are spread across the residential zone, the highly educated are often status conscious. They seek prestigious dwelling and highbrow residential area, so large percentage of the elite are found in the most recent part of the City (suburban and planned estate residential zone). Ultimately Benin City is patterned in such a way that every category of residents are spread and scattered all around the City, so that pockets of settlement are sprawling everywhere in the City and so also are house types. Therefore as the characteristics of residents vary across the different residential zone, the spaces provided in the different house-types vary also, thereby defining and identifying the various house-type across the entire City.

**REFERENCES**


The opportunism construct has received limited attention in the construction procurement literature. Yet it has been shown that opportunism is inimical to value creation in interorganizational exchanges. This work focuses on contractor’s opportunism, synthesizing insights from the transaction cost economics literature, agency theoretic literature, relational exchange theory and the construction procurement literature into a testable conceptual framework that answers the questions: What causes construction contractors to behave opportunistically? What governance devices are in use for mitigating contractors’ opportunism? The work deploys a desk-top review and synthesis of relevant construction project management and business management literature. Since this work is conceptual, future researches will test the hypotheses embodied by the conceptual framework. Hypothetical propositions that specify the mitigating impact of governance structures on contractor’s opportunistic behaviours are developed. Sound procurement policies that improve project delivery in the public sector cannot be crafted without a deep understanding of the opportunism construct. This study illuminates our understanding of contractor’s opportunism, while providing a basis for assessing the efficacy of extant governance devices in a future empirical questionnaire survey.

Keywords: contractor’s opportunism, procurement.
opportu

Synthesizing theoretical insights from transaction cost economics, agency theory and relational exchange theory and the procurement literature (Joshi and Stump, 1999; Winch, 2001; Vrijhoef et al., 2003; Ting, Chen, and Bartholomew, 2007; Khatleli and Root, 2008; Issato and Formoso, 2011); this work, a part of an ongoing develops a testable conceptual framework that specifies the relationship between governance mechanisms and opportunistic behaviour. First a synopsis of the three theoretical perspectives is presented. Thereafter, drawing on concepts from the theories, the antecedents and governance of opportunism are discussed, culminating in the testable theoretical framework.

**Transaction cost economic theory**

The idea underlying Transaction Cost Economics (TCE) was seeded by the economist Ronald Coase in 1937 (Walker and Wing, 1999). However it was Williamson’s husbandry of the concept that has earned it its influential status in inter-organisational studies (Williamson, 2007). The thrust of transaction cost economics is that any analysis aimed at minimising the costs of delivering goods and services should consider both production costs and transaction costs incurred. If a prime contractor say organization ‘A’ assigns a part of its building production process to another firm say subcontracting firm ‘B’ for execution; firm ‘A’ incurs additional costs covering the search for the appropriate firm ‘B’, establishing agreements with firm ‘B’, the establishment of processes or structures for (i) monitoring the performance of ‘B’ such that ‘B’ is prevented from ripping ‘A’ off, (ii) resolving disputes should they arise and enforcing established agreements. These categories of costs are transaction or governance costs. They are distinct from the production costs. Production costs are costs incurred by firm ‘A’ had it carried out or internalized the work subcontracted to ‘B’.

Transaction Cost Economics hints that two behavioural traits (opportunism and bounded rationality) of economic actors interact with contingency factors (uncertainty, transaction specific investments, transaction frequency and small number relationships) to create the need to govern interfirm relations (Lynch, 1996; Winch, 2001; Parker and Hartley, 2003).

**Agency Theory**

Agency theory and related literature focus on principal-agent relationships. Fayezi, O’Louhlin and Zutshi (2012) posit that an agency relationship arises whenever one individual/group of individuals -the principal- delegates work to another party –the agent. This relationship type fits the relationship that exists between the client and the contractor in public construction procurement. According to Khatleli and Root (2008), three basic assumptions underpin this theory. First, the principal and the agents are self-interested, rational individuals. The second assumption is that the agent is both effort and risk averse. Finally, asymmetric information characterise the relationship. The existence of any of these assumptions ensues in two agency problems, which the theory seeks to resolve. Eisenhardt (1989) identifies these problems. The first is the agency problem that arises when goal incongruence exist between the principal and the agent. The second problem has to do with the principal’s ability to monitor or verify what the agent is doing. Furthermore, the theory identifies two opportunism types associated with principal agent relationships,
namely adverse selection (pre-contractual asymmetric information about agent’s future performance) and moral hazards (post-contractual asymmetric information about agent’s current performance).

4.0 Relational Exchange theory

Relational norms and their use as governance mechanisms in economic exchanges have been traced repeatedly by authors (Joshi and Stump, 1999; Nystén-Haarala, Lee, and Lehto, 2010) to the work of Macneil (1974, 1978, and 1980). Macneil (a legal scholar) challenged the view of contracts as single, independent and static transactions (Gundlach and Achrol, 1993; Ivens and Blois, 2004). Macneil (1980:4) sees contracts as reflecting ‘the relations among parties to the process of projecting exchange into the future’. Macneil (1987:274) defines a contract as ‘relations among people who have exchanged, are exchanging, or expect to be exchanging in the future’ (Ivens and Blois, 2004). The thrust of Macneil’s work is that exchanges are embedded within a context of norms of behaviour. So Macneil views certain contracts as living, in that exchange partners interact with each other confidently through time in the light of mutually developed norms which govern their relationships. The exchange literature provides evidence in support of the proposition that the stronger the relational norms or transaction-atmospheric factors, the less the incidence of opportunism (Winch, 2000; Brown et al., 2000; Vazquez, Iglesias and Rodríguez-del-Bosque, 2007; Fink, Hatten and James, 2010).

The following sections rely on the theoretical concepts embodied by the three perspectives summarised above in proposing the relationships between governance mechanisms and contractors’ opportunism.

5. Unravelling the opportunism construct

Relying on the TCE literature, Wathne and Heide (2000) define opportunism as “self-interest seeking with guile”. Hawkins, Wittmann, and Beyerlein (2008) list things like stealing, cheating, breach of contract, dishonesty, distorting information, obfuscating issues, confusing transactions, false threats and promises, cutting corners, cover-ups, disguising attributes or preferences, withholding information, deception and misrepresentation as manifestations of opportunism. Muris (1981, p.521) reportedly opined that opportunism arises when a party “behaves contrary to the other party’s understanding of their contract, but not necessarily contrary to the agreement’s explicit terms, leading to a transfer of wealth from one party to the other” (Ting, Chen, and Bartholomew, 2007). Luo (2006) defines opportunism as any behaviour performed by one party to seek unilateral gains at the expense of one’s co-transactor by violating “explicit or implicit agreements, exercising private control, withholding or distorting information, withdrawing commitments or promises or shirking obligations”. Opportunism therefore refers to absence of integrity, lack of candour in the conduct of economic exchanges. It is the need to mitigate opportunism on the part of one’s exchange partner that calls for the governance of inter-organizational transactions.

The literature identifies two categories of opportunism. They are Type I (blatant/strong) form and Type II (lawful/weak) form. Luo (2006) writes that strong form (Type I) opportunism involves actions that breach the terms, clauses and conditions that are explicitly codified in the contract governing an interfirm exchange. It is characterised by the absence of adherence to principle-centred norms such as integrity and the sanctity of contract. On the other hand, weak form (Type II)
opportunistic behaviour is construed by the relevant literature to mean the violation of relational contracts (Wathne and Heide, 2000; Ryu, Jang, Lee and Lee, 2012). Relational contracts are informal social contracts, norms, mutual expectations that govern relationship between exchange partners. Relational contracting norms identified in the literature include expectations of sharing benefits and burdens, restraints on the unilateral use of power, the norm of flexibility in the face of changing circumstances. Lawful opportunism is the seeking of self interest by ignoring default obligations- obligations that are implied by relationship-specific norms, but not expressly stated in a formal contract. Because these obligations are not clearly spelt out in a contractual agreement, its breach might not be punished under the law. Opportunism in all its forms impairs successful project delivery.

In the light of the foregoing descriptions of opportunism, the following behaviours within the context of public construction procurement will pass as opportunism: (1) putting a competent team of engineers and artisans forward to win work, but supplying a totally different and less experienced team to deliver the project; (2) listing equipments that a contractor does not own as equipment possessed on a prequalification form; (3) using different contracting organisations controlled by the same owners to bid for the same project under a competitive contracting scenarios; (4) fronting for client’s key personnel in contract awards; (5) bidding unreasonably low to win work with the intention of deploying margin recovery strategies such as claims to generate profit; (6) frontloading BOQ/BEME items to make more money available to the contractor at the early phase of the work; (7) using substandard materials and workmanship on projects; (8) bribing a client’s key personnel so that decisions or actions are undertaken to the advantage of the bribing party; (9) cheating in recording and disclosing expenses in cost reimbursement contracting; (10) padding or inflating contract sums with “facilitators” or gate keepers fees; (11) delaying interim valuations preparations, issuing of payment certificates and processing of payment vouchers in order extract “gifts” from contractors/subcontractors. Achieving project success calls for minimising the occurrence of these opportunistic behaviours. Mitigating the occurrence of these behaviours requires a deep understanding of its enablers-its antecedents. We now turn our attention to a discussion of the antecedents and control of opportunism, focusing precisely on contractor’s opportunism.

6. Uncertainty, Bounded Rationality, Asymmetric Information and Opportunism

Uncertainty has been described as the inability to quantify the probability that an event will occur (Ting, Chen, and Bartholomew, 2007). Luo (2006) classifies uncertainty into external and internal uncertainties. External uncertainty covers market volatility, information unverifiability, regulatory variability and legal unprotectability. Internal uncertainty in an exchange relationship, according to Luo (2006), refers to the extent to which dyadic relations are unstable, where the instability is caused by goal disparity, resource misfit, cultural dissimilarity and bargaining power asymmetry between co-transactors.

Winch(2000) opines that uncertainty is a function of the difference between the quantity of information requisite for a decision and the quantity of available information. The more the difference, the higher the uncertainty. He identifies two drivers of uncertainty, namely complexity and dynamism. Under a complex decision making scenario, the required information is available in principle. However the problem is that the urgency of the situation make the collection and analysis of the
information technically impossible. It could also be that the cost of securing complete information outweighs the benefit. A dynamic situation on the other hand is a fluctuating situation where conditions change so rapidly such that we can not use today’s data to predict the future confidently. Under these situations the ability to take rational decisions is limited.

Besides external factors that induce uncertainty in interfirm relationships, transactor’s own limitations contribute to uncertainty in interfirm exchanges. Bounded rationality is such an intrinsic limitation of all economic actors. Lynch (1996, pg. 23), posits that the capacity of the human mind for formulating and solving problems is very small compared with the size of the problems whose solutions is required for objective rational behaviour in the real world. This is the essence of bounded rationality. It refers to limitations of rational decision making (Issato and Formoso, 2011). While man seeks to be rational in his decision making, he is limited by his analytical and data-processing capabilities - the cognitive limitations of the human mind (Walker and Chau, 1999), accessible information, and the finite amount of time available (Issato and Formoso, 2011). Other limitations to man’s decision-making rationality could be language-related. Lynch (1996) posits that language limits have to do with the inaptitude of individuals to convey their knowledge or feelings by the use of words, numbers, or graphics to others without being misunderstood by the recipient.

Winch (1989) presents the nature of uncertainty as found in the construction industry. He identifies two broad categories of uncertainties in construction: project uncertainties and contracting uncertainties. Project uncertainties covers task uncertainty, organizational uncertainty and natural uncertainty. Task uncertainty stems from the non-repetitive nature of most construction projects. In most instances each project demands solving new design and production problems, thus making it difficult to predict the procurement tasks accurately. Organization uncertainty in construction stems from the construction industry practice of assembling a new coalition of project actors for every project. The liability of newness carried by every project team member makes it difficult to predict the behaviour of the project coalition members. Each project actor seeks to maximize its interests leading to tension within the coalition. It should be noted that the bigger the project organization, the greater the tension and the more the organizational uncertainty. Natural uncertainty may come in the form of limited geological information about the site for large civil or building engineering projects. Performance uncertainty is another form of uncertainty associated with multi-party responsibility scenario such as when subcontractors are imposed on main contractors via the nominated subcontracting provisions of some forms of contract. Apportioning fault, tracing causative project actor and receiving compensations for loss, when the specified level of performance is not achieved, in multi-party responsibility situation is not an easy task (Ive and Chang, 2007).

According to Winch (1989), the use of competitive tendering is the source of contracting uncertainty. He identifies two sources of this category of construction project uncertainty, namely contractors’ estimating-related errors and the existence of a kind of accelerator effect on the demand curves facing individual contracting firm. The demand curve of most contracting firms is such that small changes in the tender success rate produces large changes in the levels of turnover. This is the case because each contract represents a high fraction of total turnover for most construction firms. This situation increases the pressure on contacting organizations to optimize their gains from every contract won irrespective of the effect on their co-transactors.
The foregoing shows that uncertainty boils down to lack of information for decision-making. Viewed from this perspective, uncertainty especially behavioural/organisational uncertainty is related to the concept of asymmetric information in agency theory. Asymmetric information occurs when one party to an exchange is better informed than the other party about the object of exchange (Lofgren, Persson and Weibull, 2002). A contractor bidding for a project knows more about his capability than the client. Asymmetric information gives rise to two categories of opportunism explained earlier adverse selection and moral hazard.

In the light of uncertainty, bounded rationality and asymmetric information, it becomes difficult for exchange partners in construction procurement exchanges to specify ex ante, all contingent actions for every possible future outcomes in the contractual agreements that bind the two procurement transactors. In the absence of such explicit contractual terms, conflict of interests might ensue. The seed is thus sown for an opportunistic co-transactor to hold-up the transaction ex post. In the light of the foregoing, it is logical to suggest that the degree of uncertainty associated with a construction procurement transaction will have a positive significant influence on the level of opportunism within the relationship. Mitigating uncertainty-induced opportunism therefore calls for reducing uncertainty.

6.1 Attenuating uncertainty – induced opportunism with contractual control

In order to reduce opportunistic behaviours on the part of contractors, procurement frameworks include processes that are aimed at reducing uncertainty. Winch (2001) shows that the project process is a temporal process of uncertainty reduction. At the inception stage, the project begins with little or no information. The uncertainty at this point is very high. Entering a construction contract with a contractor at this point poses huge opportunism threat to project delivery. As the project progresses through time, more information is generated with consequential reduction in uncertainty until the full information required is embodied by the constructed facility at completion.

Uncertainty reduction via information production is achieved by the delivery of construction professional services by the client’s procurement advisors-architects, engineers, quantity surveyors and others. The procurement advisors of the client codifies the requirements of the client into a set of drawings, specifications and bills of quantities/other payment basis which form the basis for entering into a contract with a main contracting organisation to execute the job. The codification of the intention of the principal into programmable tasks and observable, measurable behaviours which can be monitored ex post reduces the risk of opportunism as well as non-opportunistic misinterpretation of the client’s intention (Hodgson, 2004; Roehrich and Lewis, 2010).

While precontract documentation of construction projects is information – generating and thus uncertainty reducing, the fact remains that it does not eliminate bounded rationality. Given the reality that the future is unknown and unknowable, co-transacting parties find it impractical to identify every possible state of the world that might materialize and specify contingent contractual solution to each state (Scott, 2006). Even in properly scoped capital projects, unanticipated future states such as post contract specification changes or unforeseen site conditions are still observed. The incompleteness of contracts shows that it is impossible to eliminate uncertainty, the best we can do is to reduce it. In the light of the foregoing, we present the first hypothesis proposing thus:
HI: The level of reducible uncertainty (“proxied” as the quality of contractual control) in a procurement exchange is negatively related to contractor’s opportunistic behaviour in that exchange.

7. Asset specificity and Opportunism

Asset specificity refers to the degree to which transaction–specific investments or assets are non-redeployable (Lynch, 1996; Ryu et al, 2012). Antia and Frazier (2001) opines that transaction specific investments are investments that cannot be redeployed from existing uses and users except at a significant loss of productive value. Hawkins et al (2008) describes a transaction specific investment as a non-transferable investment whose utility is unique to a specific relationship. The degree of asset specificity associated with a transaction could vary from non-specific to mixed to idiosyncratic (Issato and Formoso, 2011).

Lynch (1996) cites a US construction example of transaction specific investments: Hensel Phelps Construction Company developed customizied formwork for the Tabor Center project in Denver CO, that could not be used on other projects. Asset specificity might be site specific, physical asset specific-say plant specific and human asset specific (Walker and Wing, 1999).

Prior to signing a contract, asset specificity in client–contractor relationship (viewed from either party’s perspective) is low. The client is free to select from a number of competing contractors. At this point in the relationship, the contractor has not made any transaction-specific investments. The situation changes, however, once the contract is signed and the contractor begins work on site, from an analytical baseline of unconstrained bargaining or bilateral voluntary exchange to a command structure within which one party’s ability to retaliate is limited (Wathne and Heide, 2000; Ive and Chang, 2007). The client has invested at least time and resources to select the contractor. The contractor on the other hand must have incurred expenses bidding for the contract and mobilising his resources-human and plants to the site. This post-contract market situation of the transacting parties has been described as a small numbers bargaining situation (Winch, 1989; Lynch, 1996), which is a weak competitive environment where the client’s freedom to choose contractors is severely restricted. So asset specificity is high at the post contract stage. The farther the parties have gone in the contract execution, the higher the transaction asset specificity.

The high post-contract stage asset specificity makes it possible for the under-invested party (the contractor in this case) to hold-up the transaction should unanticipated events arise. Construction industry experiences show that post contract specification changes by clients are often exploited by contractor to extract a concession from the client in form of variation claims (Winch, 1989; 2001). Rokkan, Heide and Wathne (2003) provide empirical evidence from buyer supplier–relationships substantiating the claim that transaction specific investments increase opportunism on the part of the under-invested exchange partner, while decreasing opportunism from the party with higher transaction–specific assets. It follows from the foregoing literature-inspired reasoning that one way to mitigate opportunism from the underinvesting contractor is to impose transaction-specific assets as a requirement for entering into the contract. Such transaction-specific investments imposed on a co-transactor to mitigate opportunistic behaviour are called economic hostages.

Traditional contractual provisions like the deduction of retention fees from interim certificates, the demand that contractors secure advance performance guarantees or
bonds are economic hostages intended to attenuate contractor’s opportunism. To this end we offer the second hypothetical proposition:

**H2:** The extent of transaction-specific investments/assets made by a contractor in a construction procurement exchange is negatively related to the contractor’s opportunistic behaviour.

8. Post-Contractual Monitoring

The principal’s dilemma associated with the moral hazard problem in any agency relationship is that the agent (the contractor) as utility maximizer seeks first his interest. Complete control of agent’s action by the principal is impracticable. The only option left is to monitor the agent. Monitoring of agent’s actions by the principal or through a principal-appointed supervisor comes at a price. Monitoring in client contractor relationship is carried out by control actors. According to Winch (2001), traditional contracting involves the use of two categories of control actors: the architect or engineer for quality conformance, and the consulting quantity surveyors for programme and budget.

The quality of monitoring goes a long way in suppressing contractors’ opportunism in project delivery. Two forms of monitoring have been identified in the literature (Heide, Wathne, and Rokkan, 2007), output monitoring and behaviour monitoring. Output monitoring involves measuring the visible consequences of a partner’s actions, such as a supplier’s delivery time, or product quality. Behaviour monitoring, on the other hand involves evaluating the processes that are expected to produce the outcomes in questions. The choice of the monitoring deployed for a construction procurement transaction is dependent on the type of transaction. Knowledge intensive transaction such as the delivery of design solutions to clients by engineers and architects will call for outcome monitoring. It is impractical for the client to monitor the processes associated with the delivery of these creative outputs. On the other hand, the contractor who has subcontracted the mixing of concrete in a framed building to a concreting subcontractor might result to behaviour monitoring to ensure that the subcontractor uses the specified mix of materials. A team of consultants might need to inspect the type and distribution of reinforcing bars in a suspended slab before the casting of the concrete.

Anecdotal evidence suggests that some contractors on public projects are known for executing works that are concealed on completion such as concreting on weekends when the consultants are not at work. This allows them to use standards that increase their profit at the expense of the predefined quality. Another issue impacting on the quality of monitoring is the integrity with which the control actors discharge their responsibilities. One expects to see increased contractors’ opportunism in exchanges where the consultants impose “forced gifts” on the contractor in the course of monitoring. The argument here is that a project transaction characterized by the appropriate form of monitoring will mitigate opportunism better than one in which the control actors are complacent. We hypothesize thus:

**H3:** The quality of monitoring is negatively related to contractor’s opportunism in client-contractor relationships.

9. Transaction Frequency/Long term orientation and Opportunism

Will a contractor (in a client-contractor transaction) hold-up the transaction opportunistically in the presence of ‘shadow of the future’ (Kamann, Snijders, Tazelaar
and Welling;2006)? The phrase “shadow of the future” refers to the expected likelihood that the co-transactors will meet for business in the future. The expectations of two parties to a transaction about the future of the relationship strongly affect their predisposition to opportunistic behaviour in the current transaction (Yaqub,2009). Kamann et al (2006) posits that opportunistic behaviour becomes tempting and attractive in spot market exchanges. Parker and Hartley (2003) point out that, buyers in one-off exchanges are especially at the risk of entering disappointing transactions. On the other hand, cooperative behavior in buyer-supplier relations is more probable, when there is a strong basis for more future transactions. Frequency of transaction might be one –off, occasional or recurrent. The basis for believing that a future exists for the relationship might be a history of successful past transactions (‘shadow of the past’). The promise of future businesses in the contractual agreement between the parties might be a basis for optimism about the shadow of the future.

This reasoning agrees with the utility maximization orientation of all economic actors. If the present value of stream of gains accruable to an economic actor from future transactions is far more than the immediate gains from opportunism, the chances are great that the opportunistically predisposed project actor will exercise self-restraint. The converse of this statement is also true. If a relationship comes into existence because of a one-off transaction, the chances are great that the parties will seek unilateral optimization of their interests. Jesus parable of the dishonest slave corroborates the veracity of this claim (Luke 16:1 – 8 New King James Version). The parable is a powerful anecdotal illustration of exit opportunism associated with structures where there is no opportunity of future transaction.

Unfortunately transaction frequency is low in construction. Winch (2001) argues that the value is unity for most client /supplier dyadic relationships. Traditional serial contracting and the recent experimentation with framework agreements address this problem (Tennant and Fernie,2012). It is pertinent to point out that transaction frequency has indirect mitigating effect on opportunism via reduction in uncertainty. It has been explained earlier that uncertainty and bounded rationality enables opportunism. Transaction frequency leads to inter-organizational learning. The more you work with a procurement co-transactor, the more you know about his competence and character, his strength and weaknesses. This in turn mitigates behavioural uncertainty associated with working with new exchange partner. To this end we propose the third hypothesis.

H4: The more a contractor engages in procurement exchanges with a client, the less opportunism materialises in the relationship.

10. Relational norms and Opportunism

Macneil’s (1974, 1980) relational contracting theory challenges the view of contracts as single, independent and static transactions (Gundlach and Achrol, 1993; Ivens and Blois, 2004). Macneil’s work isolates ten norms of behaviour within which exchanges are embedded. The idea of norms in exchange relationships is also found in the work of sociologists like Powell (1990) and Granovetter (1985). The notion of embeddedness developed by these authors make a case for the role of socially embedded personal relationships in economic exchanges.

Citing others, Yaqub (2009) opines that norms are expectations about behaviour that are shared by a group of decision makers and directed towards collective goals. Cannon, Achrol and Gundlach (2000) writes that ‘norms reflect expectations about
attitudes and behaviours parties have in working cooperatively together to achieve mutual and individual goals’. According to Ivens and Blois (2004), Macneil recognises that certain exchanges are more relational than others. He maps exchanges on a discrete/relational continuum where different norms apply. All of the ten norms do not apply to all exchanges on the continuum. Certain norms are emphasized more in certain exchanges than others. Norms at the relational end of the continuum – role integrity, contractual solidarity, harmonisation of relational conflict, supracontractual relations and propriety of means - promote mutually beneficial re-negotiation and adjustments when difficulties and unanticipated circumstances materialise ex post.

How do relational exchange norms mitigate opportunism and promote interfirm cooperation? The capacity of relational norms as anti-opportunism mechanisms lies in their potential to shape the antecedents of opportunism. Tangpong, Hung and Ro (2010) write that exchanges characterized by low relational norms are associated with aggressive bargaining behaviour. Such relationships overemphasize explicit contracts and aggressive negotiation to minimize uncertainty and resolve disagreements. It has been explained earlier that asymmetric information creates opportunity for selfish project actors to exploit. A relationship characterized by the norms of role integrity and preservation of the relation will facilitate free flow of information across transactional boundaries. Where proactive interorganizational information sharing occurs; it is not likely that adverse selection (the pre-contractual opportunism that exploits asymmetric information about future performance) and moral hazard (the post-contractual opportunism that exploits asymmetric information about future performance) will eventuate.

The five norms that build up to create harmonisation of conflict norm are not compatible with hold-up problem (the opportunistic practice of expropriating rents from or exploiting transaction-specific investments made by one’s exchange partner). Propriety of means promotes situations where exchange partners ignore ‘the technically correct legal implications of contracts’, which are at times modified, supplemented or completely supplanted by the norms of the ongoing relationship’ (Ferguson, Paulin and Bergeron, 2005) Supracontractual norms lead to situations in which transactions-specific tasks (say mobilisation of equipment to sites by a contractor) can start even when contract documents are still evolving. This has attendant project time performance improvement effects. Linking norms are incompatible with exploitative pricing of construction procurement services.

In the light of the above reasoning, and the existence of evidence in the exchange literature in support of the proposition that the stronger the relational norms or transaction-atmospheric factors the less the incidence of opportunism (Winch, 2000; Brown et al, 2000; Vazquez, Iglesias and Rodriguez-del-Bosque, 2007); we introduce the fifth hypothesis.

**H5:** The strength of relational norms within a client-contractor dyadic procurement exchange will have a significant negative effect on opportunism within the relationship.

Figure 2 captures the relationships between governance mechanisms and opportunism in project delivery.
Examining construction project delivery with the theoretical lenses of transaction cost economics, agency theory and relational contracting theory, this paper has discussed the opportunism construct. A number of opportunism enablers have also been isolated. Project governance mechanisms for managing opportunism in client-contractor relationships are also highlighted. The paper is part of an ongoing research work that seeks to examine the efficacy of project governance mechanisms in mitigating opportunism. Future work will focus on the identification of additional governance mechanisms with a view to develop a more robust theoretical framework for the evaluation of public sector construction project governance structures. Efforts will also be made to operationalize the constructs captured in the conceptual framework with the goal of testing the propositions within the Nigerian construction industry.

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HEALTH AND SAFETY PERFORMANCE IN THE UGANDA CONSTRUCTION INDUSTRY

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The construction industry is possibly the most hazardous industry in regards to health and safety (H&S) of workers. In Uganda, there has been poor management of H&S at construction sites and as a result, the industry registered increased frequencies of safety incidences with high fatalities. These incidences have led to loss of lives, injuries, damage to properties and equipment, reduced productivity and loss of revenue amongst others. Unfortunately, these H&S incidences are reported after the occurrence and do not show preventive measures undertaken. This study aimed at analysing the H&S performance in Uganda's construction industry in order to propose measures for effective management. Construction firms that had active construction projects within Kampala, Mukono and Wakiso districts during the study period were studied. The data on subjective performance were collected using questionnaires and observation checklists. Data on accident records were collected using accident forms. The results showed that contracting firms were generally aware of the need to uphold good H&S practices. However, only 35 percent of the H&S programmes were implemented at good level and above. On average, 40 percent of the construction sites practices were unsafe. Objectively, H&S performance was characterised by high accidents injury rate (20.2), non-fatal injury rate (18.2) and fatal injury rate (2.0) per 100 equivalent full-time workers (EFTW). Uganda government should cause implementation of the seventeen H&S programmes into a regulation and strengthen the laws governing H&S in construction industry. Construction firms should train their workers on H&S requirements in order to improve their H&S regimes.

Key words: accident, health and safety, performance, Uganda.

INTRODUCTION

Uganda's construction sector has been growing at 13 percent per annum (Uganda Bureau of Statistics (UBOS), 2009); twice the national economy average growth rate of 6.5 percent. Despite its huge contribution of 12.9 percent of the national gross domestic product (GDP) in year 2009 (UBOS, 2010), the construction industry has been experiencing very high number of fatal accidents and other health and safety (H&S) incidences in the recent past (Mwakali, 2006). Over this period, collapses at the building construction sites have been major occurrences. The main incidences in the limelight included: Bwebajja building construction accident that occurred on

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Wednesday, 1st September 2004 with 11 deaths and over 26 serious injuries (Ministry of Works and Transport (MoWT), 2004); St. Peter’s Naalya school building construction accident with 11 deaths and over 10 serious injuries (Ssempogo et al, 2008); National Social Security Fund (NSSF) building construction accident with 8 deaths and 1 serious injuries (Musoke et al, 2008; MoWT, 2008). On the global perspective, the construction industry is perceivably the most hazardous industry in regards to health and safety of the workers (Edmonds and Nicholas, 2002).

**LITERATURE REVIEW**

Safety may be defined as the condition of being secure from hurt, injury or loss. Cagno et al (2001) stated that the progressive improvement of safety conditions is a primary need in all countries. This essentially depends on the risk assessment process and the coherence of decisions taken to eliminate or reduce risk. Kartam (1997) developed a system to integrate H&S issues into all phases of a construction project from design and planning through construction and maintenance. The system was based on the “three Es” of H&S: engineering, education and enforcement. However, the main obstacle in implementing the construction safety improvement is that the contractor and the client/ employer often perceive H&S as a cost rather than a benefit. Mwakali (2006) noted that serious accidents and injuries had occurred with alarming frequency at construction sites in Uganda. Alinaitwe et al (2007) asserted that accidents at construction sites occurred either due to lack of knowledge or training; poor supervision; or lack of proper means to execute task safely or due to carelessness, apathy or downright recklessness. According to Abdul et al (2008), accidents do not just happen: they are caused by unsafe acts, unsafe conditions or both. Overtime, many theories have evolved on the causation of accidents. Some of these theories included: single factor theory, multiple causation theory and psychological accident causation theory (Ahmed and Adnan, 2005). Arguably, all accidents are multi-casual, with a combination of factors needing to coincide to give rise to an accident (Mwakali, 2006).

The construction industry is also arguably one of the worst performing for occupational health. According to Health and Safety Executive (HSE, 2007), respiratory diseases for 2006 to 2007 indicated a higher incidence rate in construction than across all industries in United Kingdom (UK). Occupational cancer deaths amongst construction workers and tradesmen reflect the risks inherent within particular construction work processes, environments and materials. They also reflect the failure by the industry to prevent or control exposures and so adequately manage this issue (Donaghy, 2009). For too long, health has had minimal attention when compared with safety. To secure improvement, the industry needs to manage both H&S issues as an integral part of its day-to-day business management – to manage the risk not the symptom (Donaghy, 2009).

Research has proved that H&S at construction sites has remained a formidable problem to construction management. According to Mohamed (2003), the construction industry suffers from the general inability to manage workplace H&S to a level where pro-active zero accident culture prevails. On the other hand, Aksorn and Hadikusumo (2008, 2007) and Idoro (2008) argued that continuous improvement of H&S can be attained through performance evaluations to guide management on future undertakings. These performance evaluations can be done through reactive and proactive approaches. Previous studies in Uganda’s construction industry focused mainly on accidents and injuries (Alinaitwe et al, 2007; Lubega et al, 2000; Mwakali, 2006). However, the accident studies have had limitations because of reflecting
negative image of contractors and reactive information that may not bring about improvement (Marosszeky et al, 2004). This argument presented a gap for this study of H&S performance in the construction industry in Uganda. The alternative approach is to focus on proactive efforts dealing with the factors responsible for such accidents, injuries and ill-health and how to control them (Mohamed, 2003). This approach involves both objective and subjective measurement of H&S performance. Objective measurement of H&S performance is through the evaluation of accidents statistics while subjective measurement is through evaluation of the implementation of H&S programmes as well as construction practices (unsafe acts and conditions). Research studies validated seventeen H&S programmes that were effective in the improvement of H&S performance in the construction industry. These key H&S programmes included: H&S policy, safety committee, safety induction, H&S training, H&S inspection, accident investigation, first aid programme, in-house safety rules, safety incentive, control of sub-contractors and selection of employees. Others are: personal protection programmes (PPP), emergency preparedness planning (EPP), safety related promotion, safety auditing, safety record keeping and job hazard analysis (JHA). These H&S programmes were thus used as variables in this study as part of the proactive measurement of H&S performance.

RESEARCH METHODOLOGY
H&S performance in Uganda’s construction industry was analysed using two main approaches, namely: subjective measurement and objective measurement. 138 construction firms that had active construction projects were purposively selected for study within Kampala, Mukono and Wakiso districts. Data for the subjective measurement of H&S performance were obtained through the use of questionnaires for assessing the implementation of the seventeen H&S programmes and observation forms for assessing the unsafe acts and unsafe conditions at the construction sites. While data for the objective measurement of H&S performance were obtained through accident forms from the reported accident records at various relevant government authorities and recorded accidents at the construction sites of the projects under study. The accident form was developed with guidance from similar previous studies (Alinaitwe et al, 2007; Mwakali, 2006) and “Form 300” of Oregon Occupational Safety and Health Division (OR-OSHA), (2011) of UK.

Observation forms included observed items and criteria for unsafe scores developed in compliance with Occupational Safety and Health Act (2006) and verified by one used in a similar previous study in Thailand (Aksorn & Hadikusumo, 2008). The observation of workers’ practices at the construction site was conducted first. Results for each construction project were tallied, analysed and combined with results of the whole study. Data collection through questionnaires and observations at construction sites were executed during four months period.

The Accident injury rate (AIR), fatal injury rate (FIR) and non-fatal injury rate (NIR) were calculated per 100 EFTW in accordance with the formulae used by the United States (US) department of labour (BLS, 2011).

\[ AIR = \frac{N_a}{EH} \times 200,000 \]  
\[ FIR = \frac{N_f}{EH} \times 200,000 \]
The unsafe acts (UA) and unsafe conditions (UC) observation indices were calculated using the standard equations and reported as percentages (Aksorn and Hadikusumo, 2008).

\[ \text{UA observation index} = \frac{\text{unsafe acts}}{\text{unsafe acts} + \text{safe acts}} \times 100\% \]  

\[ \text{UC observation index} = \frac{\text{unsafe conditions}}{\text{unsafe conditions} + \text{safe conditions}} \times 100\% \]

Data were analysed using statistical package for social scientist (SPSS) version 17 and Microsoft Excel software, 2007. The actual status of implementation of the H&S programmes was analysed and their rankings was determined using coefficient of variation (V). Multiple regression analysis was done to investigate the relationships of H&S programmes on performance. Cronbach’s alpha and split sample reliability tests were conducted to determine the internal consistency of the data. The values of Cronbach’s alpha were: 0.943 for the whole data set; 0.953 and 0.876 for parts 1 and 2 respectively of the split data, which were all greater than the recommended minimum value of 0.7 (Nunnally, 1978).

RESULTS AND DISCUSSIONS
125 responses were received from the expected 138, of which 84.8% were found valid and 15.2% found invalid for analyses. For the unsafe scores, a total of 117 construction sites corresponding to participating firms under questionnaire survey were visited. This was to allow inferential analysis of H&S performance across safety programmes implementation and unsafe scores.

OVERALL RANKING OF THE H&S PROGRAMMES
The overall ranking of H&S programmes according to their “Coefficient of Variation, (V)” is as given in Table 1. The five most highly rated H&S programmes are circled with V less than 0.500. Three of the five best ranked H&S programmes differ from those found out by Aksorn and Hadikusumo (2008) in Thai’s construction industry.
UNSAFE ACTS AND UNSAFE CONDITIONS
The figures obtained from the observations were: unsafe acts = 5105; safe acts = 8796; unsafe conditions = 513; and safe conditions = 685 respectively. Hence, as from equations (4) and (5),

\[ Unsafe \text{ act observation index} = \frac{5105}{(5105+8796)} \times 100\% = 36.7\% \]

Table 1: Ranking of the Status of H&S Programmes According to Coefficient of Variation (V)

<table>
<thead>
<tr>
<th>H&amp;S programme</th>
<th>Mean (µ)</th>
<th>Standard deviation (σ)</th>
<th>( V = \frac{σ}{µ} )</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1: H&amp;S policy</td>
<td>2.81</td>
<td>1.016</td>
<td>0.362</td>
<td>2</td>
</tr>
<tr>
<td>P2: Safety committees</td>
<td>2.94</td>
<td>1.206</td>
<td>0.410</td>
<td>3</td>
</tr>
<tr>
<td>P3: Safety inductions</td>
<td>2.32</td>
<td>1.334</td>
<td>0.575</td>
<td>11</td>
</tr>
<tr>
<td>P4: H&amp;S training</td>
<td>2.49</td>
<td>1.436</td>
<td>0.577</td>
<td>12</td>
</tr>
<tr>
<td>P5: Safety inspections</td>
<td>2.45</td>
<td>1.885</td>
<td>0.560</td>
<td>10</td>
</tr>
<tr>
<td>P6: Accident investigation</td>
<td>2.93</td>
<td>1.031</td>
<td>0.352</td>
<td>1</td>
</tr>
<tr>
<td>P7: First aid programmes</td>
<td>2.57</td>
<td>1.225</td>
<td>0.477</td>
<td>6</td>
</tr>
<tr>
<td>P8: In house safety rules</td>
<td>1.88</td>
<td>1.098</td>
<td>0.584</td>
<td>13</td>
</tr>
<tr>
<td>P9: Safety Incentives</td>
<td>1.43</td>
<td>0.880</td>
<td>0.615</td>
<td>15</td>
</tr>
<tr>
<td>P10: Control of subcontractors</td>
<td>2.72</td>
<td>1.154</td>
<td>0.424</td>
<td>4</td>
</tr>
<tr>
<td>P11: Selection of employees</td>
<td>2.76</td>
<td>1.171</td>
<td>0.424</td>
<td>4</td>
</tr>
<tr>
<td>P12: PPP</td>
<td>2.03</td>
<td>1.118</td>
<td>0.551</td>
<td>9</td>
</tr>
<tr>
<td>P13: EPP</td>
<td>1.89</td>
<td>1.406</td>
<td>0.744</td>
<td>17</td>
</tr>
<tr>
<td>P14: Safety promotions</td>
<td>1.3</td>
<td>0.713</td>
<td>0.548</td>
<td>8</td>
</tr>
<tr>
<td>P15: Safety auditing</td>
<td>2.1</td>
<td>1.242</td>
<td>0.592</td>
<td>14</td>
</tr>
<tr>
<td>P16: Safety record keeping</td>
<td>2.41</td>
<td>1.252</td>
<td>0.520</td>
<td>7</td>
</tr>
<tr>
<td>P17: JHA</td>
<td>1.86</td>
<td>1.249</td>
<td>0.672</td>
<td>16</td>
</tr>
</tbody>
</table>

The unsafe act observation index of 36.7 percent was very high. This implied that 36.7 percent of the methods and actions of workers used in the execution of the construction activities were unsafe putting the lives of workers and the safety of properties in danger.

\[ Unsafe \text{ condition observation index} = \frac{513}{(513+685)} \times 100\% = 42.8\% \]

The unsafe condition observation index of 42.8 percent was exceptionally high. It depicts that 42.8 percent of the working conditions at the construction sites were unsafe for workers. The risk of accidents occurrence or contracting occupational disease was extremely high at the construction sites.

ACCIDENTS ON CONSTRUCTION SITES
The number of accident cases from the three districts of Uganda (study area) for both on-site and reported records are shown in Table 2. Comparison of on-site accidents data and that obtained from the labour offices in this study gives only 24 percent of accidents were reported to the government authorities. Basing on the on-site accidents records and from equations (1), (2) and (3) the AIR (20.2), FIR (2.0) and NIR (18.2)
were calculated per 100 equivalent full-time workers (EFTW). The results showed an unacceptable objective level of H&S performance. This trend contrasts with those in developed economies like UK, USA, Australia and Thailand where there have been tremendous decline in accident cases. Over the same period (2006 to 2010), non-fatal work injuries rate in USA’s private construction sector declined by over 20 percent from 4.4 to 3.5 per 100 EFTW (BLS, 2011).

Table 2: Distribution of Tradesmen, Nature and Causes of Recorded Accidents (2011) and Reported Accidents (2006 to 2010 Period) at Construction Sites

<table>
<thead>
<tr>
<th>Indicators</th>
<th>On site Recorded Accidents (2011)</th>
<th>Percentag e (%)</th>
<th>Reported Accidents (2006-2011)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUM</td>
<td>628</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIR</td>
<td>20.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Type of worker involved

| Labourers | 292 | 46.5 | 59 | 39.3 |
| Carpenter | 54  | 8.6  | 13 | 8.7  |
| Concreter | 18  | 2.9  | 4  | 2.7  |
| Electricians | 20 | 3.2  | 12 | 8.0  |
| Painters | 96  | 15.3 | 28 | 18.7 |
| Plaster | 11  | 1.8  | 6  | 4.0  |
| Steel fixer | 19 | 3.0  | 3  | 2.0  |
| Plumber | 17  | 2.7  | 2  | 1.3  |
| Mason | 13  | 2.1  | 1  | 0.7  |
| Welder | 22  | 3.5  | 8  | 5.3  |
| Technician | 27 | 4.3  | 6  | 4.0  |
| Engineers | 18  | 2.9  | 5  | 3.3  |
| Foremen | 21  | 3.3  | 3  | 2.0  |

Total | 628 | 100.0 | 150 | 100 |

Nature injury incurred

| Fall (from height) | 94 | 15.0 | 24 | 16 |
| Cut | 41  | 6.5  | 13 | 8.7 |
| Hit by object | 154 | 24.5 | 43 | 28.7 |
| Vehicle | 12  | 1.9  | 3  | 2.0 |
| Machine | 81  | 12.9 | 16 | 10.7 |
| Electricity | 31  | 4.9  | 13 | 8.7 |
| Falling Debris | 55  | 8.8  | 8  | 5.3 |
| Chemical | 60  | 9.6  | 4  | 2.7 |
| Suffocation | 44  | 7.0  | 14 | 9.3 |
| Burnt | 56  | 8.9  | 12 | 8.0 |

Total | 628 | 100.0 | 150 | 100 |

These findings show that most victims of accidents were labourers followed by painters, carpenters, electricians and supervisors. The results were consistent with the outcome of previous studies and accident statistics in other developed countries (Alinaitwe et al, 2007; BLS, 2010; HSE, 2007). Alinaitwe et al (2007) suggested that labourers are more vulnerable to construction site accidents because they are mostly unskilled, most numerous at construction sites especially where there are labour intensive activities like building sites and less catered for in terms of H&S training.
The major three causes of both the reported and on-site recorded accidents were “hit by object, fall (from height) and machine”. The manual performance of most construction site tasks and the poor implementation status of some H&S programmes like PPP, H&S inspections and JHA could be the major reason. Comparatively, fall from height is the major cause of accidents even in developed countries like UK and USA. For over a decade (1996 to 2008), fall from height accounted for about 50 percent of all fatal accidents in UK’s construction industry (HSE, 2009).

**H&S PERFORMANCE IN THE CONSTRUCTION PROJECTS**

The relationship of H&S programmes’ implementation on H&S performance was investigated using “Multiple Regression Technique”. Multiple regression analysis is a statistical technique widely used to create a model which indicates the combined effects of several independent variables on one dependent variable (Damodar, 2006). In order to obtain the best predictors from a set of independents, regression analysis was undertaken using SPSS. The H&S programmes were the independent variables while AIR calculated from on-site recorded accident cases unsafe scores were used as the dependent variables.

The results of regression analysis yielded the model that reflects a set of the most effective H&S programmes for H&S performance improvement. The results of the analysis are tabulated in Table 3. The regression analysis created three models. First, the model signifying that five of the seventeen H&S programmes; namely H&S inspection (P5), in-house safety rules (P8), control of sub-contractors (P10), safety auditing (P15) and job hazard analysis (P17) were the most effective in reducing the accident injury rate (AIR) at the construction sites. The model can be expressed as follows:

\[
\]

The “sample coefficient of determination, R^2” of the model reached 0.74 thus signifying that approximately 74 percent of the accident injury rates could be accounted for by these five H&S programmes.

The second and the third models are identical and they reflect most effective programmes on the occurrence of unsafe practices (unsafe acts and unsafe conditions). Four of the seventeen H&S programmes namely: H&S policy (P1), H&S inspection (P5), PPP (P12) and safety auditing (P15) were found to be most effective in minimizing the occurrences of unsafe acts (UA) and unsafe conditions (UC). The model can be represented mathematically as follows:

\[
UA = 25.22 - 6.032P1 - 2.777P5 - 5.511P12 - 6.508P15 \quad (7)
\]
\[
\]
The value of $R^2$ of the UA model was 0.56 demonstrating that the regression was relatively high, as approximately 56 percent of the variations in the level of occurrences of unsafe acts can be elucidated by these four H&S programmes. While the value of $R^2$ of the UC model was 0.68 implying that regression model was considerably strong, as about 68 percent of the variations in the occurrences of unsafe conditions can be explained or controlled by these four H&S programmes. UA and UC were associated with the same H&S programmes signifying that the same efforts directed in alleviating status of either unsafe practice at the construction site would result into double success. The models further postulated that UA and UC practices at construction are interrelated. Therefore management efforts have to focus on both equally in the quest to improve H&S performance (Aksorn and Hadikusumo, 2007).

### CONCLUSIONS AND RECOMMENDATIONS

**CONCLUSIONS**

The results showed that, overall; five H&S programmes, namely accident investigation, H&S policy, safety committees, selection of employees and control of sub-contractors had the best actual status. Principally, there was a general acceptance of H&S programmes but low level of implementation. Only six H&S programmes (35 percent) were implemented at good level. The remaining 65 percent were either fairly or poorly implemented H&S programmes and they are of great concern if H&S performance is to improve. The unsafe acts and unsafe conditions performance indices were calculated to 36.7 and 42.8 percents respectively. Subjectively, H&S performance was conclusively measured to be poor with 40 percent of the construction site practices unsafe.

Furthermore, objective measurement of H&S performance revealed high prevalence of H&S incidences on Uganda’s construction sites. Reporting of accidents to the

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**Table 3: Regression Analysis of the effects of H&S Programmes on H&S Performance**

<table>
<thead>
<tr>
<th>Independent variables (H&amp;S Programmes)</th>
<th>Dependent variables</th>
<th>AIR (Accident Incidence Rate)</th>
<th>UA (Unsafe acts)</th>
<th>UC (Unsafe conditions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Unstandardized coefficient(s)</td>
<td>Standardized coefficient(s)</td>
<td>Ranking 1</td>
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<tr>
<td>P1: Accident investigation</td>
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<td>P3: Safety training</td>
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<td>P4: H&amp;S inspections</td>
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<td>P5: Accident investigation</td>
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<td>P17: Accident investigation</td>
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<td>P60: H&amp;S inspections</td>
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</table>

**Adjusted $R^2$**

- 0.74
- 0.56
- 0.68
Health and safety

authority was found to be considerably low (about 24 percent). This implied there was lack of enforcement of H&S regulations in reporting of occupational injuries and illness. The NIR and FIR of 18.2 and 2.0 per 100 EFTW were also clear evidence that Uganda’s construction sites were exceptionally unsafe.

RECOMMENDATIONS

It is recommended that Uganda Government cause the implementation of the seventeen H&S programmes into a regulation especially the key programmes P1, P5, P8, P10, P12, P15 and P17. The laws governing H&S at workplace specific to construction industry should be strengthened. The government should also develop guidelines on Occupational Health and Safety (OH&S) hazards at construction sites and regularly up-date them and considers constituting a dedicated regulatory authority like “Construction Industry Commission (CICO)”. H&S performance should be incorporated as one of the criteria for evaluation of tenders for construction projects and new laws should be enacted to regulate “Design for safety” in the construction industry.

The contracting firms are recommended to adopt H&S programmes as a corporate responsibility and cause their full implementations to achieve better H&S performance and hence improved productivity. The designers like architects, engineers and environmentalists are also recommended to adopt “Design for Safety” culture in all infrastructure projects and append H&S plans as part of deliverables.

Further research is recommended in the areas of: analysis of the costs of accidents in Uganda’s construction industry; critical factors that affect the implementation of H&S programmes for improved H&S performance and illnesses related to construction sites health problems.

REFERENCES


Okwel et al.


HOUSING PROCUREMENT IN INFORMAL SETTLEMENTS: A CASE STUDY OF AYOBO, LAGOS, NIGERIA

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Informal settlements have often been associated with poorly constructed houses and appalling environmental conditions, hence research on how to improve the living conditions of residents in such settlements in the developing countries are on the increase. This study examined housing procurement and the challenges associated with it in informal settlements using Ayobo, Lagos, Nigeria, as a case study. Based on data derived from household surveys conducted between 2011 and 2012, it was observed that housing procurement in the study area is based on informal land acquisition process, household savings as the principal source of housing finance and the non-utilisation of relevant professionals in the design and construction of houses. Lack of access to adequate housing finance, non-regularization of land titles and high cost of labour and materials were the key challenges confronting housing procurement in the study area. The paper argues that the current situation has implications for the quality of housing environment, and indeed the living conditions of people living in informal settlements in Nigeria and suggests that some policy actions are needed to redress the situation.

Keywords: Informal Settlements; house procurement; housing environment, Nigeria

INTRODUCTION

Housing procurement is a long time venture associated with man from the early days. However, the process of acquiring housing varies from one place to another in line with the legislations, culture and socio-economic context as well as the availability of building materials, technology and expertise. It has been established in the existing literature that housing plays more significant role than mere provision of shelter. It is the bedrock of human existence and to a large extent determines the health and socio-economic well-being of both residents and the community (Ibem and Aduwo, 2013). As a result, the demand for shelter, especially, among the poor and low-income people, who lack the financial capacity to acquire decent housing has continued to grow rapidly in many developing countries. Rondinelli (1990) observed that this development was primarily due to rapid and uncontrolled urbanization and the failure of conventional housing procurement strategies to meet ever increasing demand. A major outcome of this is the growth and multiplication of informal settlements where the living conditions can best be described as appalling.

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and an affront to human dignity in many cities in the developing world, including Nigeria.

Erguden (2001) noted that housing in informal settlements is associated with severe structural and service deficiencies which impact negatively on the health and quality of life of the residents. Among other things, Thomas (2008) argued that poor quality housing in informal settlements show manifestations in hazardous locations; lack of basic services; substandard housing/building structures; overcrowding; unhealthy living conditions (open sewers, uncontrolled dumping of waste and polluted environments) and tenure insecurity. This goes to suggest that many of the qualitative deficiencies in housing in most informal settlements can be traceable to the construction process and lack of access to basic services. Hence there is a need to further explore housing procurement in informal settlements in cities in the developing countries. Since informal settlements are home to a majority of urban dwellers in these countries, it is argued that the quality of housing in such settlements has far reaching implications for national development, economic growth, political and social stability. Therefore, any attempt to explore and understand the dynamics of housing procurement in informal settlement can contribute to the overall quest for sustainable development.

It is on this premise that this paper examined housing procurement in informal settlements in Nigeria, using Ayobo, Lagos as a case study. This study was part of the overall study which sought to explore the dynamics of homeownership in informal settlements and was prompted by the proliferation of informal settlements in many urban areas in Nigeria. The purpose of the current study was to examine housing building process and the challenges associated with it in the study area. It is expected that the study will extend our understanding of the current issues associated with housing procurement in informal settlements in Lagos, Nigeria. The paper proceeds with a review of literature on housing procurement in informal settlements in urban areas; the description of the research method adopted for the study; presentation and discussion of study findings. It ends with some concluding remarks.

**HOUSING PROCUREMENT IN INFORMAL SETTLEMENTS IN URBAN AREAS: ISSUES AND CHALLENGES**

The existing literature on housing shows that house building process among people of lower income bracket in informal settlements is usually incremental, evolving within the context of changing household income, demographic structure and aspirations (Turner, 1976). However, details of the actual building process varies from one context to the other. In Latin America and parts of Asia for instance, cases of land invasion as a means of land acquisition are well documented while in East and Southern Africa, squatting on illegal land has been very popular. In both cases, occupation precedes housing construction which involves house owners, friends and family members, using rudimentary-like discarded cloth, cardboard, plastic, wood and metals. Such houses are improved and expanded over time in a process Renaud (1984) referred to as “progressive investment”. In those regions of the world, many of the settlements that evolved in this process have been able to undergo regularization of tenure and in the process attracted public provision of basic infrastructural services.

In Nigeria, however, housing development by the poor has followed a different trajectory. Land invasion and squatting are very minimal. Land is often purchased not through public channels but through the informal market from land owning families or those who desire to resell their plots. At the periphery of urban areas and large cities
such as Lagos, Kano, Ibadan, Port Harcourt, Enugu and others, land is relatively cheaper and sometimes, favourable payment arrangements are negotiated between the buyers and sellers (Rakodi, 2007). House building process is usually incremental using grades of materials within the means of each household. Opoko (2004) pointed out that in most informal settlements in Nigeria, many households rely on artisans and local builders for the actual construction of houses. However, where household members have the relevant skills, such members are usually actively involved in sourcing materials and generally managing the construction process. Progress of work depends on household income, and as Keare and Paris (1982) and Murray (2008) rightly observed, the construction would normally be in phases and thus take a long time to complete. Olotuah (2005) also observed that the quality of housing in many cities in Nigeria (which are mainly comprise of networks of informal settlements) is not very good as a result of the mode of procurement. This notwithstanding, Rondinelli (1990) identified advantages of self-building by the poor to include increasing the housing stock; affordability; satisfaction; increased real wealth; skills development; employment and income generation.

The processes of procuring housing in informal settlements is often fraught with several challenges arising from the perceived illegality of informal settlements as well as the disadvantaged and impoverished conditions of the people. Although, Ugonabo and Emoh (2013) opined that land is a crucial element in the property development process, several studies (including Payne and Majale, 2004; Beall et al., 2006) have established that gaining access to land especially by the urban poor is one of the serious constraints confronting housing development in many developing countries. According to Omirin (2002), accessibility to land encompasses its tenure security, affordability, availability and the ease with which it is acquired. Consequently, Kombe (2001) and Rakodi (2007) attributed difficulties in gaining access to land to failure of the formal land delivery system. They argue that in recent times, poor households cannot buy land while low-income households with some income can only do so through negotiations for flexible methods of payment. Gilbert and Gugler (1994) reasoned that this is because while shrewd investors make huge profits the poor are priced out of the market. In Nigeria for instance, the Land Use Act of 1987 which vested ownership of all land on government was enacted to facilitate easier access to land for housing development, has introduced several bottlenecks in land administration which have served to further constrain access to land (Ibem and Odum, 2011). Among the several challenges associated with acquisition of land in the country include double purchase of same land from government and customary owners, lengthy and cumbersome transactions involving several steps and bureaucracy (Ikejiofor, 2005; Ugonabo and Emoh, 2013). Another major constraint in land acquisition is tenure security. Lack of security of tenure exposes owners to the risk of evictions and consequent loss of investments (Tibaijuka, 2005). Therefore, Erguden (2001) was of the view that promoting security of tenure is a prerequisite for sustainable improvement of housing and environmental conditions.

Housing procurement in informal settlements is also confronted with the challenges of poor regulatory framework. Regulatory framework in this context encompasses planning regulations which stipulate what development is permitted, and planning standards which stipulate acceptable level of quality and administrative procedures (Payne and Majale, 2004). Dysfunctional regulatory frameworks constitutes a barrier to effective housing development process by making it lengthy, time consuming, cumbersome and expensive, thereby creating incentives for people to operate outside
the formal sector (Payne, 2001; Opoko, 2005; Nigerian Vision 2020 Programme, 2009). It has been observed that many a times prescribed standards are high, expensive and reflective of what obtains in developed countries (Murphy, 2008; Schilderman and Lowe, 2002). Consequently, there have been calls for regulatory reviews which among others will allow formal system of housing procurement process to be complimented by informal systems (Kombe, 2001) while at the same time making the process cheaper, faster and context specific (Murphy, 2008).

In the developing countries, another area of concern is the availability of conventional building materials. Due to poor industrial capacity base, the supply of building materials usually falls below the demand, thereby creating scarcity, increase in price and continued dependence on importation (Opoko, 2004). Moavenzadeh and Rossow (1976) identified disadvantages of importation of building materials to include high cost, low consumption of building materials, incompatibility with local conditions and use of foreign exchange. In addition, natural resources are left undeveloped while opportunities for employment, training, income generation and redistribution are lost. Opoko (2004) also observed that although research and development have resulted in new alternative materials in Nigeria, these materials are not widely used for reasons which include lack of public awareness in the use and standardization of these materials.

Generally speaking, housing development is capital intensive as such many households spend greater proportion of their income on housing. Kuye (2007) noted that the magnitude of funds required for housing development is often more than what poor households can afford, while Ellis (2007) indicated that the housing finance system in many countries, which is still at a rudimentary stage and characterized by tough lending guidelines is not helping matters. The lack of long term mortgage loans and unusually high down payment ratio have been identified as factors militating against the quest for homeownership (Cho, 2007). It is also established in the literature that poverty remains at unacceptably high levels around the world and is rapidly becoming an urban phenomenon (Buckley and Kalarickal, 2004), and thus has drastically reduced the ability of households to access relevant inputs needed in housing development. In fact, Bertaud (2001) posited that housing supply and demand issues impact on affordability and therefore advised that affordability be addressed by simultaneously tackling both supply and demand constraints.

In spite of these challenges, Gilbert and Gugler (1994) suggested that the evaluation of housing by urban poor in informal settlements should be done cautiously. According to them, this is because (i) comparatively, services in informal settlements in urban areas appear better than those in the rural areas (ii) most of the criteria by which housing conditions are judged are highly subjective and ethnocentric; and (iii) evaluation should take into cognisance differing cultural, social, economic and environmental conditions. Moreover, it has also been established in the literature that the habitability of a house is influenced not only by the engineering elements but also by social, behavioural, cultural and other elements in the entire societal-environmental system (Lawrence, 2002; Olotuah and Bobaoye 2009). This suggests that the provision of shelter per se and its physical soundness are not sufficient to guarantee good housing environment that is habitable.

In view of the foregoing, several countries in the global south have embarked on reviews aimed at ameliorating these challenges. In the Nigerian context, such reforms have aimed at encouraging public/private partnership; making land more easily available; encouraging the use of local building materials; strengthening research and
Housing procurement development and evolution of a sustainable mortgage finance system. However, the impact of these efforts have been limited and patchy; which is an indication that more studies are needed to further examine house building processes in informal settings for a possible solution to the obvious challenges and with a view to improving the living conditions of the residents. Therefore, the current study seeks to contribute to policy and practice by identifying procurement related issues that promote the habitability and sustainability of housing environment in informal settlements in urban areas in the developing countries.

RESEARCH METHOD

Ayobo is one of the largest and fastest growing informal settlements in Lagos metropolis. This settlement had hitherto served as farmlands for the rural land owning families but is currently one of the major axes of development for land-strapped Lagos. Ayobo presents a typical feature of an informal settlement in a rapidly growing city and was therefore chosen for this study.

The study adopted a combination of both qualitative and quantitative research methods. The survey research design was used and the study population was the household heads resident in the study area between November 2011 and May 2012 when the surveys were conducted. The household heads were the respondents in the survey, but where the household head was not available, a representative that is spouses or other adult members of the household was selected for the survey. A multi-stage sampling technique was used in selecting the respondents. In the first instance, a systematic sampling technique was adopted in selecting every 8th building in all the streets in the study area. Where there was a single household residing in the selected building, the head of the family was automatically picked for the survey. In buildings where there were more than one households, random sampling technique was used in selecting a household head. Secondly, in buildings that were occupied by more than four households, two household heads were purposively selected to ensure adequate representation.

The main data collection instrument used in this study was pretested questionnaire administered by the researchers and ten trained field assistants. The questionnaire was structured to capture information on the respondents’ socio-economic and demographic characteristics, residential history and aspiration, processes of acquiring houses, housing characteristics and respondents’ perception of their housing environment. Of the 1200 questionnaires administered, 1151 (96%) valid questionnaires were retrieved. Data collected using the questionnaire instrument were augmented by in-depth one-on-one interviews with randomly selected household heads and observations. These helped to probe further on questions on the questionnaire and those that were not captured in the questionnaire, thereby unveiling a rich repository of relevant data needed to enhanced our understanding of the issues investigated. Data derived through the questionnaire were analysed using the Statistical Package for Social Studies, SPSS (version 17) and the descriptive statistics was the primary data analysis technique used. Interview responses and observations were also analysed using content analysis technique. The result is as presented in the next section of this paper.
STUDY FINDINGS

Socio-Economic and Demographic Characteristics of the Respondents

The result shows that of the 1151 respondents in the survey, 388 (34%) of them were either owner occupiers or living in family houses; meaning that a majority (66%) of the respondents in the survey were renters or belonged to other tenure types. Since, the focus of this paper is on housing procurement amongst house owners (land lords) residing in the study area, findings of the current study as presented in the subsequent paragraphs are with particular reference to this category of respondents and do not include renters. The result of the socio-economic and demographic characteristics of the respondents as presented in Table 1 shows that a majority (60%) of the respondents were male and 35% female while 66% of them were over 40 years of age. As would be expected most of them were of the Yoruba ethnic origin and were married. Almost all of the landlords residing in the study area had formal education with about 50% of them being self-employed. A majority (58%) of them were Christians, 74% were low-income earners, while 12% and 8% were middle and high-income earners living, respectively. Also the result shows that most of the house owners encountered in the survey lived in self-contained and single family houses. It was therefore not surprising that 49% of them had household sizes of between three and six persons. The result on the length of stay of the respondents indicates that a majority of them had lived in their respective residences for between 6 years and 20 years, thus suggesting that most of buildings were constructed in last 20 years or so.

TABLE 1: SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

<table>
<thead>
<tr>
<th>RESPONDENTS’ CHARACTERISTICS</th>
<th>FREQUENCY(n=388)</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>233</td>
<td>60.0</td>
</tr>
<tr>
<td>Female</td>
<td>135</td>
<td>35.0</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Age (Years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;25</td>
<td>27</td>
<td>7.0</td>
</tr>
<tr>
<td>25 - 40</td>
<td>86</td>
<td>22.0</td>
</tr>
<tr>
<td>41 - 50</td>
<td>147</td>
<td>38.0</td>
</tr>
<tr>
<td>51 - 60</td>
<td>76</td>
<td>20.0</td>
</tr>
<tr>
<td>61 - 70</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>&lt;70</td>
<td>12</td>
<td>3.0</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Ethnic Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoruba</td>
<td>306</td>
<td>79.0</td>
</tr>
<tr>
<td>Ibo</td>
<td>54</td>
<td>14.0</td>
</tr>
<tr>
<td>Hausa</td>
<td>13</td>
<td>3.0</td>
</tr>
<tr>
<td>others</td>
<td>11</td>
<td>2.8</td>
</tr>
<tr>
<td>No response</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>7</td>
<td>8.0</td>
</tr>
<tr>
<td>Christianity</td>
<td>224</td>
<td>58.0</td>
</tr>
<tr>
<td>Islam</td>
<td>148</td>
<td>38.0</td>
</tr>
<tr>
<td>Traditional Religion</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>42</td>
<td>11.0</td>
</tr>
<tr>
<td>Married</td>
<td>295</td>
<td>76.0</td>
</tr>
<tr>
<td>Widowed</td>
<td>31</td>
<td>8.0</td>
</tr>
<tr>
<td>Divorced</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
<td>No response</td>
<td>9</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Highest Educational Attainment
No response 4 1.0
No formal education 31 8.0
Primary 89 23.0
Secondary 99 26.0
Ordinary National Diploma (OND) 84 22.0
First degree (HND, BSc., B.A.) 55 14.0
Post-graduate 26 8.0
Employment Status
No response 3 0.8
Retired 78 20.1
Self-Employed 192 50.0
Wage Earner 64 17.0
Unemployed 31 8.0
Others 20 5.1
*Monthly Income (Naira)
No response 18 5.0
No income 7 1.1
<N17,000:00 95 25.0
N17,000:00 - N40,000:00 116 30.0
N41,000:00 - N100,000:00 74 19.0
N101,000:00 - N250,000:00 46 12.0
>N251,000:00 32 8.0
Current Household Size (Persons)
1-2 70 18.0
3-4 113 29.0
5-6 77 20.0
7-8 31 8.0
<8 97 25.0
Type of House Occupied
No response 5 1.3
Self-contained flat 142 37.0
Single family house 159 41.0
Rooming house 74 19.1
others 8 2.0
Length of Household Stay in House (Years)
0-5 89 23.0
6-10 128 33.0
11-15 47 12.0
16-20 50 13.0
21-25 31 8.0
<25 43 11.0

*US1= N156 as at March 2013

Housing Procurement Strategies

Sources of Housing Inputs

The study found that 43% of the respondents encountered in the survey indicated that they purchased land on which they built their houses from land owning families, while around 25% obtained their land as family inheritance as presented in Table 2. About 19% reported that they purchased their land from private land owners. Among those who purchased land from their owners, 56% of them made one down payment while the remaining percentage made regular instalment payments. However, 2.3% reported that they obtained land used in the construction of their houses as gifts, 1.0% were given land as payment in kind for services rendered and only very few (0.5%) reported that they were squatters.
Table 2: Land Procurement Strategies

<table>
<thead>
<tr>
<th>Mode of sourcing land</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land owning family</td>
<td>165</td>
<td>42.5</td>
</tr>
<tr>
<td>Private land owner</td>
<td>72</td>
<td>18.6</td>
</tr>
<tr>
<td>Government</td>
<td>17</td>
<td>4.4</td>
</tr>
<tr>
<td>Inheritance</td>
<td>95</td>
<td>24.5</td>
</tr>
<tr>
<td>Gift</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>Payment in kind</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Illegal occupation</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payment schedule</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One payment</td>
<td>216</td>
<td>55.7</td>
</tr>
<tr>
<td>Instalments</td>
<td>134</td>
<td>34.5</td>
</tr>
<tr>
<td>Others</td>
<td>18</td>
<td>4.6</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Land transactions in the study area were also found to be predicated on the notion of trust. It was observed that transactions between land buyers and sellers were nevertheless, well documented. However, strategies, such as back-dating of transaction documents and under reporting of the value of purchase, among others were adopted with the aim of circumventing the law. Another common feature of land transaction in the study area was multiple sales of same land to different buyers and obstructions of housing construction process by the indigenous landowners popularly known in local parlance as “omoniles” who demanded for extra money from those who bought land for housing construction in the area.

Result presented in Table 3 shows the sources from which respondents obtained funds for their houses. Only 5.2% of the respondents indicated that they sourced money used in housing development from the banks, while a majority (69.3%) relied on their personal/household savings as the principal source of funding for their housing development.

Table 3: Sources of Funds for Housing Development

<table>
<thead>
<tr>
<th>Source of Money for the House</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal savings</td>
<td>269</td>
<td>69.3</td>
</tr>
<tr>
<td>Bank loan</td>
<td>20</td>
<td>5.2</td>
</tr>
<tr>
<td>Family members</td>
<td>24</td>
<td>6.2</td>
</tr>
<tr>
<td>Friends</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Employer</td>
<td>27</td>
<td>7.0</td>
</tr>
<tr>
<td>Cooperative society</td>
<td>23</td>
<td>6.0</td>
</tr>
<tr>
<td>Money lenders</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>2.0</td>
</tr>
<tr>
<td>No response</td>
<td>15</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Debt Status on House

| Yes                          | 34                | 9.0            |
| No                           | 330               | 85.0           |
| No response                  | 24                | 6.2            |

From the result, it is evident that about 6.2% of the respondents sourced money from family members while 0.8% sourced money from friends. The role of employers and
co-operative societies in housing development was evident in the study area as 7% sourced money from employers and another 6% sourced money from cooperative societies which they belonged to. Notably, less than 1.0% of the respondents borrowed from money lenders to finance the construction of their houses. Only very few (9%) respondents were still owing on their building transactions. These were mainly those who negotiated and secured concessionary payment schedule from vendors of housing inputs like land, building materials and labour.

With respect to the sources of building materials used for housing construction, 65.4% of the respondents indicated that they bought the materials from open market; 21% obtained the materials from distributors while 7.2% got their supplies direct from the manufacturers as shown in Table 4. About 67% of the respondents indicated that the building materials were paid for at the point of purchase while 26% said that they made instalment payments for the materials. About 0.5% of the respondents claimed that they got the building materials as gifts.

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturers</td>
<td>28</td>
<td>7.2</td>
</tr>
<tr>
<td>Distributors</td>
<td>81</td>
<td>21.0</td>
</tr>
<tr>
<td>Open market</td>
<td>254</td>
<td>65.4</td>
</tr>
<tr>
<td>Scrap</td>
<td>7</td>
<td>1.8</td>
</tr>
<tr>
<td>Gift</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>No response</td>
<td>15</td>
<td>4.0</td>
</tr>
<tr>
<td>Total</td>
<td>388</td>
<td>100.0</td>
</tr>
</tbody>
</table>

It is noteworthy that the use of scraps or nondurable materials as building construction materials appeared not to be common in the study area as only very few (2%) of the respondents were found to have used scrap and/or non conventional materials. In fact, it was observed that most of the buildings from where the respondents were selected constructed with approved conventional building materials. This is not a surprise as building materials shops were seen in the neighbourhood. However, our investigation revealed that materials from these shops were more expensive due to the cost of transportation from the manufacturers’ warehouses or factory to the neighbourhood. Some of the respondents who were interviewed expressed their desire to use other more affordable building materials that could equally ensure high standards if the law allowed them to do so.

**Housing Design and Construction of Houses**

The result presented in Table 5 reveals that about 44.1% of the respondents claimed that their houses were designed by architects; 18% claimed that draughtsmen designed their buildings; 14% of the respondents said that their houses were designed by contractors while 11% indicated that artisans designed their buildings. Interestingly, only 8% claimed that either themselves or other family members designed their houses. With regards to who constructed the houses, Table 5 also shows that 47% of the respondents claimed that their houses were constructed by hired labour, 21% said that their houses were constructed by small-scale contractors while 10% claimed to have used the services of large scale building contractors. However, very few respondents indicated that they used their friends and family members who had the requisite construction skills in the housing construction process.
Table 5: Design and Construction of Houses

<table>
<thead>
<tr>
<th>Who Designed the House?</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self</td>
<td>30</td>
<td>7.7</td>
</tr>
<tr>
<td>Artisan</td>
<td>42</td>
<td>10.8</td>
</tr>
<tr>
<td>Contractor</td>
<td>55</td>
<td>14.2</td>
</tr>
<tr>
<td>Draughtsman</td>
<td>68</td>
<td>17.5</td>
</tr>
<tr>
<td>Architect</td>
<td>171</td>
<td>44.1</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Who Constructed the House?</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family</td>
<td>15</td>
<td>3.9</td>
</tr>
<tr>
<td>Friends</td>
<td>26</td>
<td>6.7</td>
</tr>
<tr>
<td>Hired labour</td>
<td>184</td>
<td>47.4</td>
</tr>
<tr>
<td>Small-scale contractor</td>
<td>80</td>
<td>20.6</td>
</tr>
<tr>
<td>Large-scale contractor</td>
<td>37</td>
<td>9.6</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>No response</td>
<td>44</td>
<td>11.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration of House Construction</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one year</td>
<td>65</td>
<td>16.7</td>
</tr>
<tr>
<td>One - two years</td>
<td>152</td>
<td>39.2</td>
</tr>
<tr>
<td>Three - five years</td>
<td>84</td>
<td>21.6</td>
</tr>
<tr>
<td>Six - ten years</td>
<td>41</td>
<td>10.6</td>
</tr>
<tr>
<td>More than ten years</td>
<td>17</td>
<td>4.4</td>
</tr>
<tr>
<td>Still in progress</td>
<td>17</td>
<td>4.4</td>
</tr>
<tr>
<td>No response</td>
<td>12</td>
<td>3.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Status of House When First Occupied</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed</td>
<td>199</td>
<td>51.3</td>
</tr>
<tr>
<td>Partially completed</td>
<td>181</td>
<td>46.6</td>
</tr>
<tr>
<td>No response</td>
<td>8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Of all the respondents, only 18% of them indicated that they moved into their houses within a year of commencing construction. However, for a majority (61%) of the respondents, the occupation of their houses took place between one and five years. About 11% claimed that their houses took between six and ten years to construct, 4.4% said that their houses took more than ten years to construct while another 4.4% claimed that their houses were still under construction. The result showed that 47% of house owners moved into their respective houses which were not yet fully completed.

**Challenges of Housing Procurement in the Study Area**

One of the major challenges of housing procurement in Ayobo identified by the respondents in the survey was the issue of security of tenure. Although, the result in Table 6 shows that a greater proportion (85%) of the respondents, claimed to have obtained building plan approval before constructing their houses, only 36% of them claimed the approved building plans as a proof of ownership. About 31.2% claimed that the receipts of purchase of land/building was their proof of ownership while 7.0% claimed that the agreement for the sale of land/building was their proof of ownership. Only 3% of house owners said that they had no proof of ownership of their property, while 15% of house owners indicated that they had a certificate of occupancy (C of O).
Table 6: Respondents’ Proof of Ownership

<table>
<thead>
<tr>
<th>Proof of Ownership</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Building Approval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>331</td>
<td>85.0</td>
</tr>
<tr>
<td>No</td>
<td>38</td>
<td>10.0</td>
</tr>
<tr>
<td>No response</td>
<td>19</td>
<td>5.0</td>
</tr>
<tr>
<td>Proof of House Ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate of occupancy</td>
<td>58</td>
<td>15.0</td>
</tr>
<tr>
<td>Approved building plans</td>
<td>139</td>
<td>36.0</td>
</tr>
<tr>
<td>Receipt for sale of land/building</td>
<td>121</td>
<td>31.2</td>
</tr>
<tr>
<td>Agreement for sale of land/building</td>
<td>27</td>
<td>7.0</td>
</tr>
<tr>
<td>None</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
<td>3.1</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Similarly, the result in Table 7 reveals that 48% of the respondents reportedly encountered funding challenge in the process of constructing and/or acquiring their houses; 16.5% had challenges with the procurement of building materials; 8% had labour related challenges; 9.3% had building plan approval challenges while 5% witnessed land disputes. In addition, the cost of labour was also on the increase as the respondents indicated. According to the respondents, there was a dearth of skilled workers (trades men) such as bricklayers, carpenters, painters, plumbers and other artisans in the area.

Table 7: Problems Encountered in the Process of Acquiring House

<table>
<thead>
<tr>
<th>Problems</th>
<th>Frequency (n=388)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance</td>
<td>188</td>
<td>48.0</td>
</tr>
<tr>
<td>Building materials</td>
<td>64</td>
<td>17.0</td>
</tr>
<tr>
<td>Labour</td>
<td>29</td>
<td>8.0</td>
</tr>
<tr>
<td>Building approval</td>
<td>36</td>
<td>9.0</td>
</tr>
<tr>
<td>Land disputes</td>
<td>18</td>
<td>5.0</td>
</tr>
<tr>
<td>Others</td>
<td>15</td>
<td>4.0</td>
</tr>
<tr>
<td>No response</td>
<td>38</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**DISCUSSION**

It is evident from this study that house owners in the study areas encountered in the survey were predominantly middle-aged men of low-income status, with minimal formal education and mainly employed in the informal sector. Going by the evidence in the existing literature from the ‘global south’ this result is well expected. In addition to this, a number of features very common to housing development informal settlements in other parts of the world were also found in the study area. With regards to access to land for housing development, it is acknowledged globally that land is a key input in housing procurement, and it availability at affordable cost can have significant impact on the performance of the housing sector. Evidence in this study however show that the type of land invasion often associated with informal settlements in parts of Latin America and Southeast Asia was not the case in the study area as most of the respondents claimed that they obtained land for housing construction through acceptable means. In support of findings of previous study by Rakodi (2007), land transactions in the study area were found to be predicated on the notion of trust because of the quasi-legal nature of housing development in the area. The levels of trust were strengthened through social linkages like ethnic and religious
groups as well as membership of clubs and the Community Development Associations. Thus land transactions tended to allow for negotiation of prices and payment schedule. This responded favourably to the incremental mode of construction employed by respondents most of whom financed their housing projects from personal savings. Although, the operational land management and administration legislation in Nigeria prohibits informal transactions. Strategies adopted to circumvent this legislation often increased the vulnerability of buyers to fraudulent practices and disputes especially as evidenced by multiple sale of same land to different buyers. Also, these strategies tend to create opportunities for buyers to be exploited by the land sellers and public officials.

Besides the issue of accessibility to land, the study revealed that veritable sources of housing finance is a major challenge for housing development in informal settlements. The prevailing economic situation in Nigeria has impoverished many households, making it difficult for an average family to have adequate income needed for housing development. Many commercial banks and mortgage institutions in the country are unwilling to provide long term funding for housing development in informal settlements perhaps due to the low-capital base of the residents, their inability to provide acceptable collateral and the envisaged low returns from such transactions. Reliance on money lenders had often not been considered as a viable option for long term projects like housing. This is because this approach to sourcing money is associated with exorbitant interests charged and short repayment period allowed by money lenders. Findings of this study thus tended to suggest that personal savings and informal sources were the main sources of housing finance in informal settlements in Nigeria. This is no doubt a strong indication of a poorly operated mortgage and housing finance mechanism in the country which had continued to serve the rich to the detriment of the poor.

The low level of indebtedness by the respondents on the other hand clearly suggests that the houses were built within the financial means of respondents. What may however be of concern is the quality of the houses considering the socio-economic characteristics of the respondents which compelled them to build incrementally and made it practically impossible for a majority of them not to engage the services of qualified architects and professionals builders (contractors) in the design, planning and construction of their housing projects. In fact, the reported use of architects by about 44% of the respondents appeared questionable considering the quality of the designs of the buildings. This result is probably because of the protracted battle between architects and draughtsmen in the country as many draughtsmen deceptively usurp the position of architects by parading themselves as architects despite the legislation regulating professional architectural practice which clearly stated who qualified to act and be referred to as “architect”. Therefore, the involvement of non-professionals in housing procurement as this study suggests, poses a threat to the safety and quality of the housing environment. This development needs to be checked, more so as there have been reported cases of poor environmental quality and building collapse in the area, some of which were blamed on the activities of quacks in the building construction industry in Nigeria.

Also, the insistence on the use of high building standards and approved materials had tended to put a constraint on the possibility for people to use inexpensive local materials and traditional construction techniques which are cheaper and less complicated in application; and thus making the cost of building materials to be out of reach to a majority of aspiring home owners in the study area in particular and in Nigeria in...
Housing procurement

general. Although various research and development activities have resulted in the development of alternatives, these are yet to be effectively introduced to the market. Consequently, their benefits remain within the confines of laboratories.

Generally speaking, in the context of Nigeria, procuring building materials from manufacturers and distributors is usually cheaper than buying from open market; but the piecemeal method of accumulating funds as well as the incremental manner in which houses in the study area were reportedly constructed may have made it difficult for most of the respondents to buy directly from manufacturers or their distributors. Hence a large proportion of respondents resorted to the open market and possibly at a higher cost. One major challenge of buying from the open market, however, is the possibility of buying fake and substandard building materials, which negates safety and security of the residents. In the same vein, the lack of adequate supply of skilled craftsmen and the resultant high labour costs can be attributed to the engagement of many of the craftsmen in commercial motorcycle transport business considered to be a quicker and more regular source of income in the study area.

The study also found that a majority of the respondents in the survey do not have C of O of their landed property; suggesting a major defect in tenure. The Certificate of Occupancy (C of O) is an official document conferring ownership of landed property on its holder and forms the basis of compensation in the event of government acquisition. Tenure insecurity increases the risk of evictions, loss of investment and stifles housing improvements, hence tackling this constitutes a critical challenge to home ownership in the study area.

CONCLUSION

This study has shown that housing procurement in the study area thrived in informal practices constrained by several challenges which need to be addressed in order to facilitate effective procurement processes and ameliorate the current adverse effects on housing and environmental quality. To this end, firstly there is a need to revisit land administration in the country in order to make it faster, cheaper, more transparent and less cumbersome. Secondly, a deliberate policy on housing finance in the informal urban sector should be put in place. This is necessary to encourage financial institutions to provide long term facilities for housing development in informal settlement using land where the building is to be constructed as a collateral. Thirdly, it is imperative to evolve new standards that are in line with the people’s socio-economic context. Such standards should promote the use of proven local raw materials that are durable and at the same affordable to the majority. Finally, there is a need for more involvement of professionals in the building industry in housing procurement in informal settlements in order to provide needed technical assistance. Architects, builders and engineers have a role to play in educating the people of the need to engage the services of professionals at every stage of their housing projects. This will contribute to enhancing the quality of housing environment and eliminate some of the constraints militating against housing procurement in informal settlements in Nigeria.

REFERENCES


Housing procurement


HOW DOMESTIC SPACE EMBODIES STATUS: A COMPARATIVE STUDY OF KITCHENS AND CULINARY PRACTICE IN ILE-IFE, NIGERIA

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Estates Design and Technical Services, NHS Berkshire, St.Marks Hospital, Maidenhead, Berkshire United Kingdom

Many ethnographic studies identify the kitchen as a gendered space, and argue that because gender defines status and power relations in society, such distinctions will be manifested in the way space is designed and used. A gendered space is therefore a status space. The purpose of this study is show how status is manifested and to measure this manifestation by analysing the distribution of culinary practices in space. This paper discusses how status is manifested in domestic space, by undertaking an ethnographic study of culinary practices in seventy-five households in Ile-Ife, Nigeria. By using a combination of architectural morphology tools based on the 'space syntax' theory, which has been developed at the Bartlett School of Graduate Studies, University College London, since the 1970s, and descriptive statistics, the study shows how the shared patterns of presence and separation of persons, objects, activities, and food in space may be used to measure the interrelationship between space and social status. The study finds that there is a tendency for the status attributed to these phenomena to be influenced by other variables that share the same spatial environment.

Keywords: social status, domestic space, culinary practice, kitchen, gender,

INTRODUCTION

The sociological concepts of status, solidarity and social mobility are usually described in terms of the society at large, but not as well from the perspective of the domestic environment and relationships, even though it is widely acknowledged that the domestic space is the one environment that makes social and cultural interaction accessible to every person. This study seeks to explore how these interactions and interrelationships are manifested in the way and manner domestic space is used through the analysis of kitchens in Yoruba households in Ile-Ife, Nigeria.

The identity of the kitchen as a gendered space is evident in several ethnographic studies (Rendell, 2000; Grosz 2000), and it is common in most cultures for food preparation and culinary activities to be delegated to people of lower rank in households, and who are most likely to be female (Ardener, 2000; Massey 2000; Rendell 2000). These studies argue that because gender determined status and power

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relations in society as well as solidarity identity, such distinctions would be manifested in the way space was designed and used.

The main question to be asked is whether social hierarchy and social structure has a spatial dimension in the domestic environment, in other words, is socially defined position exhibited in the manner space is used; and, if so, can it be measured? This paper shows how status is manifested in different lifestyle settings in households in Ile-Ife, Nigeria, by analysing the dynamics of culinary practice within the domestic space. Spatial configuration was analysed using the space syntax methodology developed by Hillier and Hanson (1984).

Research data was based on an ethnographic and spatial morphological study conducted in mid 1990s of seventy-five households in three study areas in Ile-Ife, Nigeria. The first area consisted of the pre-colonial traditional core of Ile-Ife called Enuwa, near the palace, and where the established indigenous Ife people lived in extended family compounds. The second area consisted of the business district, called Lagere and Akarabata, where the immigrant settlers and commercial traders lived. The third study area was the university campus staff quarters for the senior staff of Obafemi Awolowo University. The study was developed in three stages; first, in an exploratory survey of 30 houses in one of the study areas in 1988, in order to find out if there were valid questions to be explored further. This was then followed by a comprehensive study of 75 houses in 1995, which consisted of interview of 25 households in each of the three study areas, guided by a structured open-ended questionnaire. In 2003, a spot-check of 10% of the original participant households was carried out to see if the findings were still relevant, and it was found to be so. The researcher lived in Ile-Ife, and grew up in one of the study areas, and was therefore familiar with the history and development of the three areas.

Demographically, the households come from different socio-economic backgrounds, ranging from academic elites to working families in skilled manual, clerical employment to farming and trading. They exhibit various levels of education achievement, Westernisation, and are at different stages of the development life cycle of the family but with a common ethnicity (Yoruba) and culture.

The housetypes were identified as the (a) orowa type (single-storey central living hall), (b) rooming type (double-storey central circulation) and (c) the modern type
Domestic space

(self-contained single family) housetypes (See Fig 1). Structurally and spatially, the sample households range from extended polygynous households (or compound families) residing in family compounds (agbo-ile), to multi-family households in shared tenement properties to single nuclear family households in self-contained modern houses for university lecturers.

PROBLEM DEFINITION

Space in interaction with Status, Solidarity and Social Mobility

Several studies have argued that there is or should be a relationship between the conscious articulation of space, the use of space, and the cultural perspective that is inherent or reflected by the interaction of these three components (Wilk 1990, Lawrence 1987). Studies in ethnography and material culture claim that some activities such as sacred or menial tasks, are status signifiers, and certain objects such as modern technology, electronic goods and sacred artefacts are status symbols (Shove and Hand, 2012; Amadiume, 1987; Csikszentmihalyi and Rochberg-Halton 1981). Other studies in architectural morphology have shown how rooms can be imbued with hierarchical ranking that determines accessibility and exclusion (Spain, 2000; Hanson 1998; Kent 1990). With respect to the workplace, Vischer (2005) suggested that spatial configuration directly signified the status of employees in traditional office settings and open plan layouts whereby increased privacy and isolation of the workspace correlated with increased seniority and status.

Therefore, if people occupy space according to status, if roles are allocated according to status, and if space can indicate status, it should be possible to correlate the morphological properties of status space with the spatialisation of status activities and objects. Likewise, as solidarity permits some form of equivalence amongst variables, it can also be argued that people of equal standing would be permitted access to equivalent space, perform activities and handle material commensurate with their standing, or conversely be excluded.

LITERATURE REVIEW

The purpose of this section is to define the parameters for the study, and how they will be employed in answering the question of how status, solidarity and social mobility are manifested in space, by observing the spatial patterns of persons, objects, activities and food in respect to kitchens, cooking and culinary practices in households in Ile-Ife.

Status

According to Abercombie et al (2000 p 345), status is defined in three ways, “first, as a position in a social system, secondly, as the relative position of a person in a publicly recognised scale or social stratification, and thirdly, in association with lifestyle and distinct patterns of consumption”. Compton (1993) stated that most complex social systems are constituted by inequality in the form of social stratification. Status is thus characterised by distinction and social differentiation.

Solidarity

Basically, solidarity has its origins in trying to explain how social networks are formed in society. Durkheim (1893, translated: Halls 1984) identified mechanical solidarities based on collective consciousness in pre-industrial society, and organic solidarities based on the rights of the individual in industrial society. Current essays on solidarity now tend to focus on the relational aspects of the members of the
solidarity. (Fararo, Doreian 1998). Essentially solidarity refers to the cohesion, mutual
dependence, community of interests and responsibilities of a group, but in the same
vein, represents exclusivity and exclusion form others not considered part of the
group. (Heise, 1998; Breiger and Roberts (1998). In that sense, the effect of the
solidarity is to unify or cohere this group of people around a pivot, and at the same
time exclude others. So whilst solidity represents collectiveness, status represents
difference.

Social Mobility

Social mobility is the degree to which a person can change their social status. There
are two kinds of mobility, intra-generational, i.e. whereby a person’s social status
changes in the course of their lifetime; and inter-generational, where the social status
of the descendants of a person changes from that of their parents (Abercombie et al
2000; Bilton et al 1987). Social mobility occurs when there is movement between the
different levels of hierarchy, such that people can then move into higher or lower
status groups and acquires solidarity with others in that group (Haralambos, Holborn,
Heald 2004). Social mobility, therefore, measures the ease or resistance of that
movement, in other words, the fluidity of the social grouping (Clarke, 2001; Bourdieu,
1979).

Space as a physical and social entity

De Certeau (1984 p 117) made the distinction between place and space in that ‘place’
is a static phenomenon that occupies a position, and excludes another from occupying
the same position, whilst ‘space’ is constituted by movement and time. Space also has
to be delimited by boundaries to give it an identity, whether of outside and inside, and
this makes it a catalyst for social interaction and a container for social production and
reproduction (Hillier, 1996; Rendell, 2000). Psarra (2003) made the distinction
between shape and space, the former being perceived instantly, and the latter being
experienced through movement and time. As such, there is going to be a different
interaction between person and person, person and activity, person and objects, and
person and space. Space is characterised by boundary, movement and occupation.

There is a sense in which spatial boundaries serve to reinforce differentiation, hence
status; movement between spaces indicates fluidity and permeability, hence mobility;
and the occupation of space implies an equivalence of spatial experience and
conditions, hence solidarity.

Status foods

A study carried out by Ojofeitimi & Olufokunbi (1986) on food preferences and
nutrition at the Obafemi Awolowo University, Ife found that people’s preferences for
food was not based on its nutritional qualities but on the status and perception of the
food as that of the rich. They concluded that the lack of information on the nutritive
values played a greater part in the problem of malnutrition in developing countries
than poverty because the status of food relates more to its economic value than its
nutritional value.

The impact of energy source, infrastructure and technology on culinary practice

Food preparation processes help to illustrate the difficulty faced by households
particularly in terms of the deficiency of basic utilities and infrastructural facilities in
Nigeria. Hygiene in domestic cooking space is linked to infrastructure, which has
health and safety implications (Redmond and Griffith 2009).
The fuel used for cooking determines how much time is spent on housework, starting from the collection of the fuel, cooking times, and even the diet. As not all households have access to a gas, electric or kerosene stove, the time spent fetching firewood constitutes part of the cooking time. Likewise, the time spent fetching water would ordinarily prolong the working day and determine how much water is used for other cleansing purposes. Fuel sources used in developing countries, range from electricity, to gas, kerosene, coal, firewood and sawdust, depending on individual economic capabilities. Poorer people can only afford a stove or range with one or two burners, which means that cooking takes place in a single sequence, further prolonging the time spent cooking, and would in effect, limit diet choice. For instance, a pot of stew would take two hours to prepare (one hour with modern electronic appliances) but can only be preserved short term (up to three days) without refrigeration. The use of kerosene stoves and firewood results in deposits of soot on walls, which make the kitchen unattractive and incompatible for other activities.

Access to pipe-borne water for a large percentage of the population was outside of their home environment and even for those who have it, it was irregular. The 1999 Demographic Survey found that several homes used wells, streams and rainwater as contingency supply; 25% of households had access to pipe-borne water either directly into their homes or through a public tap; more than 40% of households used water from a well or borehole; and 25% used surface water (river, pond, dam), which was most susceptible to contamination. The average per capita volume for the nation was 60 litres per day, yet the minimum for temperate climates is 115 litres per day. Even then, only about 19.29% of the households in the Oyo and Osun states had this water requirement met. About 74.2% of urban households lived up to 15 minutes away from the water source. Households also suffered water shortage either in the dry season, or when there was power failure to operate the water treatment equipment at the plant, and sometimes for no clear reason.

Electricity supply was inconsistent such that people no longer used fridges and freezers to store up several months supply of perishable foods. The Survey 1999 claims that on average, 45% of households in Nigeria have electricity, with 84.3% in urban areas and only 14.9% in rural areas, such that this imbalance indicated that electricity can be seen as a symbol of standard of living. The use of open gutters and the lack of plumbing and drainage facilities for many homes contribute to the poor living conditions.

Summary

The literature has shown that people, activities, objects, food and space acquire or possess status. These parameters also interact with one another within spatial boundaries, and become subject to similar spatial experiences when they occupy the same space, irrespective of their individual statuses. The co-presence of people, activities, objects and food in spatial interaction becomes the means by which the difference, cohesion and fluidity of culinary related parameters will be measured in order show how space embodies status. Isaacs-Sodeye 2012.

METHOD

The boundaries of culinary activity

As culinary activity and storage patterns are distributed in spaces beyond the immediate vicinity of the cooking space, the study looks at the overall domestic environment in addition to the cooking space. Consequently, a fundamental constraint
that had to be lifted in this study was a conceptual one, and was that of seeing the kitchen as one space, designated and set apart for cooking. Instead, the kitchen had to be broken down into constituent components of food preparation activities, the transformation of food to an edible state and patterns of storage of food and utensils. This provided the flexibility of being able to analyse and map culinary activities that take place in locations beyond the cooking spot. In addition, it became possible to compare constituent elements across the sample households, which would have otherwise not been feasible given the different lifestyles and social environments represented in the sample. In this research, the kitchen will be assessed in terms of spaces that are used for culinary-related activities and storage, termed “culinary-mapped spaces”.

Procedures

In order to measure status, solidarity and social mobility in domestic space it was necessary to define what needed to be measured, what could be measured, how it could be measured and how, as well as why it should address the issues raised. Rapoport (1990 p 12) suggested that activity has to be studied within the context of systems of activity by considering “who does what, where, when, including or excluding whom (and why)?”. Hillier and Hanson (1982) showed how spatial configuration can be understood through the patterns of permeability and visibility amongst spaces, and how these spatial properties have an influence on space use.

If the above principles of the interrelationship between status, solidarity, social mobility and persons was applied with respect to space, solidarity can be expected to be manifested in a co-present occupation of space, status will be manifested in the separation or distinction between spaces and social mobility will allow the permeation between boundaries of occupied space in order to achieve a change of status. It is therefore necessary to use spatial analytical techniques that can measure joint occupation, connection, boundaries and difference between spaces. To this end, it is proposed to examine this spatial pattern by using the principles of the space syntax theory developed by Hillier & Hanson (1984) in the Social Logic of Space.

Space Syntax Methodology

The space syntax methodology analyses spatial configuration in terms of the pattern of connection between spaces, and the relative position of spaces to others within the system by reducing floor plans to graphs indicating these properties, which can then be compared. As a tool, it serves to objectify space and its attributes, which is particularly useful in domestic space that can be laden with symbolism and subjectivity.

In order to ascertain and interpret the syntax (generative rules) of spatial configuration, two concepts of representation of permeability and visibility were introduced, namely, axially and convexity. Axiality represents a line of vision and possibility of access, whilst convexity represents a space of occupation and field of vision (Fig 2 below). In elementary terms, people occupy space convexly and move from one space to another axially.
The Justified graph

Another space syntax analysis employed is the justified graph (j-graph for short). The justified access graph for interior premises is constructed by first representing the convex spaces with a circle, the connection with a line and the carrier space (usually the outside) as a circle with a cross. From the graph, the sequence of accessibility can be read, and can be interpreted as either transitional or continuous (i.e. leading to another space) or a dead-end. Fig 3 below illustrates this situation. The four plans have similar geometric and adjacency structure, but different accessibility graphs (Isaacs-Sodeye 2012).

![Diagram of the Justified Graph](source)

Fig 3a, 3b, 3c, 3d: Basic configurational relationships

From the graph of any given configuration, it is possible to assess the step depth of a space, connectivity and control. Step depth indicates the number of convex spaces that have to be traversed from a reference space to another. In Fig 3 above, space B is 2 steps from the entrance in Plans a, b and d, and 3 steps away in Plan c. Connectivity measures how many spaces are linked to any particular space. Also, Space A is linked to 3 spaces in Plans a and b, 2 spaces in Plan c, and 1 space in Plan d. Control measures how well a particular space permits or restricts accessibility to other spaces within the overall system. Space A controls access to B and C in Plans a, b and c but not in d.

**Isovists**

Isovists are two-dimensional representations of visual fields, and they measure the range of visibility from particular points in space to all areas within a space and beyond. Current studies are looking into 3-D representation (Schnadelbach 2012).
Figure 4: Isovists from a convex space: Source – Hanson J (1998)

When the isovist is used to map areas of permeable proximity, then those spaces need to adjoin one another. When it is used to map areas of visual proximity, such as through a glazed screen or window, those spaces need to be adjacent to but not necessarily adjoin one another.

Space, Status, Solidarity and Social Mobility

The relationship between status, solidarity, social mobility and people in indicated in the schematic diagram below. Status and solidarity have defined boundaries, and social mobility seeks to permeate those boundaries.

Fig 5: Schematic diagram of the relationship between space, status, solidarity, social mobility and persons.

Convexity of a space relates to solidarity because joint spatial occupation implies a common spatial condition, though it does not mean equality of experience, for example, a defendant and a judge in a courtroom may face similar climatic conditions but the difference in their individual statuses will determine their spatial experience. Visibility and permeability relates to the integrity of the boundary between convex spaces and whether they allow transmission across the barriers, and therefore relates to fluidity and social mobility. The step depth relates to separation and distinction particularly where subjects are kept apart to maintain their status in order not to blur the differences. Therefore, the process will be to spatially map and measure culinary-related activities, objects and food storage in terms of what occurs within and across spatial boundaries.

RESEARCH STRATEGY

In the fieldwork, 75 households were studied, consisting of 25 in each of the three study areas (i.e Extended family Orowa housetype, Multi-family Rooming housetype
and Nuclear family Modern housetypes). Interviews were conducted guided by a structured questionnaire which asked questions ranging from the demographic make-up of the household in terms of age, sex, gender and the allocation of roles on this basis; infrastructural facilities (source of water, fuel, light, drainage and plumbing), locus of culinary activities (cooking, dishwashing, ceremonial cooking, food-processing and eating), waste disposal, storage of objects, implements, appliances; storage of food (perishables, non-perishables, foodstuff, cooked foods, grains, fruits, vegetables, ingredients); and their opinions about allocation of activities according to gender and age, privacy and accessibility of the cooking space to inhabitants and non-resident people, as well as their preferences regarding the compatibility and incompatibility of the joint spatial occupation of people, activities, object and food.

The responses were then mapped onto the floor plans to represent the ‘footprints’ of culinary activity, storage of objects and food and circulation. This was used to assess spatial co-present occupation of activity, objects and food, their movement across spatial boundaries and the use of boundaries to differentiate or separate particular activities, objects and food. Through space syntax analysis, the morphological properties of each space is ascertained in terms of depth, convexity, permeability and visibility.

A typical set of analyses illustrating the process is shown using one of the houses as follows: (See Fig 6). The house is a detached two-bedroom and study bungalow in the university campus. It has an entrance drive, a car porch and on-site parking for two cars, at the rear and a reservoir tank next to the entrance drive. The front door leads the entrance hall, and there are three other exit doors to the grounds from the kitchen, the bedroom wing and the living room, and they are used at varying frequencies, and they have distinct effects on how outdoor space is used. The area used for ceremonial cooking is also indicated on the site plan.

Fig 6: Floor plan and j-graph mapped with space labels
In Fig 7 below, the different circulation patterns are represented as follows: the green line tracks the circulation between the kitchen and outdoor spaces, i.e. from the car to the kitchen (from shopping to storage), and from the kitchen to the backyard; The blue line tracks the circulation between the kitchen and other indoor spaces, i.e. from the to the dining and living room (for eating) and bedrooms (for storage); and the red line marks the kitchen work triangle between the cooker, sink and fridge.
Fig 6 – Tracking the various circulation patterns in the domestic space.

This shows that how culinary related activity can take place in several convex spaces beyond the spaces designated for the cooking stove. All such spaces will be termed “culinary-mapped spaces”. Justified graphs of each house were used to assess the step depth from the front door for each plan with the adjoining of external spaces taken into consideration.

The justified graph in Fig 6 shows that there are twenty spaces consisting of 16 internal spaces and 4 external spaces. The map shows four steps of spaces from the front door, which consists of 4 spaces in level 1, 4 spaces in level 2, five spaces in level 3, and 6 spaces in level 4.

Legend: Source of heat Source of water Storage

Fig 7 – Calculation of Mean Depth

In Fig 7, the mean depth is calculated by summing up the multiplication of the step depth by the number of spaces, and then dividing it by the number of spaces minus one. Therefore, \[ MD = \frac{0 \times 1 + 1 \times 4 + 2 \times 4 + 3 \times 5 + 4 \times 6}{20 - 1} = \frac{0 + 4 + 8 + 15 + 24}{19} = 2.684 \]. The step depth of each space is the number of boundaries and spaces that has to be traversed from a carrier space to reach it.

**How Activity, Objects And Food Are Operationalised**

For activities: The activities mapped consist of the daily ones – cooking, eating and dishwashing, and the occasional ones – foodprocessing and ceremonial cooking. The location of the three basic nodes – heat, water and food storage- and the location of the activities are also mapped on a justified graph. The step distance of each activity relative to the cooking space was measured. The closer this figure is to zero, then the stronger the integrity of the culinary boundary, and the higher it is, the more spaces have to be traversed from the cooking space, and the weaker the culinary boundary. A sample graph is shown in Fig 8 below.
The three basic nodes graph show the location of heat, water and storage to be within the kitchen boundary. The Activity graph shows dishwashing (blue) and foodprocessing taking place in the same space as the cooking (red), so the step distance is zero. However, eating takes place in the kitchen (zero), and in the dining room which is one step from the cooking space, and the living room at two steps, therefore the average step distance will be given by \((0 + 1 + 2)\) divided by 3 spaces = 1.0 steps. Ceremonial cooking takes place outside, and it is two steps away. Therefore in terms of spatial distance from cooking, the order is as follows:

Cooking : dishwashing = foodprocessing < eating < ceremonial cooking.

The average step distance for culinary-related activity is \((0+0+1+2)\) divided by 4 = 0.75

For objects and food: The analysis on objects and food assesses the storage patterns in terms of movement from the place of storage to the place where it is to be used. Objects are implements and facilities, which consist of traditional implements (mortar & pestle, and the grinding stone), electronic implements or appliances (mixer / blender, kettle) electronic facilities (fridge/freezer, microwave, cooker etc), and cooking utensils (ladles, pots, pans, cutlery etc). Seven categories of food were identified, and they range from the perishables (meat, fish, dairy – animal proteins), to fruits and vegetables, to cooked food, ingredients (spices, sugar, salt), to uncooked foods (tubers), to grains and semi-processed foods (rice, beans, gari- cassava flour, elubo – yam flour) to processed and canned foods, the most durable.

Likewise, the step distance from the place of storage of utensils and food to the cooking space is measured to find out the strength/ integrity of the culinary boundary.

Using the same step depth distance from the cooking space calculation, the results show that cooking utensils and electrical appliances score zero, thereby maintaining the integrity of the culinary boundary, whereas the mortar and grinding stone, and the fridge/freezer score 0.5, and weaken the boundary. This is given as:

Cooking: utensils = electrical appliances < mortar etc = fridge/cooker
The average step distance for utensils and equipment is given as \((0 + 0 + 0.5 + 0.5 \div 4 = 0.25)\).

Food is stored in the kitchen, kitchen store, dining room and bedroom, and the calculations show that perishables, cooking ingredients, and tubers score zero (kept in the kitchen), fruit and vegetables scored 0.5 (kept in kitchen and dining room), grains and cereals scored 1.0 (kept in kitchen and store), and canned foods scored 5.0 (kept in the bedroom).

The spatial distance of retrieval of food to the cooking space is as follows:

**Cooking:** perishables = cooking ingredients = tubers < fruit and vegetables < grains and cereals < canned foods.

And the average step distance for food is \((0 + 0 + 0 + 0.5 + 1 + 5 \div 6 = 1.083)\).

Therefore, utensils and equipment are closest to the kitchen boundary at 0.25, followed by culinary related activity at 0.75, with food storage being furtherest at 1.083. A perfect boundary will be where all three units are at zero, so the higher the distance from the cooking space, the more that variable impinges on other spaces in the house, and has a presence beyond its designated space.

The above analysis was carried out on all 75 houses, and the step depth and spatial co-presence of all activities, objects, food and persons was mapped relative to the location of the cooking hearth or kitchen.

Table 1 below shows the results as follows:

<table>
<thead>
<tr>
<th></th>
<th>Orowa Houses</th>
<th>Rooming Houses</th>
<th>Modern houses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average step distance: Culinary Activity</strong></td>
<td>1.604</td>
<td>1.68</td>
<td>0.90</td>
</tr>
<tr>
<td><strong>Average step distance: Utensils</strong></td>
<td>1.271</td>
<td>1.41</td>
<td>0.482</td>
</tr>
<tr>
<td><strong>Average step distance: Food</strong></td>
<td>1.612</td>
<td>2.21</td>
<td>0.93</td>
</tr>
<tr>
<td><strong>Average step distance: Total</strong></td>
<td><strong>1.486</strong></td>
<td><strong>1.95</strong></td>
<td><strong>0.844</strong></td>
</tr>
</tbody>
</table>

The pattern shows that the modern houses with integral infrastructure has the strongest culinary boundary, and the orowa and rooming houses, where facilities are shared with kin and non-kin respectively have weaker culinary boundaries.

The integrity of spatial boundaries was examined to understand the concentration of activities and storage patterns into one space or the dispersal over several spaces either physically or in sensory terms (visually, auditory and olfactory) and the extent to which these activities and objects ultimately impinge on other spaces with different designated functions and space labels. Studies show that people, space, activity, objects and food acquire a status relative to others of its kind, and as such, people have a status in relation to other people. Likewise, spaces have more importance than other spaces; activities require different grades of skill and are representative of status in form of the personnel to whom it is allocated; and in material culture, some objects are more valued than others. Studies also show that the status of food was found not be related to its nutritional qualities but more as a perception of the food of the rich. As such they all bear symbols of status that is understood by people in the domestic environment. By tracking the footprints of persons, activities, objects and food across the domestic space, the study examined how the sociological concepts of status, solidarity and social mobility were applied in the use of space.
The Yoruba tend to employ the principles of seniority and equality to negotiate their status and authority, responsibility and delegation in everyday life and society, and these principles feature in the domestic environment and particularly in relation to the kitchen and culinary activity.

RESULTS AND FINDINGS

People

In the modern integral kitchens in the university households, mothers were mentioned as the main cooks, assisted by daughters first, and then sons. Mothers claim to have the superior expertise and experience in culinary matters and in this way, they raise the status of the kitchen. The kitchens are equipped with electronic appliances as well as traditional implements, and most utensils and food are within easy proximity, though it is also likely that some foods and fragile appliances could be kept locked up, or basically under her control. Nevertheless, the hierarchy of persons is evident in the manner roles and responsibilities are allocated. So, in practice, a person of low status such as a maid or youngest female could be working in the kitchen, and need to use electronic utensils, which are high status objects that have been kept in the bedroom, which is a higher status space in comparison to the kitchen. This lower status individual then uses the electronic appliances to prepare food which is a lower status activity which is eaten in the parlour, in other words as a higher status activity in a higher status space. The used dishes are then cleaned up and washed in the kitchen sink or by the well in the backyard which is lower status space relative to the kitchen. This illustrates the traversing of status boundaries that can occur in culinary matters. The status of the individual is evidenced in the type of work allocated to her with respect to the availability of alternative personnel. In other words, their status varies when others come to participate in the activity. For instance, if a senior person were to be present, a junior would be expected to carry out the lower skilled jobs like dishwashing or peeling, grating, and other pre-cooking tasks and the senior may then take on the cooking activity itself.

Also the study showed that male involvement in the kitchen did not significantly alter across the sample, as cooking was still viewed as the responsibility of the female, such that if they were present in the home, the males were not likely to be involved, and this was irrespective of socio-economic backgrounds.

Space

By mapping culinary activities and objects into all the spaces in that they impinge upon, the socio-spatial properties of adjoining spaces to the kitchen begin to emerge, in terms of how that configurational relationship is perceived. Bearing in mind that adjoining spaces would generally have a sensory (visual, smell, sound) proximity to the kitchen, the mapping showed a range from housetypes where a related activity could take place in the adjoining spaces to other situations where several functional convex spaces have to be traversed to link the same and similar activity. For example, the analysis showed how eating could take place in the adjoining dining room in an integrated kitchen, but in a detached kitchen, such cooked food would traverse the backyard and the hallway, to get to the parlour for eating. In the same vein, though food processing and dishwashing may be too messy for the kitchens that do not have pipe-borne water supply, plumbing and drainage, the presence of toilet facilities in the backyard could prevent foodprocessing taking place there as an alternative venue whereas they would not have that much of an effect on dishwashing. Certainly, the
presence of utility services, and the compartmentation of food and utilities can help to strengthen the integrity of the kitchen boundary, but other social parameters relating to compatibilities and incompatibilities of activities in terms of spatial proximity and co-presence, can contribute to the weakening or strengthening of the boundary.

**Activity**

The study found domestic cooking to be a status activity, and more specifically, a low status activity in the shared accommodation because of the tendency for it to be delegated, but a high status activity in the modern household due to the emphasis on skill particularly when the mistress of the household undertakes the role. The mode of solidarity found in domestic culinary practice tends to be the one between a mother and her children in the main but the father would tend to be excluded. The aspiration of social mobility for households is to live in self-contained accommodation with integral utilities and infrastructural facilities and electronic appliances, and these trappings are also status symbols. The study found that cooking does not always take place in the most segregated spaces as in the modern house, but can also take place in the most integrated space as in the orowa of orowa houses, yet, because the orowa is a multi-functional space it can be argued that cooking in this context has no place of its own, and when it when it does, it acquires a status by its association with cooking.

The mapping of eating, food processing, dishwashing and ceremonial cooking in relation to cooking revealed that cooking was either associated with eating or associated with messy activities. Generally, eating as an activity was seen to be pulling towards to living room and iyara in the modern households and orowa and rooming households respectively, and away from the kitchen, whilst ceremonial cooking pulled away from the kitchen towards the outside. In all, the analysis revealed the cultural notions of spatial compatibility and incompatibility of different activities in close proximity, and the effect of sensory proximity of an adjoining activity or space as mentioned above, that could determine whether any of the culinary related activities was acceptable or not in the cooking space.

Besides the generic culinary activities of food preparation, cooking and dishwashing, the study found that in comparison to the elite women, several women in low-income households expend considerable labour and time in ancillary activities, which included fetching water, firewood and coal, making the fire, regularly fanning the flames as the food cook, quenching the fire and sweeping up the ashes. Tasks also consisted of daily reheating cooked stews, and preserving meats by smoking, sun-drying or deep-frying, etc.

**Objects**

The possession of traditional and modern equipment relates to socio-economic capability of families, with the traditional utensils being the main types found in low-income households and the electronic appliances, in the higher income households. Most households owned a mortar and a grinding stone, though not all used them. Traditional implements such as ladles (omo-orogun), serving scoop (igbako), sieves (ase) etc. are also found in every kitchen, as most foods in the Yoruba menu would require their use. Equipment such as the urn (amu) was not found in the modern Unife houses. The analyses also showed that though more labour-expending processes were being discarded in favour of technology, as seen in the use of the grinding stone, yet, where technology did not seem to produce a good enough substitute product, as in the case of pounded-yam, people either revert back to traditional implements or changed
Domestic space

their diet, as in the case where processed powdered iyan was used and kneaded in the same way as amala, fufu etc. The 1999 Nigerian Demographic and Health survey used the ownership of fridges to assess the economic capability of their sample because fridges, like cars and television sets were status symbols in the society. The present study found that in kitchens in Enuwa and Akarabata, the fridge ownership was lower than the national average and this further emphasizes the significance of fridges as status symbols.

With respect to utilities like fuel and water, the analyses of Enuwa and Akarabata households revealed that in some cases where purer pipe-borne water was available but at considerable distance to the home, several people elected to use the water source in closer proximity, which in several cases was the well for their daily cooking. It is worthy to note that there was a possibility that these wells might be polluted, although the study did not query whether these users were aware of the risks and had made an informed choice on their source of water. In any case, convenience emerged as a priority in these scenarios. The cooking times were somewhat similar across the sample, as most people worked around the daily schedules of school and work. As such, ready-made foods like bread and cereals were popular and favoured by those who could afford them.

Compatibility and incompatibility in space and time

In traditional Yoruba domestic space, even in those with poly-functional spaces and few designated function spaces, the tendency would be to spatially isolate cooking, food-processing, eating, laundry and dishwashing activities as much as possible in order to prevent the contamination of food with soap, of smells and oils with clean laundry and of dirty water with food. If this could not be achieved spatially, then it became a function of time, as the sequence of activities ensured that no two incompatible activities took place simultaneously. On the other hand, living/non-service activities such as entertaining, eating, sleeping was found to take place within the same spatial boundary. In houses with modern infrastructure in the form of plumbing and drainage, cooking and dishwashing was spatially compatible, because the latter was compartmented.

CONCLUSION

In the spatial analysis, the j-graphs showed which variables were kept together and which variables were kept apart. Therefore, the social positioning of the culinary mapped spaces was assessed with respect to the co-spatiality of activities and proximity of adjacent activities. The results show that the orowa was seen more as a central living space in orowa houses but more as a main circulation space in rooming houses. As such, it had a higher symbolic status in accommodation shared with kin and a utilitarian status in accommodation shared with co-tenants.

The study found that there was considerable divergence of eating and dishwashing on either side of cooking, such that in houses without a designated kitchen, whereby a multi-functional space was used, if eating was to take place there alongside cooking, then dishwashing tended to be excluded, because dishwashing and eating did not appear to be co-spatially compatible in these house types. This is therefore a pattern of status of divergence, in that the both variables moved in different directions from the focal point.

In some instances such as in rooming houses where individual households worked to their own timetables and patterns, it was found that where previously, food preparation activities such as foodprocessing and eating took place in the hall space
alongside cooking, when another co-tenant moved in and chose to bathe their babies in the hall or wash dishes, it was found that eating relocated into the room. In this situation, dishwashing moved in and interacted and re-distributed the social positioning of all the other activities, because its occurrence in a space excluded or rather made some other activities co-spatially incompatible. As such, dishwashing has produced status by association for cooking and foodprocessing. By moving into the orowa, dishwashing has acquired a higher status as a result of its promoted co-spatiality with cooking and foodprocessing, relative to its previous lower status outside in the yard. Eating on the other hand a high status activity that was previously co-spatial with cooking, then moves into an exclusive space to maintain its status, and this space may be more segregated and deeper, and as a result has created a status by re-segregation. The study also found that the sensory proximity of adjacent activities have an effect on the incompatibility of space and activity.

One characteristic of shared accommodation was the multi-functionality of spaces such as the orowa/hall and the iyara/room, which meant that spaces had a weak categoric differentiation, i.e. spaces did not have strong designated functions (Hanson, 1982). The orowa was used as both a service and living space, and the iyara was both a living space and a sleeping space. It was found that the convergence of various types of activities resulted in lowering the status of the multifunctional space, such that higher status activities sought exclusive segregated spaces to occupy.

Furthermore, the study found that the boundary of the kitchen was weakened by the location storage spaces in relation to cooking and modern houses had the closest spatial distance from cooking, and rooming houses had the longest spatial distance. The study showed that the presence or lack of modern infrastructural facilities like plumbed water supply, electricity and drainage had an effect on the spatial distance of activities like dishwashing and the storage of food, particularly those requiring refrigeration.

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Domestic space


Hanson, J. (1998) Decoding Homes and Houses: Cambridge University Press..


IDENTIFICATION OF CONSTRUCTION DELAY FACTORS: PERCEPTION OF MULTINATIONAL AND INDIGENOUS CONSTRUCTION FIRMS IN NIGERIA

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The study is to identify the factors responsible for construction delay in Nigeria construction industry from the perception of the multinational and indigenous contractors. To achieve the objective of the study a research survey was adopted. A total of fifty-eight (58) questionnaires were used for the analysis using descriptive and inferential statistics. The study revealed that cash flow problems, shortage of construction materials, client’s financial difficulties, inadequate consultant experience, incompetent project team, poor design, and delay in design, inadequate contractor experience, lack of communication and coordination, project financing problem and change are the most influencing factors affecting the two firm’s types. The study also established an empirical relationship between the perceptions of the two firm’s types.

Keywords: Construction, Contractor, Client, Delay, Indigenous, Multinational

INTRODUCTION

The construction industry is an essential component in socio-economic development of any nation. Construction projects are characterized with poor performance in terms of projects pre-planned objectives (Ajayi, Ogunsanmi, Salako & Mafimidiwo, 2012). The complications and challenges that lead to delay occur during the project implementation phase. (Assaf and Al-Hejji, 2006) defines delay as time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. (Majid, 2006) describes delay as time loss. Delay in construction project can occur through many sources or means. Delays in projects could occur due to: characteristics of the project, internal and external factors affecting the construction organisation, social, economic and cultural issues and so on. These issues can be associated with project stakeholders namely: clients, contractors, subcontractors, consultants and external factors (such as statutory agencies).

According to (Aibinu and Jagboro 2002), the major criticism facing Nigerian construction industry is the growing rate of delays in project delivery. The study identified the most significant effect of delays are cost and time overrun; the result further showed that an 18% contingency should be added to pre-contract estimates to cover for delays. Seven out of ten projects suffered delays in their execution (Odeyinka and Yusuf 1997). Delay in construction business is a global problem. Various researchers have conducted studies on causes of delays during the

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construction process in different countries across the globe. The results have shown the causes of delay vary across countries, project complexity and project size.

Contractors in Nigeria can be categorized based on the scope of operation the firms involve in. Contractors are either national (indigenous) or multinational firms (Samuel 1999 and Olateju 1991). National (indigenous) firms whose operations are limited to Nigeria and the multinational firms operate both in Nigeria and other countries (foreign). The indigenous firms operate within local regulation standard of the country. The multinational on the other hand operates within both local and foreign regulations pertaining to their affiliated nations. Such as British Standard (BS), US Standard and International regulations and Standard Organisation (ISO) and so on.

Nigerian indigenous contractors are majorly sole proprietorship and very few are partnership or limited liability companies. Their organisation sizes vary between 1-3 permanent staffs with an organisational structure comprising of the CEO or managing director, secretary and a site personnel. The organisation size and structure is determined by the complexity and size of the construction project been executed. Employees are usually employed on temporary basis and laid-off after project completion. This strategy is used by firms to reduce cost of overhead. In terms of production resources like equipments and finance, the indigenous firms cannot be compare to their multinational counterpart. The multinational firms comprises of mixed management of foreign expatriates and indigenous staffs. Their organisation span is large within 4-30 permanent staffs, with organisational structure covering several strategic and operational responsibilities. The multinational’s competitive advantage lies within their capability and availability of finance, technology, information, human resources, technical and managerial know-how. The multinational tend to handle majority of the large and complex projects. (Ogbedor 2002), attest that 96% of the Nigerian construction industry is dominated by foreign contractors due to the incompetence of the indigenous contractors in handling complex projects.

The issues of construction delays are peculiar to both the two firm’s types; though the indigenous firms are mostly criticized for it than their foreign counterparts. Various studies on the causes of delay in construction, its effects and methods of minimization have been carried out by different academic researchers. Their studies analysed within the view of the clients, consultants, contractors, other construction stakeholders, comparism between countries or location. The Nigerian construction industry comprises this two firm’s types the indigenous and multinational firms which are subjected to various delay factors in different dimension in terms of performance and credibility. This paper explores the response pattern between the indigenous and the multinational contractors in Nigerian construction industry in relation to causes of delay in projects in delivery. The study seeks to identity construction delay factors from the perception of both the indigenous and multinational contractors and establishes whether there is a significance relationship between the perceptions of the two firm’s types.

**Previous studies of causes of delays**

Numerous researchers have conducted studied on the causes of delays in the construction industry in several developing countries across the globe like Ghana, Egypt, Iran, Vietnam, Indonesia, Thailand, Palestine, Saudi-Arabia, Jordan, United Arab Emirate (UAE) and so on. Diverse and varying factors leading to construction delay have been identified. However, some of these study areas have similarities with Nigeria as a developing country whose economy on one major source of revenue.
The studies identified carried out literature reviews of earlier research to identify causes of delays; questionnaire surveys and some occasional interviews were conducted to assess the perception of the targeted respondents on the importance of identified factors. Several studies have assessed the perception of: contractors and consultants (Odeh and Battaineh, 2002; Le-Hoaï, Lee & Lee, 2008; Purrostam & Ismail, 2011); project managers and consultant (Motaleb & Kishk, 2010); contractor, client and consultant (Assaf & Al-Hejji, 2006; Sambasivan & Soon, 2007; Abd El-Razek, Bassioni & Mobarak, 2008; Le-Hoaï, Lee & Lee, 2008; Fugar & Agyakwah-Baah, 2010); large and small contractors (Alwi & Hampson, 2003). However, Toor and Ogunlana, (2008) did a case study of an airport project in Thailand using questionnaires and interviews. Further, an analysis was carried out to examine the variance in respondent’s perception based on type of organization (client, designer, consultants, contractors), position in the organization, experience as project manager in their past projects and educational background

The findings from earlier studies in developing countries are quite comparable. The findings highlights: the need to attract and develop human resource to cope with the demands of the construction industry, adoption of new contract award process where lowest price is not the major consideration, enforcement of liquidated damages and offering incentives in contract documentation for early completion, adopting new contract procurement procedures such as design and build and construction management; this will eliminate delays, and construction clients must provide adequate resources for project and reduce bureaucratic processes in payment (Odeh and Battaineh, 2002; Toor & Ogunlana, 2008; Le-Hoaï, Lee & Lee, 2008; Fugar and Agyakwah-Baah, 2010; Purrostam & Ismail, 2011)

**RESEARCH METHOD**

A literature review of causes of delays in construction from year 2000 to date was done. Summary of causes of delay from review are shown in Table 1. A questionnaire was developed to assess the perception of the indigenous and multinational construction firms based on the 52 causes of delays in construction projects in Lagos, Nigeria. The questionnaire was divided into two parts. The first part requested background information about the respondents. The second part of the questionnaire focused on factors of construction delay. Fifty- three factors causing construction delay was identified. A five point likert-scale ranging from 1 (Not important) to 5 (very important) was adopted to assess the importance associated with delay factors identified. The total of seventy (70) sets of survey questionnaire was distributed covering both indigenous firms (40nos) and multinational construction firms (30nos). The firms surveyed were selected based on recommendation from professional colleagues which have involvement with the firms since all the construction firms in Lagos State cannot be survey. Fifty-eight (58) sets (82.9%) were returned and there were 32 sets (55.2%) from indigenous firms and 26 sets (44.8%) from the multinational firms. The likert- scale adopted was transformed into relative importance index for each factors and ranked. Spearman Rank Correlation (Rs) was used to establish whether there is any form of significant relationship between the indigenous and multinational construction firms in relation to the causes of delay during construction projects execution in the organisations. The hypothesis stated as
H1: There is no statistically significant relationship between the causes of construction delays as perceived by the indigenous and the multinational firms.

Relative important index

$$RII = \frac{\sum P_i U_i}{N(n)}$$

Spearman Rank Correlation (Rs)

$$Rs = 1 - \frac{6 \sum d}{n (n^2-1)}$$

Test for significant (t)

$$t = rs \sqrt{n-2} \sqrt{1-rs^2}$$

ANALYSIS OF DATA

Demographic characteristic of respondents are given in Table 2, according to the table, 32 questionnaires were received from the indigenous construction firms and 26 from the multinational firms. The designation of the respondents from the two types of firms differs; where majority were builder (36.2%). The work experience of the respondents lies more within 0-5 years for the indigenous firm’s and 6-10 years for the multinational. The staff strength of the multinational firms is more than the indigenous firms. Most of the firms specialize in building and civil engineering works.

Table 2: Demographic characteristic of respondents

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Indigenous</th>
<th>Multinational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms types (questionnaires received)</td>
<td>32</td>
<td>26</td>
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<tr>
<td>Staffs strength</td>
<td></td>
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<td>≤ 2</td>
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<td>30+</td>
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<td>Respondents designation</td>
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<td>Engineer/Designer</td>
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<td>Working experience (years)</td>
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<td>16-20</td>
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<td>Above 20</td>
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<td>1</td>
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<tr>
<td>Cost of projects executed (Naira)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5 million</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>5-50 million</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>50-150 million</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>150 million ≥</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Field of specialization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building only</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>civil Engineering works only</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Building and civil engineering works</td>
<td>11</td>
<td>20</td>
</tr>
</tbody>
</table>
Cash flow problems (0.90), shortage of construction materials (0.89), clients financial difficulties (0.86), incompetent project team (0.85), inadequate consultant experience (0.85), inadequate contractor experience (0.84), poor design and delays in design (0.84), lack of communication and coordination (0.83), incomplete drawing/detail design (0.82), change orders (0.81) and project financing problems (0.81) are the delays factors considered by the two firms types as top ten contributive issues that leads to projects delay (see table 2).

Table 2: Ranking of factors that causes construction delay

<table>
<thead>
<tr>
<th>Causes of construction delay</th>
<th>Multinational RII</th>
<th>Rx Rank</th>
<th>Indigenous RII</th>
<th>Ry Rank</th>
<th>Weighted RII</th>
<th>Rz Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow problems</td>
<td>0.88</td>
<td>2</td>
<td>0.91</td>
<td>1</td>
<td>0.90</td>
<td>1</td>
</tr>
<tr>
<td>Shortage of construction materials</td>
<td>0.89</td>
<td>1</td>
<td>0.89</td>
<td>2</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>Client’s financial difficulties</td>
<td>0.82</td>
<td>5</td>
<td>0.89</td>
<td>2</td>
<td>0.86</td>
<td>3</td>
</tr>
<tr>
<td>Inadequate consultant experience</td>
<td>0.81</td>
<td>7</td>
<td>0.88</td>
<td>5</td>
<td>0.85</td>
<td>4</td>
</tr>
<tr>
<td>Incompetent project team</td>
<td>0.81</td>
<td>7</td>
<td>0.89</td>
<td>2</td>
<td>0.85</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate contractor experience</td>
<td>0.81</td>
<td>7</td>
<td>0.86</td>
<td>7</td>
<td>0.84</td>
<td>6</td>
</tr>
<tr>
<td>Poor design and delays in design</td>
<td>0.84</td>
<td>3</td>
<td>0.83</td>
<td>12</td>
<td>0.84</td>
<td>6</td>
</tr>
<tr>
<td>Lack of communication and coordination</td>
<td>0.78</td>
<td>11</td>
<td>0.86</td>
<td>7</td>
<td>0.82</td>
<td>9</td>
</tr>
<tr>
<td>Incomplete drawing/detail design</td>
<td>0.78</td>
<td>11</td>
<td>0.86</td>
<td>7</td>
<td>0.81</td>
<td>10</td>
</tr>
<tr>
<td>Project financing problems</td>
<td>0.76</td>
<td>15</td>
<td>0.86</td>
<td>7</td>
<td>0.81</td>
<td>10</td>
</tr>
<tr>
<td>Change orders</td>
<td>0.82</td>
<td>5</td>
<td>0.80</td>
<td>14</td>
<td>0.81</td>
<td>10</td>
</tr>
<tr>
<td>Slow decision making by client</td>
<td>0.83</td>
<td>4</td>
<td>0.76</td>
<td>24</td>
<td>0.80</td>
<td>12</td>
</tr>
<tr>
<td>Slow mobilization of labour</td>
<td>0.81</td>
<td>7</td>
<td>0.79</td>
<td>16</td>
<td>0.80</td>
<td>12</td>
</tr>
<tr>
<td>Weather condition</td>
<td>0.76</td>
<td>15</td>
<td>0.84</td>
<td>10</td>
<td>0.80</td>
<td>12</td>
</tr>
<tr>
<td>Equipment allocation problem</td>
<td>0.75</td>
<td>19</td>
<td>0.84</td>
<td>10</td>
<td>0.80</td>
<td>12</td>
</tr>
<tr>
<td>Late delivery of materials</td>
<td>0.77</td>
<td>14</td>
<td>0.78</td>
<td>19</td>
<td>0.78</td>
<td>16</td>
</tr>
<tr>
<td>Unforeseen ground condition</td>
<td>0.78</td>
<td>11</td>
<td>0.77</td>
<td>22</td>
<td>0.78</td>
<td>16</td>
</tr>
<tr>
<td>Improper project planning and scheduling</td>
<td>0.76</td>
<td>15</td>
<td>0.80</td>
<td>14</td>
<td>0.78</td>
<td>16</td>
</tr>
<tr>
<td>Improper project feasibility study</td>
<td>0.75</td>
<td>19</td>
<td>0.81</td>
<td>13</td>
<td>0.78</td>
<td>16</td>
</tr>
<tr>
<td>Poor procurement of construction materials</td>
<td>0.76</td>
<td>15</td>
<td>0.78</td>
<td>19</td>
<td>0.77</td>
<td>20</td>
</tr>
<tr>
<td>Unrealistic time estimate</td>
<td>0.75</td>
<td>19</td>
<td>0.79</td>
<td>16</td>
<td>0.77</td>
<td>20</td>
</tr>
<tr>
<td>Inflation/Prices fluctuation</td>
<td>0.72</td>
<td>30</td>
<td>0.79</td>
<td>16</td>
<td>0.76</td>
<td>22</td>
</tr>
<tr>
<td>Lack of capable representative methods</td>
<td>0.73</td>
<td>25</td>
<td>0.76</td>
<td>24</td>
<td>0.75</td>
<td>23</td>
</tr>
<tr>
<td>Inappropriate construction methods</td>
<td>0.73</td>
<td>25</td>
<td>0.76</td>
<td>24</td>
<td>0.75</td>
<td>23</td>
</tr>
<tr>
<td>Inadequate project management assistance</td>
<td>0.73</td>
<td>25</td>
<td>0.76</td>
<td>24</td>
<td>0.75</td>
<td>23</td>
</tr>
<tr>
<td>Inaccurate cost estimate</td>
<td>0.71</td>
<td>34</td>
<td>0.78</td>
<td>19</td>
<td>0.75</td>
<td>23</td>
</tr>
<tr>
<td>Client interference</td>
<td>0.75</td>
<td>19</td>
<td>0.73</td>
<td>29</td>
<td>0.74</td>
<td>27</td>
</tr>
<tr>
<td>Improper equipment</td>
<td>0.71</td>
<td>34</td>
<td>0.77</td>
<td>22</td>
<td>0.74</td>
<td>27</td>
</tr>
<tr>
<td>Shortage of skill labour</td>
<td>0.73</td>
<td>25</td>
<td>0.73</td>
<td>29</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>0.74</td>
<td>24</td>
<td>0.72</td>
<td>35</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Inaccurate site investigation</td>
<td>0.73</td>
<td>25</td>
<td>0.73</td>
<td>29</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Poor site management and supervision</td>
<td>0.72</td>
<td>30</td>
<td>0.73</td>
<td>29</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Labour productivity</td>
<td>0.72</td>
<td>30</td>
<td>0.73</td>
<td>29</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Insufficient numbers of equipment</td>
<td>0.71</td>
<td>34</td>
<td>0.74</td>
<td>28</td>
<td>0.73</td>
<td>29</td>
</tr>
<tr>
<td>Inadequate fund allocation</td>
<td>0.70</td>
<td>37</td>
<td>0.73</td>
<td>29</td>
<td>0.72</td>
<td>35</td>
</tr>
<tr>
<td>Shortage of equipment parts</td>
<td>0.72</td>
<td>30</td>
<td>0.72</td>
<td>35</td>
<td>0.72</td>
<td>35</td>
</tr>
<tr>
<td>Slow response and poor inspection</td>
<td>0.70</td>
<td>37</td>
<td>0.71</td>
<td>37</td>
<td>0.71</td>
<td>37</td>
</tr>
<tr>
<td>Escalation of material prices</td>
<td>0.70</td>
<td>37</td>
<td>0.70</td>
<td>38</td>
<td>0.70</td>
<td>38</td>
</tr>
<tr>
<td>Unreliable subcontractor</td>
<td>0.70</td>
<td>37</td>
<td>0.68</td>
<td>39</td>
<td>0.69</td>
<td>39</td>
</tr>
<tr>
<td>Unreliable suppliers</td>
<td>0.70</td>
<td>37</td>
<td>0.68</td>
<td>39</td>
<td>0.69</td>
<td>39</td>
</tr>
</tbody>
</table>
Lack of experience of client in construction 0.69  44  0.68  39  0.69  39
Slow mobilization of equipment 0.70  37  0.65  43  0.68  42
Contractor’s financial difficulties 0.70  37  0.63  47  0.67  43
High interest rate 0.69  44  0.65  43  0.67  43
Frequent equipment breakdown 0.68  46  0.62  48  0.65  45
Conflict and civil commotion 0.62  49  0.67  42  0.65  45
Unreasonable constraints to client 0.63  48  0.65  43  0.64  47
Inadequate modern equipment 0.75  19  0.49  50  0.62  48
Labour supply 0.68  46  0.51  49  0.60  49
Problem with neighbours 0.54  50  0.64  46  0.59  50
Strike 0.51  52  0.45  51  0.48  51
Low motivation and morale 0.52  51  0.45  51  0.49  52

According to table 2, the indigenous contractors rated cash flow problems (0.91), shortage of construction materials (0.89), client’s financial difficulties (0.89), incompetent project team (0.89), inadequate consultant experience (0.88) and lack of communication and coordination (0.88) as very important attribute of construction projects delay experience in their organisation. Shortage of construction materials (0.89), cash flow problems (0.88), poor design and delays in design (0.84), slow decision making by client (0.83) and change orders (0.82) are the top five attribute of delays experience by the multinational firms.

Table 3. Spearman rank correlation coefficient of the association of factors causing delay between indigenous and multinational firms

<table>
<thead>
<tr>
<th>Variables</th>
<th>Rs</th>
<th>df</th>
<th>t_cal</th>
<th>t_tab</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors</td>
<td>0.86</td>
<td>51</td>
<td>11.66</td>
<td>1.678</td>
<td>Accept Hi</td>
</tr>
</tbody>
</table>

Referring to table 3, the spearman rank correlation coefficient, rho (rs) is 0.855 which indicate a strong positive association between the two types of firm’s perception of the causes of construction projects delay. At 0.05 level of significant, t_cal is 11.66 and t_tab is 1.678 therefore accept alternative hypothesis. This is an indication that both the multinational and indigenous construction firms experience delay in projects execution in almost the same pattern.

**DISCUSSION**

From the perception of the indigenous firm’s cash flow problems seem to be the most important construction delays factor while the multinational firms agreed on shortage of construction materials. The multinational firms believed that shortage of construction materials is the most influencing delay factor but the indigenous firms ranked it as the second influencing factor of construction projects delay in their organisation. Poor design and delays in design and slow decision making by client were ranked 3rd and 4th as factors causing delay in construction projects execution by the multinational respondents. The indigenous firm’s respondents agreed that client’s financial difficulties and incompetent project team has same influence on construction delay as shortage of construction materials (see table 2). From the study the overall perception of the two firms types of first ten causes of construction delay in the study area are cash flow problems, shortage of construction materials, client’s financial difficulties, inadequate consultant experience, incompetent project team, poor design...
and delays in design, inadequate contractor experience, lack of communication and coordination, incomplete drawing/detail design, project financing problems and change orders. These factors were confirmed in the study of (Assaf & Al-hejji 2006, Al-Momani 2002, Frimpong et al 2003, Odeh & Battaineh 2002, Sweis et al 2008).

The issues of construction delays in the construction industry concern both the multinational and the indigenous firms. Cash flow problems affect construction business since very construction process has a cost implication. For an effective construction execution cash must be available every time as needed. Cash flow problems can be due to client’s financial difficulties or managerial related factors. Prompt release of cash is paramount to minimized delay. Shortage of construction materials can occur due to cash flow problems or improper planning and coordination within the organisation. These can leads to delay in commencement of construction activities increasing the project delivery time. The impact of client’ financial difficulties on construction process cannot be overemphasis it can leads to the abandonment of the project not just delay in completion time. Others identified factors are organisation managerial issues which can be properly handle from the inception of the construction project. Effective due process should be employed in selection of the project teams; this is a determinant of construction projects success.

The study reveals that there is a positive association between the perceptions of the two firm’s types on construction delay factors. It indicates that both the multinational and indigenous firms are subject to construction delays if their construction processes is not void of the identified delay factors.

CONCLUSIONS

This study focused on the causes of construction projects delay as perceived by indigenous and multinational construction firms in Lagos, Nigeria. The study revealed that the two firm’s types agreed that out of the total of 52 factors identified the top ten influencing factors causing delay arranged in descending order of importance are

I. Cash flow problems
II. Shortage of construction materials
III. Client’s financial difficulties
IV. Inadequate consultant experience
V. Incompetent project team
VI. Poor design and delays in design
VII. Inadequate contractor experience
VIII. Lack of communication and coordination
IX. Incomplete drawing/detail design
X. Project financing problems/ Change orders

The study also shows that there is a positive association between the perceptions of the two firm’s types. That is both the indigenous and multinational firms were facing almost the same causes of construction projects delay in the study area.
REFERENCES


IDENTIFICATION AND CHARACTERISATION OF WETLANDS FOR SUSTAINABLE DEVELOPMENT IN EDE REGION, SOUTHWESTERN NIGERIA.

Gasu M. B.¹
Department of Urban and Regional Planning, Osun State University, Osogbo, Osun State Nigeria.

The study was undertaken to identify and characterize wetland with a view to exploring them for productive activities in Ede region, Southwestern Nigeria. Data for the study was collected from primary and secondary sources. Global Positioning System (GPS) which equally served as a primary source of data was utilized for ground truthing and also to obtain coordinates of wetlands. Topographic map (1962) served as secondary data was digitized and a point map of wetlands created. Plants samples were collected and taken to the herbarium for identification. The wetlands in Ede Region generally, were characterized by standing water or shallow inundations or saturation at near the surface, hydromorphic soils and the presence of hydrophytes as the dominant plant species which was in concordance with The Committee on Characterization of Wetlands 1995. Therefore, based on these characteristics, three types of wetlands were identified: riverine, lacustrine and palustrine system. They could offer opportunities for water supply, fish farming, cattle ranching throughout the year, cultivation of maize three times in a year, yam twice a year and rice three times in a year whose maximal exploitation requires the incorporation of the principles of sustainable development.

Keywords: characterization, point map, sustainable development, wetlands, poverty.

INTRODUCTION

Wetlands refer to ecosystems which depend on shallow inundation or saturation at or near the surface of the substrate (Boavida, 1999). Wetlands all over the world have been estimated to cover over 1,280 million hectares, based on the variations in the definitions used for their identification (Finlayson et al, 2005). The distribution of wetlands covers every climatic zone, country and continent, except the Antarctica. They are equally diverse in nature occupying different environments; spatially and temporally, but also in terms of physical location, ecology, hydrology and geomorphology. It covers about 6% of the earth's land surface distributed as follows; 30% are peatlands (or bogs), 26% marshlands (or fens), 20% swamps, 15% floodplains and 2% lakes. Mangroves cover some 240,000 km² of tropical coast, while coral reefs extend over an estimated 600,000 km² worldwide. There is an uneven distribution in specific types of wetlands all over the world despite their abundance. For instance, the cool wet climate of the temperate and sub-artic zones favour the development of bogs, which according to Mitsch et al, (1993) probably accounts for over half of the world’s wetlands (Millennium Ecosystem Assessment MA, 2007). According to Hughes (1996) bogs and peat are relatively scarce in tropical areas but a few are located in highland areas which receive abundant rainfall as well as in humid

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tropics of Indonesia (Kalimantan). Hughes (1996) observed further that mangrove forest is the tropical and subtropical equivalent of temperate saltwater marshes. Lake Chad, a major inland wetland which is the main stay of the economy of the sub-region, has greatly been on the decline since 1960 where it has reduced to less than 1/10 its size and covers an area of 2,500 km$^2$ down from 28,000 Km$^2$ in 1960 in the Sudano-Sahelian region. Other major inland wetlands in Africa include; Niger River Inner Delta in Mali and Sudd Swamps in Sudan (Jolley et al, 2001). They cover 24,009 Km$^2$ in Nigeria (Kio and Ola-Adams, 1990).

Prudent use of wetland resources require sustainable development (SD) which is a pattern of resource use aimed at meeting human needs while preserving the environment so that these needs can be met not only in the present, but in the indefinite future (Wikipedia, 2008). Natural resources whether renewable or non-renewable still need proper management which calls for conservation and sustainable management. This therefore means that we have to use our resources less wastefully (Gasu, 2011). Sustainable development has emerged since the 1970s as the way forward in dealing with the rapid degradation of the natural environment and save our only live support planet from total destruction. The first global meeting on this issue, the UN Conference on the Human Environment was held in Stockholm 1972 and focused mainly on the environmental issues, such as pollution and waste, which were most evident in the wealthy nations, and associated with industrial development and a rapid growth in consumption (Gasu et al, 2008, Gasu and Gasu, 2010). Sustainable development is based on the notion that economic development cannot go on degrading the environment indefinitely and therefore the environment must be protected in such a way as to preserve essential ecosystem functions and provide for the well being of future generations. Sustainable development should therefore seek to integrate environmental and economic policies as well as global policies which should lead to the overall improvement of the quality of life and not just income. Therefore, poverty must be eradicated and resources distributed more equally and all the sections of the society must be involved in the decision making process (Jordan, 1995).

Sustainable Development came to the limelight during the Rio de Janeiro Conference in 1992 in Brazil, which came out with Agenda 21 principles on SD. Ten years later came the Johannesburg summit in 2002 South Africa which again re-affirmed sustainable development as a central element of the international agenda and gave impetus for global action to fight poverty and protect the environment on the platform of Millennium Development Goals (MDGs) (WSSD, 2002). According to Langhelle (1991), the Brundtland Commission popularised SD internationally by organising the UN Conference on Environment and Development (UNCED), otherwise known as the Earth Summit which gathered many heads of states, in Rio de Janeiro in 1992 (GEO4, 2007).

The most important characteristic of sustainable development is the emphasis on the interdependence between development and revenue generation. Our Common Future highlighted the interaction between economic growth, poverty and natural resources management. Sustainable development therefore becomes a balancing act and sometimes compromise between efficiency (economic sustainability), equity (social sustainability) and conservation (environmental sustainability Jordan, 1995; WSSD, 2002). A very good attribute of sustainable development is the participatory approach, hence people are considered as part of the problem and solution (Gasu, 2011).
THEORETICAL FRAMEWORK

Characteristics of Wetlands

Wetlands ecosystems are diverse both in terms of their physical characteristics and their geographical distribution. They vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, and vegetation. They can be natural or man-made, and temporary or permanent in nature. Natural wetlands include river margins, lakes, coastal lagoons, mangroves, mudflats, peat lands, bogs, fens, mires, swamps, sloughs, seeps, oxbows, wet meadows, flood plains and coral reefs (Lambert, 2006). Man-made habitats include fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms and canals. Wetlands can be categorised into the following: (a) estuaries (b) open coasts, (c) floodplains (d) freshwater marshes (e) lakes and ponds (f) bogs and peat lands and (g) swamp forest (Dugan, 1990; Barbier et al, 1997; Fadare et al 2010 and Gasu, 2011).

Coastal marshes, covered with vegetation adapted to saline water are common to all continents. Boavida (1999) while characterizing wetlands observed that, all countries should have a plant lists designated “National List of Plants Species that occur in Wetlands” known by the abbreviation “Hydrophytes List”. Therefore a given community is typical of wetlands when more than 50% of the dominant taxa are hydrophytic (Committee on Characterisation of Wetlands, 1995). The surface soils of wetlands are saturated with water for periods that are long enough for the soil oxygen to be depleted for a greater part of the growing season. Wetlands are known to occur where geological formations or variations in topography impede drainage or permit surface flooding for extended periods. Saturation with water usually gives the soils chemical and visual characteristics that are indicative of wetland conditions.

The *sine qua non* conditions for the development and sustainability of wetlands have been identified to be the frequency and duration of inundation or saturation with respect to the growing season which is 15 days during most years; with the critical depth for saturation being 30cm of the upper soil layer where majority plants roots thrive (Boavida, 1999 and Committee on Characterisation of Wetlands, 1995). Okusami (2011) limits the depth of saturation to 100cm beyond which a zone ceases to become hydromorphic. Other significant morphological features identified include, clay and silt coatings and sand grains and concentrations with silty and loamy texture in alluvial materials for those inland while those in the coastal areas are cretaceous sediments predominantly clay and sandy (Okusami, 2011). These characteristics are based on standing water, hydromorphic soils and the presence of hydrophytes. Most plants that thrive on wetlands are plants that can live in anaerobic soils by transporting oxygen to their roots internally and respiring anaerobically or adapting to seasonal soil saturation. This may explain probably why there is permanent lack of oxygen in saturated soils, since they take up oxygen and the diffusion of this gas in water is very slow, hence, in most cases there is no oxygen replacement and therefore, the loss may be permanent. Generally, hydromorphic soils are characterized by lack of oxygen and very low redox potentials during saturation which in turn may lead to alteration of colour of the soil (Boavida, 1999; Committee on Characterisation of Wetlands, 1995 and Gasu, 2011).

Generalization on the hydrology of wetlands is difficult because the hydrology of each wetland is unique and at times seasonal (Edwards, 1990; Paker and Corbit, 1993). They are therefore made up of floodplains, marshes, deltas, swamps, peat land,

In the United States of America, the Primary Indicators Method (PRIMET) was recently devised with the purpose of helping to accurately define the limits of wetlands in its territory (Tiner, 1993 quoted in Boavida, 1999). This method according to Boavida (1999) is based on the premise that every wetland in its natural undrained condition possesses at least one unique distinctive feature that distinguishes it from the adjacent upland. Therefore the unique characteristics of vegetation and soil are used for wetland identification and delineation. According to the author, PRIMET is not intended to diminish the need for phytosociological studies of wetlands or detailed descriptions of hydromorphic soils but simply seeks to produce accurate consistent and reproducible wetland delineations with minimal effort which could be used worldwide. Similarly, wetlands are boundaries between terrestrial and aquatic ecosystems and therefore constitute transition zones between the terrestrial environment and streams or lakes designated as riparian zones (Committee on Characterisation of Wetlands, 1995). However, the fundamental criterion for the identification of wetland is its hydrology, whereby the area must be recurrently flooded for at least 15 days during the growing season on repeated years (Boavida, 1999).

Based on the *sine qua non* conditions for the development of wetlands, Masarirambi et al (2010) identified three types of wetlands in Swaziland: riverine, lacustrine and palustrine systems and that of the three systems riverine was the most prominent. The riparian zone in the words of Boavida “is extraordinary” as it performs so many ecological functions such as; conservation of biodiversity, prevention of flood damage to river ecosystem communities and habitat for waterfowl. It was at this backdrop that this work was conceived to identify and characterize wetlands with a view to exploring them for agricultural production to reduce poverty and ensure sustainable development.

**THE STUDY AREA**

The study was undertaken in Ede region with a population of 159,866 at the 2006 census (NPC, 2007. It is located on latitude 7º 31' and 7 º 55’ North and longitude 4 º 15’ and 4 ° 40' East Fig. 1.0. Ede region covers the wetland areas of Ede South and Ede North Local Government Areas of Osun State, Southwestern Nigeria. It is bounded to the South by Ayedade, to the East by Atakumusa and Osogbo, to the North by Egbedore and to the West by Ejigbo and Ayedire Local Governments Areas of Osun State.

The area is low-lying forming a basin-like-structure which makes it to retain enough water for cultivation in both the wet and dry seasons. It is drained by Shasha and Osun rivers as well as their tributaries and because of the low-lying nature of the area alluvial soils deposits rich in agriculture dominate. These are some of the characteristics which make possible the presence of wetlands in reasonable quantities. White (1983) describes the hot-harmattan as the north-easterly desiccating wind which carries drier conditions in the dry season and last for three months from December to February during which each receives less than 50mm of rainfall. The wet season is influenced by South West Trade winds with a mean annual rainfall of 1196mm recorded from the meteorological station at Osogbo (Smyth and Montgomery, 1962).
Temperatures are generally between monthly 23° C to 27° C and relative humidity is between 67% and 88% (Smyth and Montgomery, 1962).

**Fig 1.0 Location Map of Study area Ede Region**

**Source: Produced from Arcview Data for Nigeria in 2010**

The soils of this area are associated with the Iwo and Egbeda associations. They have been mapped out as soils which have inherent poor drainage. Okusami (2011) has researched extensively on these soils and described them as soils with impeded drainage because of the presence of 2:1 clay minerals (i.e. montmorillonite) in the horizons. The area was mapped out from detailed survey and aerial photographs on which exceptional vegetation of tufted grasses almost devoid of trees are associated. The poor quality of these soils is indicated by the presence of savannah vegetation which gradually merges into the most southerly occurrence of extensive grassland. In the forest region many of the very poor soils are of swamp origin found in the valley bottom whereas with the case of the grassland, the majority are sandy and or shallow on upper slopes sites. According to Smyth and Montgomery (1962) the soils are associated with the parent material and derived from a basic rock, probably dioritic in nature and their clay fraction includes a high proportion of montmorillonitic clays.
minerals. As a result, very marked expansion and contraction occurs on wetting and drying, sufficient to disrupt roots and to inhibit tree growth (White, 1983).

The study area is located within the tropical rainforest belt but the present vegetation is far from being a rainforest as it has been modified or cleared to give way for crop cultivation which is the dominant economic activity. White (1983) identified the vegetation as Guineo-Congolian Swamp forest similar in appearance to the rain forest as some of the tallest trees attain a height of up to 45 meters. Furthermore, he describes the main canopy to be irregular, open and superficially resembles broken or secondary rain forest which can be attributed to mans’ disturbance. Until recently, swamp forest was usually more or less virgin as it was considered unsuitable for farming but nowadays it is cleared on a large scale for rice farming. Dense tangles of shrubs and lianas fill the gaps, in which climbing palms (Ancistropyllum Eremospatha and Calamus) with their evil hooked spines are particularly characteristics, as are clumps of the large aroid cyrtosperma Senegalense (White, 1983). It has diversified endemic flora though poor in species richness. The present vegetation includes a high portion of savannah grassland dotted with trees and palm trees dominating which is of high economic value. Ede is typically an agrarian economy with a few commercial outlets. They grow food crops such as cassava, maize, beans, yam as well as cotton and tree crops such as cocoa and palms. Local industries include cotton weaving, cottonseed milling, and cocoa and palm processing. The objective of this study was to identify and characterise wetland resources in Ede Region with view to exploring them for productive activities while living within the allowable limits of maintaining a sustained environment. Generally, information on wetlands, types and the possible uses into which we can put them for human survival is scanty.

**RESEARCH METHOD**

Spatial data collected from analogue and digital sources as listed in the schematic diagram (Fig. 2) was inputed into the computer system. The topographic maps of 1962 gotten from Ministry of Lands were scanned and imported into the ILWIS (3.2) environment. The maps were then georeferenced, geocoded, edge-matched, resampled and a sub-map of the study area (Ede region) extracted and incorporated into the spatial data base. This was followed by on screen digitizing of rivers, roads and other features. Points related features like settlements and wetland were incorporated as point features. Data on land use features such as roads, rivers, wetlands, forests, soils, settlements as well as farmlands and characteristics of wetlands were collected by direct observation. Plants samples were equally collected and taken to the herbarium for identification. Magellan 14 channels Global Positioning System (GPS) was also used to obtain coordinates of wetlands which were systematically selected based on identified features. The secondary sources of data collected include; census data from the population commission, textbooks, newspapers, published and unpublished thesis, internet and journals.
RESULTS AND DISCUSSION

General Characteristics of Wetlands in Ede Region.

Results in Table 1 shows that bamboo and Euphorbiaceae (Achornia Cordifolia) were amongst the most prominent plant species found on the wetlands in the study area. Others were: oil palm (Elaeis guineensis), raffia palm (Raphia farinifera), fern (Anthyrium filix femina), reeds (Phragmites communis), date palm (Phoenix dactylifera) and nipa palm (Nypa). The wetlands in Ede Region generally, could be characterized by standing water or shallow inundation or saturation at near the surface, hydromorphic soils (Okusami, 1991; and 2011), and the presence of hydropytes such as typha which were equally observed as characteristics of inland wetlands by Boavida (1999) in Poland and Masarirambi et al. (2010) in Swaziland. The Committee on Characterization of Wetlands (CCW, 1995) stated the minimum requisite for an ecosystem to be classified as a wetland to include: sustained inundation or saturation at or near the surface for 15 days during the growing season, the presence of physical, chemical and biological features reflective of recurrent sustained inundation or saturation (Boavida, 1999). Wetlands in Ede region include; ponds, river valleys, areas drained by streams, rivers, swamps, flood plains, marshes and damps.

Therefore, based on these characteristics three types of wetlands were identified in Ede region which were equally very similar to those identified by Masarirambi et al., (2010) in Swaziland: riverine, lacustrine and palustrine systems.
Table 1: Identified wetland areas and characteristics shown on in drainage map of Ede

<table>
<thead>
<tr>
<th>S/ N</th>
<th>Name</th>
<th>Location</th>
<th>General Characteristics</th>
<th>Present use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Abere</td>
<td>07 44’ 07” 004 30’ 51”</td>
<td>Plantains/banana, oil palms (<em>Elaeis guineensis</em>), Euphorbiaceae (<em>Achornia cordifolia</em>),</td>
<td>Has some ponds and the rest are lying fallow.</td>
</tr>
<tr>
<td>2</td>
<td>Oladuloye/Owode</td>
<td>07 43’ 38” 004 29’ 58”</td>
<td>Poultry, ponds, oil palms <em>Elaeis guineensis</em>, raffia palms (<em>Raphia farinifera</em>), Euphorbiaceae (<em>Achornia cordifolia</em>), Bamboo, stream</td>
<td>Extensively used for poultry, ponds, market gardening but a greater proportion is fallow</td>
</tr>
<tr>
<td>3</td>
<td>Agodo/Apena</td>
<td>07 40’ 44” 004 31’ 41”</td>
<td>Raffia palms (<em>Raphia farinifera</em>), stream, Euphorbiaceae (<em>Achornia cordifolia</em>), Fern (<em>Anthyrium filix femina</em>), bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>4</td>
<td>Adejowun</td>
<td>07 13’ 40” 004 32’ 09</td>
<td>Euphorbiaceae (<em>Achornia cordifolia</em>), oil palms (<em>Elaeis guineensis</em>), streams, bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>5</td>
<td>Alajue</td>
<td>07 38’ 54” 004 31’ 32”</td>
<td>Streams, Euphorbiaceae (<em>Achornia cordifolia</em>), oil palms (<em>Elaeis guineensis</em>), standing water, reeds (<em>phragmites communis</em>), bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>6</td>
<td>Agbagba/Edigba</td>
<td>07 39’ 44” 004 30’ 45”</td>
<td>Pond, oil palms (<em>Elaeis guineensis</em>), streams, cocoa, banana, Euphorbiaceae (<em>Achornia cordifolia</em>), bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>7</td>
<td>Ponpola</td>
<td>07 40’ 55” 004 29’ 02”</td>
<td>Elephant grass, oil palms (<em>Elaeis guineensis</em>), Euphorbiaceae (<em>Achornia cordifolia</em>), bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>8</td>
<td>Akoda</td>
<td>07 41’ 11” 004 28’ 06”</td>
<td>Sugar cane, oil palms (<em>Elaeis guineensis</em>), Euphorbiaceae (<em>Achornia cordifolia</em>), rice (<em>oryza sativa</em>), bamboo, stream Vegetable,</td>
<td>Rice with the greater part Not in active use</td>
</tr>
<tr>
<td>9</td>
<td>Sanya</td>
<td>07 26” 39’ 004 29’ 05”</td>
<td>Euphorbiaceae (<em>Achornia cordifolia</em>), oil palms (<em>Elaeis guineensis</em>), banana, bamboo</td>
<td>Not in active use</td>
</tr>
<tr>
<td>10</td>
<td>Idiawe</td>
<td>07 09” 39’ 004 27’ 15”</td>
<td>Oil Palms <em>Elaeis guineensis</em>, yam (<em>Dioscorea alata</em>), bamboo</td>
<td>Yam cultivation</td>
</tr>
<tr>
<td>11</td>
<td>Elewure</td>
<td>07 38” 38’ 004 27’ 01”</td>
<td>Stream, Oil palms <em>Elaeis guineensis</em>, Euphorbiaceae (<em>Achornia cordifolia</em>) elephant grass, bamboo</td>
<td>Not in use</td>
</tr>
<tr>
<td>12</td>
<td>Sekona</td>
<td>07 08” 37’ 004 26 55</td>
<td>Ponds, oil palms <em>Elaeis guineensis</em>, rice (<em>oryza sativa</em>), maize, Euphorbiaceae (<em>Achornia cordifolia</em>), Vegetable, bamboo</td>
<td>Fish farming, rice and maize farms</td>
</tr>
<tr>
<td>13</td>
<td>Araromi/Logun</td>
<td>07 57” 36’ 004 23’ 50”</td>
<td>Date palms (<em>Phoenix dactylifera</em>), oil palms <em>Elaeis guineensis</em>, bamboo, Euphorbiaceae (<em>Achornia cordifolia</em>)</td>
<td>Not in active use</td>
</tr>
<tr>
<td>14</td>
<td>Otagere</td>
<td>07 25” 40’ 004 24’ 28”</td>
<td>Date palms (<em>Phoenix dactylifera</em>), standing water, Euphorbiaceae (<em>Achornia cordifolia</em>), Nipa palms (<em>nypa</em>)</td>
<td>Not in active use</td>
</tr>
<tr>
<td>15</td>
<td>Ededimeji</td>
<td>07 31” 41’ 004 27’ 21”</td>
<td>Stream flowing, oil palms (<em>Elaeis guineensis</em>), rice (<em>oryza sativa</em>), maize (<em>zea mays</em>), banana and raffia palms (<em>Raphia farinifera</em>), bamboo</td>
<td>Rice and maize farms</td>
</tr>
</tbody>
</table>
The soils in Ede wetlands were identified as hydromorphic, which had equally been extensively identified and characterized by (Okusami and Rust 1992; Okusami, 1991, 2011). The riverine system was the most extensive and was made up of flood plains, swamps and areas along rivers and streams. They provide areas for dry season farming activities (Fadama) for crops such as rice (*Oryza Sativa*) which could be grown three times in a year, maize (*Zea Mays*) four times in a year, okro (*Hibiscus Esculentus*), pepper (*Capsicum Annum*), poultry farming, yam (*Dioscorea allata*) twice in a year, green pastures for grazing animals throughout the year (Fadare *et al*, 2010; Gasu, 2011) and raw materials for handcraft at GAA Elegun, Timi Agbale, Abere, Ekiniku, Owode, Araro, Akoda, Sekona, Agbale and Ededimeji. They could therefore, provide alternative sources of livelihood and improve on the revenue base of the sub-region and reduce the incidence of poverty. The lacustrine systems were identified to consist of mostly impounded reservoir for water supply at Ede (Erinle dam) waterworks. The palustrine systems were equally, identified to be made up of ponds and springs. They were being developed for fish farming at Oladuye, Owode, Sekona and Abere (Fig. 4). Okusami (2011) also studied wetland soils of the savanna ecosystem and characterized them for genesis, classification and potential productivity index for lowland rice (*Oryza sativa l.*) cultivation and concluded that it could be undertaken profitably.

Figure 4 shows the identified wetlands and the drainage network for Ede region. The detailed characteristics of each wetland and their present usage are shown in Table 1. A very dominant plant species of very high economic value which characterise almost all the wetlands is the bamboo which could be useful in the construction industry as poles to support decking, scaffolding, construction of houses, raft and bridges (Crosby, 2009). The bamboo too could be used for enrichment planting of degraded forest areas and water catchment which could serve as buffers in these areas and our major cities to absorb the carbondioxide in the atmosphere thereby mitigating against the global menace of climate change which will go a long way to ensure sustainable development.

SUMMARY AND CONCLUSIONS

Three types of wetlands were identified generally, in Ede region which were equally very similar to those identified by Masarirambi *et al*, (2010) in Swaziland defined by: riverine, lacustrine and palustrine systems. The Committee on Characterization of Wetlands (CCW) 1995; posited that, the minimum requisite *sine qua non condition* for an ecosystem to be classified as a wetlands include; sustained inundation or saturation at or near the surface for 15 days during the growing season and the presence of physical, chemical and biological features reflective of recurrent sustained inundation or saturation (Boavida, 1999).

The study identified the soils at Ede wetlands as hydromorphic with dominant plant species such as: bamboo, Euphorbiaceae (*Achornia Cordifolia*), oil palm (*Elaeis guineensis*) and raffia palm (*Raphia farinifera*). The riverine system was the most extensive wetland and was made up of flood plains, swamps and areas along rivers and streams suitable for dry season farming activities for crops such as rice (*Oryza Sativa*), maize (*Zea Mays*), animal husbandry as well as raw materials for the craft industry. The lacustrine system was identified to consist of mostly impounded reservoirs for water supply at Ede region while the palustrine system were equally, identified to be made up of ponds and springs which could be developed for fish farming.
Wetland resources are under serious pressure of destruction from population and human settlement development. To aid planning and decision making process, proper identification and characterization of these resources upon which human survival is centered is necessary in order to ensure that the human use of the environment and the resources are sustained. The planning implications of this study is that the bamboo and other resources identified could be used for enrichment planting of degraded forest areas and water catchments which could serve as buffers in these areas and around our major cities. The bamboos have the capability to absorb the carbon dioxide in the atmosphere thereby combating the global menace of climate change which could also go a long way to ensure sustainable development.

Figure 4: Shows Identified GPS locations of wetlands and drainage of Ede Region
Source: Produced from 1962 topographic maps and 2010 GPS locations by Author.

REFERENCES


IMPACTS OF ROAD TRANSPORTATION ON REGIONAL DEVELOPMENT OF IGBOMINA REGION OF OSUN STATE, NIGERIA

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The only functional means of transportation in Nigeria and the study area in particular is the road transport system. The aim of this paper is to examine the impact of road transport on regional development of Igbomina region of Osun state, Nigeria. The paper identified modes of transportation often used in the region. It also examines the effects of road transportation on the socio-economic characteristics of the people in the region. People’s productivity in relation to transportation of goods and services in the region was also determined. Three hundred and sixty questionnaires were randomly distributed in the three major cities in the region based on their areal extent and population. Focus group discussion was also used to obtain information from commercial motor drivers and motorcycle riders. Descriptive and analytical statistical methods were both employed to analyze the data gathered. The findings showed that road transport has both positive and negative impact on the regional development of the area. However, the bad conditions of the road in the area affect cost of transportation of goods and services in the region, which in turn affect the regional development of the area. This study therefore, suggests that an improvement in the road transport system will enhance regional growth and development of the area.

Keywords: Road transportation, road condition, region, development.

INTRODUCTION

The only functioning means of transportation in Nigeria and the study area in particular is the road transport system. The analysis of the impacts of road transport infrastructure on the regional development of the Igbomina region of Osun state was to obtain a better understanding of the impacts of road transport development and infrastructure investment on its regional economies. Improved understanding of the impacts of road transport proves to be very useful in the design of transport projects and in developing the theory and practice of road transport project appraisal.

Road transport development is an essential factor in the development of a region. There is always the need to collect, assemble, move, transfer and distribute goods and services from spatially located origins to destinations (Adesoye, 2010). Goods and services are produced in different geographical space of a nation or region, some in the rural areas and others in the urban centres and this has led to the interdependence of regions, towns and villages in which transport bridges the gap (Adesoye, 2010). Road transportation can therefore be described as the parallel for regional development.

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According to Tunde and Adeniyi (2012), transport is regarded as an important factor involved in agricultural development all over the world. Transport enhances regional market, interaction among geographical and economic regions and opens up new areas to economic focus. This implies that for any development to take place transport plays a crucial role. Aderamo and Mogaji (2010) observed that transport constitute the main avenue through which different parts of the society are linked together. Ajiboye and Afolayan, (2009) also noted that road transport is the most common and complex networks while Tunde and Adeniyi, (2012) maintained that road transport covers a wide range of physically convenient, highly flexible and usually the most operationally suitable and readily available means of movement of goods and services over short and long distances.

This paper, however, aim to examine the impacts of road transport on regional development of Igbomina region of Osun State, Nigeria. The objectives of the paper are:

i. Identify modes of road transportation used in the region.

ii. Determine nature and conditions of road transport facilities in the study area.

iii. Examine the effects of road transport on the socio-economic development of the region.

iv. Determine peoples’ productivity levels in relation to ease of movement by road transport.

**Hypothesis**

Hi- there is no difference in the cost of transportation within the cities in the region.

Hii- there difference in the cost of transportation within the cities in the region.

**STATEMENT OF PROBLEMS**

According to the Federal Government of Nigeria [FGN], 2010 a well functional and integrated transport system amongst other things, stimulates national development and enhances the quality of live for all; allows markets to operate by enabling the seamless movement of goods and people; provides vital links between spatially separated facilities and enables social contact and interaction; promotes economic development by increasing access to labour and physical resources thus facilitating the realization of a country’s comparative advantages. Adedotun,(1992) also maintained that transportation is the only means of exchange of all factors of production from place to place and the means of achieving economic and political development.

The Nigeria transport system functions in a crises situation and one of the principal causes identified by the 1993 National Transport Policy Document was “a major imbalance between the needs of Nigeria society and economy for adequate transport facilities and the ability of the transport sector to meet such demands”. This is a statement of fact even today with respect to most transport system in Nigeria and Igbomina region of Osun State in particular. As at today overall demand for transport services in Nigeria seems to exceed the supply. The Nigeria transport system is still in a very difficult situation that needs urgent remedies.

Nigeria has become increasingly dependent on the road system to meet virtually all its inland transport needs as the rail, pipeline, and inland water way systems have deteriorated over the past decades (Daramola, 2010). Road transports account for about 90% of the internal movement of goods and people in Nigeria (FGN, 2010). At
the same time, the road network itself has suffered from continuing lack of maintenance and investment by the three levels of governments, Federal, State and Local (FGN, 2010; 24, Alison-Madueke, 2008).

Nigeria has a total of 193,200km of roads out of which about 18% belongs to the Federal Government, 16% belongs to the State Governments while the remaining 66% belongs to the Local Governments in the country (FGN, 2010; 24, The New Nigerian, 2009). Schelling (2000), observes that only 16.4% of the total road network were in good condition. Hence Daramola (2010) concluded that much of the Nigeria roads network were in parlous state. According to Chiawo (2005), 80% of the Federal and State roads were in a deplorable state and in 2007 only 15% of the Federal roads were said to have some evidence of structural integrity (Federal Road Maintenance Agency (FERMA), 2007).

As provided in the Nigeria constitution each tier of government has independent responsibilities for the planning, financing, and maintenance of their roads. The Draft National Transport Policy of 2010 noted three major issues that affect the road network:

- Misuse particularly as a result of axle over loading causing damage to roads
- Neglect of periodic and routine maintenance and
- Inadequate design and construction.

It is almost impossible to ply most of the Nigerian highways and the study area in particular and not end up with a feeling of regret and bitterness on how much importance the government attaches to this vital sector, and by implication the welfare of its citizens.

Ovih (2010), noted that Nigeria roads and Igbomina region of Osun State in particular are characterized with series of gullies and craters or small lakes of water and mud. He observed too that some of the highways in Nigeria are terribly bad which impede free movement of vehicles and consequently led to time wastage. Chris Juslin (2011) also observed that many roads in Nigeria (Igbomina region of Osun State in particular) have little or no effective drainage system; very few have culverts or side ditches. During the rainy season between April and October many roads become impassable, as the resultant overland flow has no place to go. This result in flooding that erodes the roadways in the study area. The Federal Government of Nigeria is very conscious of this, which gives reason for the establishment of Federal Roads Maintenance Agency (FERMA) in November, 2002 to monitor and maintain the Federal roads network.

**STUDY AREA**

Igbomina region of Osun state is made up of two Local Governments, i.e Ila and Ifedayo Local governments. The region lies between Longitudes 4° 5'E and 5° 5'E; Latitudes 7° 5'N and 8° N. According to 2006 population census, the region has ninety nine thousand five hundred and sixty two (99,562) people. Based on the 2006 population, projected to 2012 at 3.2% the region has one hundred and twenty thousand, two hundred and seventy four people (120,274). The region shares boundary with Kwara State to the North, (where other Igbomina people are), to the
South it shares boundary with Bolorunduro and Obokun Local Governments in Osun State, to the east, it shares boundary with Ekiti State while to the west it shares boundary with Odo-Otin Local Government of Osun State.

The study area lies between 457m and 609m above sea level. A number of Precambrian basement complex rocks are found in the area. The area is dissected by a number of rivers, most of them taking their sources from the hills and each occupying valleys of various depths and width. Three drainage basin can be recognized namely Aketi, Osin and Oyi river basin. The study area being in the tropical region possesses the attributes of equatorial tropical climate. The vegetation of the area is that of the rainforest, however due to the prevailing agricultural practices of rotational bush fallow and shifting cultivation in the area, most of the original forest has been reduced to secondary forest (Osun State Government, 2012).

The climate, vegetation and soils of the area to a greater extent favour the growth of perennial crops such as cocoa, kola nut and planting of food crops such as yam, maize, cassava etc.

**CONCEPTUAL FRAMEWORK**

**Regional Development**

There is no universal understanding of the appropriate definition of region on which this work could base its analysis. According to Blij (1971) it may be easy to visualize a region, but to define it accurately and incontrovertibly may be very difficult. Herbertson (1965) assert that a region “should have a certain unity of configuration, climate and vegetation”. Furthermore, Omuta & Onokerhoraye (1994) maintained that a region must have “similarity, over a contiguous area of leading activities based upon similarity of natural environment”. Richardson (1974) maintained that a region is a sub national area unit. According to Perloff et al (1960) “The term region is generally areas which have certain common or complementary characteristics or which are tied by extensive inter-area activities or flows”.

Omuta and Onokerhoraye (1994) critically argue that “regions are simply generalizations of the human mind”. In the same manner, Whittlesey (1954) defines region as “an intellectual concept, an entity for the purposes of thought”. However, Richardson (1969) identified three types of regions: Uniform or homogeneous region, Nodal regions, Programming or planning regions.

The first classification above claims the idea that separate spatial unit can be linked together on the grounds that they exhibit certain uniform characteristics. These characteristics might include similar production structures, homogenous patterns of consumption and like occupational distributions of the labour force. They might reflect geographical factors such as the ubiquity of dominant natural resources, or a similar topography or climate; or again they might include non-economic variable such as uniform social attitude, a regional identity or a similar socio-political outlook.

Secondly, nodal regions emphasize the interdependence of different components within the region rather than inter-regional relationships between homogeneous regions. The focus of nodal region is in the controlling centre of the region rather than on drawing the boundaries.

Programming or planning region is defined in terms of the coherence and unit of economic decision making and reflects established, political or administrative boundaries.
It may not be possible to talk of regional development without a proper understanding of what development is all about. However, there is no universal definition of what the term development is all about. Some definitions are based on economic criteria, some on social conditions, while some are based on political considerations. From economics point of view development, it has to do with growth in domestic products or rise in per-capital income. To a Sociologist such as Deutsch (1971) development encompasses numerous processes of change which are frequently associated. These include spatial mobility, occupational change, change in roles expectations, needs behaviour associations and identity. Julius Nyerere (1969) a political scientist defined development as “The development of people”.

All the definitions of development given above are quite relevant to the regional analyst and planner who are primarily concerned with the spatial aspects of development (Omuta & Onokerhoraye 1994). Within the context of this work development has to do with socio-economic changes which are drastic and which touch all spheres of society within the study area.

RESEARCH METHODS

Data Collection: Two types of data were collected for the study. These are primary and secondary data. Primary data were derived from field work, which involved direct interview technique and administration of questionnaire. The questionnaire was addressed to the inhabitants of the region and information sought included the socio-economic characteristics of the respondents, modes of transport often used, how often they traveled, distance covered, cost of travel, and the effects of road transport on their productivity.

For the administration of the questionnaire, three major cities in the region were surveyed. These cities are: Ila-Orangun, Oke-Ila Orangun and Ora-Igbomina. Three hundred and sixty questionnaires were administered in the cities as follows based on their areal extent and population (Table I).

Table: I QUESTIONNIARE DISTRIBUTED IN THE CITIES

<table>
<thead>
<tr>
<th>S/N</th>
<th>Cities</th>
<th>NO of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ila-Orangun</td>
<td>160</td>
<td>44.44</td>
</tr>
<tr>
<td>2</td>
<td>Oke-Ila Orangun</td>
<td>110</td>
<td>30.56</td>
</tr>
<tr>
<td>3</td>
<td>Ora-Igbomina</td>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

The questionnaires were administered in the randomly selected streets in each of the cities and head of the households in each of the houses systematically chosen were interviewed.

Focus group discussion was also used to obtain information from commercial motor derivers and Okada (motor cycle) riders at their terminals on their opinion on the conditions of roads and the impacts of the roads on their economy.

The sets of questionnaire administered were supplemented by field observations, where the type and quality of roads in the study area were evaluated. The road quality was evaluated on the basis of the following indices: the condition of roads (whether tarred or untarred); the period of mobility (seasonal or all seasons); type of surface amongst others.
The secondary data were extracted from the review of published and unpublished records kept by the administrative authorities at the local, regional and state levels. Text books, journals, internet and other relevant materials were used for conceptual frame work and literature review.

**Analysis of Data:** Descriptive statistics such as tabulation and percentages were used to summarize the socio-economic attributes of the people in the region, their modes of movement, nature and condition of roads in the region. Analysis of variance (ANOVA) was use to test whether there is difference in the cost of transportation within the cities in the region.

**RESULTS AND DISCUSSION**

**Socio-Economic Characteristics of Respondents:**

The socio-economic statuses of the respondents considered in this study are: sex, age, educational background, monthly income and marital status. The study revealed that 73.3% of the respondents are male while 26.7% are female. This was because heads of the households in the study area were sampled. Majority of people interviewed were of working age that is 81.1% while the remaining 18.9% were of dependant age. Educational background of the respondents is another socio-economic variable that may influences the impact assessment of road transport in the study area. The study however showed that 27.8% of the respondents in the region had no formal education while 25.6% had primary education and 22.8%, 23.1% had secondary and post secondary education respectively (See table II).

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Ila-Orangun</th>
<th>Oke-Ila-Orangun</th>
<th>Ora-Igbomina</th>
<th>Total</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No formal education</td>
<td>41</td>
<td>36</td>
<td>23</td>
<td>100</td>
<td>27.8</td>
</tr>
<tr>
<td>Primary education</td>
<td>39</td>
<td>28</td>
<td>25</td>
<td>92</td>
<td>25.6</td>
</tr>
<tr>
<td>Secondary education</td>
<td>48</td>
<td>24</td>
<td>10</td>
<td>82</td>
<td>22.8</td>
</tr>
<tr>
<td>Post Secondary education</td>
<td>32</td>
<td>21</td>
<td>30</td>
<td>83</td>
<td>23.1</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>110</td>
<td>90</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

Monthly income of respondents is another strong socio-economic parameter which may influence the respondents’ use of road transport. Table III shows that 14.2% of the respondents claimed to earned less than N20,000 per month, 25.8% claimed to earn between N20,000 and N40,000 per month, 34.4% earned N40,000 to N60,000 per month, while the remaining 25.6% claimed to earn above N60,000 per month. Finally on social –economic characteristic of respondents, their marital status showed that 65.3% of them were married while 21.6%, 3.1%; 5.8% and 4.1% were single, separated, divorced and widowed respectively. The socio-economic characteristics of the respondent as stated above indicates...
that most of them had deep knowledge of what it takes to use road transport and benefits derived in using such a mode of transport in the study area.

Table III: Estimated Monthly Income of Respondents

<table>
<thead>
<tr>
<th>INCOME</th>
<th>Ila-Orangun</th>
<th>Oke-ILA-Orangun</th>
<th>Ora-Igbomina</th>
<th>TOTAL</th>
<th>PERCENT(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N&lt;20,000</td>
<td>16</td>
<td>23</td>
<td>12</td>
<td>51</td>
<td>14.2</td>
</tr>
<tr>
<td>N20,001-30,000</td>
<td>28</td>
<td>44</td>
<td>20</td>
<td>92</td>
<td>25.6</td>
</tr>
<tr>
<td>N30,001-40,000</td>
<td>56</td>
<td>23</td>
<td>14</td>
<td>93</td>
<td>25.8</td>
</tr>
<tr>
<td>N40,001-50,000</td>
<td>33</td>
<td>12</td>
<td>17</td>
<td>62</td>
<td>17.2</td>
</tr>
<tr>
<td>N&gt;50,000</td>
<td>27</td>
<td>8</td>
<td>27</td>
<td>62</td>
<td>17.2</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>110</td>
<td>90</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

MODES OF TRANSPORT SYSTEMS OFTEN USED BY THE RESPONDENTS

Table IV: Modes Frequently Used by the Respondents

<table>
<thead>
<tr>
<th>Modes</th>
<th>Ila-Orangun</th>
<th>Oke-Ila Orangun</th>
<th>Ora Igbomina</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>53</td>
<td>14.8%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>05</td>
<td>02</td>
<td>-</td>
<td>07</td>
<td>1.9%</td>
</tr>
<tr>
<td>Motor-cycle</td>
<td>34</td>
<td>27</td>
<td>19</td>
<td>80</td>
<td>22%</td>
</tr>
<tr>
<td>Private car</td>
<td>21</td>
<td>08</td>
<td>06</td>
<td>35</td>
<td>9.8%</td>
</tr>
<tr>
<td>Passenger Vehicles</td>
<td>80</td>
<td>55</td>
<td>50</td>
<td>185</td>
<td>51.5%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>110</td>
<td>90</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

One of the objectives of this research work was to determine mode of transport system often used by the respondents in the study area. Table IV shows mode of transport frequently used by the respondents on their daily activities either to their place of work, market centres, religious places and relaxation centres. 51.5% of the respondents admitted to make use of passenger vehicles such as commercial buses and taxi cabs, 22% made use of commercial motor-cycles; 9.8% made use of private car, 1.9% made use of bicycle while the remaining 14.8% admitted that they do walk to their daily place of activities. The analyses however shows that majority of the respondents depends on the use of road transport for their daily socio-economic, religious and political activities.

The distances covered by the people from their house to their place of work in the three cities are discussed here. As shown on Table V 13.9% of the respondents have their place of work within 5kms radius, 37.3% at 5-10kms radius, 2.4% at10-15kms radius, 15.8 % at 15-20kms radius, 9.4% at 20-25kms radius while the remaining 2.2% have their places of work above 25kms radius.
Table V: DISTANCE (KMS) FROM HOME TO PLACES OF WORK

<table>
<thead>
<tr>
<th>Distance (kms)</th>
<th>Ila-Orangun</th>
<th>Oke-Ila Orangun</th>
<th>Ora-Igbomina</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5kms</td>
<td>21</td>
<td>7</td>
<td>22</td>
<td>50</td>
<td>13.9</td>
</tr>
<tr>
<td>5-10kms</td>
<td>66</td>
<td>42</td>
<td>26</td>
<td>134</td>
<td>37.3</td>
</tr>
<tr>
<td>10-15kms</td>
<td>35</td>
<td>28</td>
<td>14</td>
<td>77</td>
<td>21.4</td>
</tr>
<tr>
<td>15-20kms</td>
<td>20</td>
<td>20</td>
<td>17</td>
<td>57</td>
<td>15.8</td>
</tr>
<tr>
<td>20-25kms</td>
<td>18</td>
<td>8</td>
<td>8</td>
<td>34</td>
<td>9.4</td>
</tr>
<tr>
<td>&lt;25kms</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>2.2</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>110</td>
<td>90</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

Table VI: Frequency of plying the road.

<table>
<thead>
<tr>
<th>Periodicity</th>
<th>Ila-Orangun</th>
<th>Oke-Ila Orangun</th>
<th>Ora-Igbomina</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyday</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Every Official work Days</td>
<td>95</td>
<td>64</td>
<td>48</td>
<td>207</td>
<td>57.5</td>
</tr>
<tr>
<td>Every Other Day</td>
<td>05</td>
<td>10</td>
<td>07</td>
<td>22</td>
<td>6.1</td>
</tr>
<tr>
<td>Every Market Day</td>
<td>50</td>
<td>31</td>
<td>25</td>
<td>106</td>
<td>29.4</td>
</tr>
<tr>
<td>Others (twice or thrice a week)</td>
<td>10</td>
<td>05</td>
<td>10</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>110</td>
<td>90</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

Table VI revealed that most of the people interviewed (57.5%) move along their routes only on the official work days i.e Monday to Friday in the study area. This may be attributed to the nature of their work and even the condition of the roads which are bad and thus prevent unnecessary movement most especially during the weekends. 29.4% ply their routes only on the market days, 7% do ply their routes twice or thrice in a week, 6.1% plies their route every other day, while none of the people claimed to ply their routes every day. Response on this question indicates that the road condition in the region does not encourage regular or continuous plying of the roads in the area. Most people only move along their routes when necessary either for work or market.

NATURE AND CONDITIONS OF ROAD TRANSPORT FACILITIES IN THE STUDY AREA

Road transport is the most predominant mode of transportation, and this is confirmation of the crucial role it plays in the socio-economic development of a nation especially in the movement of people, goods, and services. One major aspect of the field survey was focus on the nature, quality, quantity and characteristics of the road network in the study area.
On the attributes of the roads in the study area, Table VII shows that 62.26% of the roads were tarred while 24.82% of the tarred roads were tarred with asphalt materials and the remaining 37.44% tarred road made up of macadam surfacing. It was also observed that only 33.09% of the tarred roads have smooth and even surface while the remaining 66.91% were characterized with a lot of potholes and uneven surface. Within the study areas there is no single four lane road, 62.26% of the roads were two lanes and the remaining roads which were mainly Local Government roads were one lane type.

Furthermore, 62.26% of the roads are motorable at all seasons and 22.31% of the roads are partially seasonal in use and the rest 15.48% of the roads were strictly seasonal because of their poor condition. Among the roads Federal government has none; Osun State Government owns 65.13% while the remaining 34.89% of the roads belongs to the two Local Governments in the region. The analysis shows that the region has been neglected by the Federal Government in the area of road development.

Furthermore 22.5% of the respondents claimed that their road conditions were very bad, 37.8% were of the view that the roads were bad; 37.8% also maintained that the roads were fairly goods only 1.6% claimed that the roads were good. Drivers and commercial motor cycle riders also maintained that the poor condition of roads in the area have negative effects on their driving and productivities. One can however deduce from the analysis that the roads in the study areas were in bad shape since about 60% of the respondents claimed that the roads were bad and considering the number of potholes that characterize the said tarred roads.

The conditions of the roads in the study area definitely have adverse effects on the socio-economic development of the region due to their bad condition.
PASSENGER TRAVEL TIME AND COST OF TRANSPORTATION IN THE STUDY AREA

Table VIII: Summary of Passenger Travel Time and Cost of Transportation in the Study Areas.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ila-Orangun</th>
<th>Oke-Orangun</th>
<th>Ila-Orangun</th>
<th>Ora-Igbomina</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Average cost of transporting a bag of product (maize) (50kg) per km (N)</td>
<td>N13.00</td>
<td>N15.00</td>
<td>N10.87</td>
<td></td>
</tr>
<tr>
<td>2. Average cost of transport fare per kilometer (N) in the region</td>
<td>N30.00</td>
<td>N40.00</td>
<td>N40.00</td>
<td></td>
</tr>
<tr>
<td>3. Average passenger travel time per km</td>
<td>2.17 mins</td>
<td>1.55mins</td>
<td>2.12mins</td>
<td></td>
</tr>
</tbody>
</table>

Table VIII shows the summary of average passenger travel time and cost of transportation per kilometer in the study area. The table shows that people in Oke-Ila Orangun pay higher on a bag (50kg) per kilometer of their products (N13.00) compared to other towns while Ora-Igbomina people pay less (N10.87). On the average in the Igbomina region of Osun state people pay N12.96 on goods worth of 50kg per kilometer. The study also shows that an average of N36.67 is spent on transport fare per kilometer in the region. On the other hand people from Ila orangun spent about 2.17 minutes per kilometer, Oke-Ila Orangun people spent 1.55 minutes per kilometer while people of Ora-Igbomina spent 2.12 minutes per kilometer. On the average in Igbomina region of Osun state people spent 2.08 minutes per kilometer in travelling. The location of the region at the peripheral area of Osun state coupled with the bad condition of roads in the region account for the high cost of transportation in the area.

However analysis of variance shows that there is no significant difference in the cost of transportation in the three communities with calculated value of 0.00005 and the table value at 5% is 3.55 (See table VI). From the analysis, it shows that the region has been neglected in the area of road development when one considered the financial cost of transportation and the time cost in the region. This definitely have negative effects on the productivity and socio-economic development of the region considering time wasted on a trip. Factors responsible for this high cost of transportation in the region as identified by the respondents in the study area were the poor conditions of roads in the area.

Effects of transport cost on price of goods and respondents productivity.

The respondents confirmed the general notions that transportation has an effect on the production level of people as well as the price of goods and services. The study shows that 23.6% of the respondents very much agreed that transport cost has effects on the price of their products, another 46.4% admitted they much agreed, 24.2% slightly agreed and the remaining 5.8% did not agree at all. On the issue of transport cost on people’s production 25.6% of the respondents very much agreed that transport has effects on their production, 41.1% much agreed; 28.9% slightly agreed, only 4.4% did not agree that transport cost has effects on their production. This further shows the importance of road transportation in regional development. If there are no good road transport facilities, the people will not be able to produce more since they would not be quite sure of how they would take their products to the market centres. Price of the
few materials available in the market would be very high because of the high cost of transport and many people would not be able to afford it. Similarly it would affect the general economy, of the region, hence the need for road transportation planning, development and management in the region.

Table IX: ANOVA TABLE

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degree of Freedom</th>
<th>Variance Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>0.0002</td>
<td>2</td>
<td>0.0001</td>
</tr>
<tr>
<td>Within Groups</td>
<td>35.67</td>
<td>8</td>
<td>1.98</td>
</tr>
</tbody>
</table>

F-Value =0.00005

SUMMARY OF FINDINGS

According to Onakomaiya and Ekanem (1981) the role of transportation is to promote interaction through accessibility between places and therefore between urban and rural areas of a country. For these reasons, this study therefore concerned itself with the role of road transportation in the regional development of Igbomina region of Osun state.

The major findings in this study can however be summarized as follows; that the majority of people interviewed were male adult of working age with an average monthly income of #50,000 only. The survey also showed that most of the people interviewed used passenger vehicles as modes of movement (51.5%). The analysis further showed that most of the people in the area depend on road transportation for their socio-economic and political trips. While most of the people sampled claimed to travel less than 10kms from their home to their place of works (51.2%). From the study none of the respondents ply the roads every day. This is as a result of the deplorable condition of most of the roads in the region, which also calls for urgent attention of both the Local, State and Federal Governments in Nigeria.

The study further showed that most of the roads’ surfaces are made up of laterite (37.74%), followed by macadam surface (37.44%) while only 24.82% of the roads made up of asphalt. Presence of the Federal Government on road development and construction is not felt at all in the region. All the roads in the region were owned by the State and Local Governments. Furthermore, the study showed that an average of #12.96 is paid on an average of goods worth of 50kg per kilometer while a passenger pay an average of transport fare of #36.62 per km. This is relatively high considering the economy of the region. In the region people spent an average of two minutes per kilometer on a journey. This shows that a journey of 1hour where the road is good will take 2hours in the region. Without missing words all these delays in movement and relatively high cost of transport fare have negative effects on the regional development of the area. Majority of the people interviewed also confirmed that their productivity is negatively affected with the road transportation situation in the region.

The transportation problems as presented in this study are the poor transportation facilities and the high cost of transportation which places a heavy burden on the people and movement of goods in the region.

RECOMMENDATIONS AND CONCLUSION

It has been confirmed from this study that road transportation has effects on the regional developments of the study area. The region is not quite accessible and is
faced with serious transportation problems which in turn have affected the level of production and the enthusiasm to produce in the region. Cost of transportation and time spent on a trip in the region is relatively high; hence this is responsible for the low development of the region. The study also showed that the region has been neglected in the area of road development by the various tiers of governments, yet road transportation is the only available mode of transportation in the area. However the following basic policy recommendations are made.

There is the need therefore to open up the region, especially the numerous rural areas in the region that have not been linked effectively in order to achieve the objective of integrated regional development. This can be achieved if both the State and Local governments allocate more of their annual budgetary expenditure on the provision, development and maintenance of roads.

Federal Government should take over a large number of reliable regional routes for efficient construction and maintenance while it should also allocate more funds to the Local governments in order to finance the construction, rehabilitation and maintenance of the roads within their councils.

Both State and Local Governments are called upon to participate in the provision of public transport needs in the regional area to complement the few public modes provided by the private individuals.

It is also imperative to adequately involve the private sector, especially corporate organizations like industries, insurance companies in road infrastructural provision and funding. Some of these roads can equally be concessioned to these private organizations on built, operate and transfer agreement.

Furthermore, the government should make the issue of road development a major policy issue to be implemented with all vigour by paying greater attention to the construction and maintenance of the roads in the region and in the country at large.

In conclusion if the road transportation in the region is developed, it would further open up the area into economic focus, facilitate the dispersal of economic activities, gaining access to various natural resources and market. It will also makes the diffusion of growth processes easier, promote the social and political cohesion among the people as well as facilitating the execution of various political and administration projects.

REFERENCES


Road transportation


This study examined the relationship between housing development and wetland loss. Over the years, the amount of wetland that has been lost to housing development for various uses cannot be over emphasised. This was as a result of the wetland reclamation exercises carried out due to the increasing demand for land for various public (government) and private (individual) housing development projects. There is the need to introduce the principle of sustainable development into the use of wetland zones. The data for this research were obtained from both primary and secondary sources obtained from the field, literatures and interview sessions with staff of the Land Registry. Through multi-stage, cluster sampling technique used to administer questionnaires the total area of wetland lost to land reclamation, within the study area was determined. It was discovered that in the 2012, a total of 4,185.56 hectares (28.86%) of wetland was lost to land reclamation for various housing development projects as against the initial 14,500 hectares of wetland as recorded by the Lagos State Government in the 1980 – 2000 regional development master plan, leaving a balance of 10,314.44 hectares (71.14%) of wetland in EtiOsa local government area of Lagos state. Thus, increasing the rate of housing development, housing provision and delivery in EtiOsa Local Government Area of Lagos State at the detriment and loss of aquatic life and wetland ecosystem at an alarming rate that needs to be checked and attended to. This paper discusses the consequences of wetland loss; and develops alternative management strategies for the preservation, conservation and sustainable utilization of the remaining wetlands.

Key words: housing development, environmental sustainable development, wetland zones and loss

INTRODUCTION

One of the features of urbanization is the rate at which urban centres are growing. The world is changing from a world of rural villages to a world of towns, cities and mega cities because urbanization is closely associated with increasing levels of income and improvements in social indicators such as life expectancy, literacy, infant mortality and access to infrastructure and social services (Egunjobi and Agbola, 1993). At the same time, cities and towns provide employment and education opportunities, attracting an ever growing number of migrants and for others seeking a better life. However, rapid rate of urbanization has resulted in absolute and severe
shortage of dwelling unit (World Commission on Environment and Development WCED 1987).

In several urban centres, many wetlands are threatened for the sake of residential development. Kotze, Breen and Quian, 1995 and Hollis 1992 contend that while it is important that the proximate causes of wetland loss are identified, the underlying causes are largely socio-economic and political. These according to them include poverty and economic inequality, population pressures from growth, immigration and mass tourism, social and political conflict, sectoral demands on water resources, centralized planning processes and financial policies, resulting to the loss of 50 per cent of world’s wetlands (World Commission on Environment and Development 1987).

In the 2012, a total 2421.856 hectares of wetland was lost to private land reclamation to housing development, 914.83 hectares lost to village excision while 840.87 hectares of wetland lost to public (government) site and services project; in all a total of 4,185.56 hectares (28.86%) was lost to land reclamation as against the initial 14,500 hectares of wetland leaving a balance of 10,314.44 hectares (71.14%) of wetland in EtiOsa Local government area of Lagos state(source 1980 – 200 Lagos State Regional Development Master Plan and 2012 Author’s field survey), thus increasing the rate of housing provision and delivery in EtiOsa Local Government Area of Lagos State at the detriment and loss of aquatic life and wetland ecosystem at an alarming rate that needs to be checked and attended to in reducing and/or out rightly discouraging the rate of wetland encroachment and loss.

Against this background, this paper sets out to examine the extents to which physical development has contributed to wetland loss in Nigeria using Eti-Osa LGA of Lagos State as a case study. Also, this studyexamines the rate and consequences of wetland loss with a view to developing appropriate options for managing the remaining wetlands.

**WETLAND MANAGEMENT AND SUSTAINABILITY**

People in a broad spectrum of activities are using the wetlands but, not all activities performed in wetlands or their catchment areas are necessarily sustainable. Unsustainable human activities lead to wetland loss. The need to introduce the principle of sustainability into the use of wetland for residential development provides the justification for this study. The Sustainability of wetland environment cannot be separated from proper management of wetlands. This is because wetlands sustain thousands of communities with a wide range of products such as drinking water, food and timber. They are great spots for fishing, canoeing, hiking and bird watching (USEPA 2002). Wetlands function as a barrier to shoreline erosion from wave action because of their interlocking root system which stabilize soil at the water’s edge, enhance soil accumulation through sediment trapping, cures wave action, and slow water currents (Heinelich 1998). Generally, wetland loss is difficult and costly to reverse, although wetland restoration (the rein-statement of some, or all, pre-existing functions to “lost” wetland (Hollis 1993) and wetland creation (the introduction of some wetland functions to formerly non-wetland areas) are increasingly popular applied sciences and conservation tools (Moser M et al, 1996).

The objective of sustainable development is to reach a point where the city’s development needs are attained without the imposition of ecological unsupportable economic and social demands upon natural resources and systems (Adeowu, 2005). If
Housing development
town and cities will continue to grow, residential development will continue to take
place. However, the negative impact of residential development on ecological
resources should be mitigated and this will be a function of the quality of
environmental management strategies adopted. The cities could be guided and
managed to develop and become assets, to our socio-economic development that is, to
become an engine of positive growth (a development) a creation that we can sustain
and that can sustain (not destroy) us (Onibokun, 2006).

Urban dwellers utilize wetland resources by harvesting or extracting some of the finite
flow of valued goods produced by them or by putting in them unwanted bye products
(e.g. municipal solid wastes, sludge, etc), thus acting as a sink. In this connection,
residents using wetland resources face at least two underlying incentive problems.
The first is the problem of overuse, or even destruction because one person’s use
subtract from the benefits available to others. The second is the free-rider problem
that arises from the difficulty or cost of barring some individuals from the benefits
generated by wetland resources. Unfortunately, awareness of the need for sustainable
cities is still insufficient in most Third World countries. Where residential
development does not exhaust wetlands, there will be sustainable cities. However, if
the opposite is the case, wetlands may be degraded or lost and, loss of wetlands means
denying their contributions to sustainable urban development. It also implies that
while meeting the needs of the present generation the needs of the future generation
will be jeopardized. For these reasons, the sustainability factor is of paramount
importance in housing delivery and wetland management

The focus of the paper therefore is to trace and examine the implication of housing
development on wetland loss. To achieve this, objectives stated was to identify the
major threats to wetland, identify the rate and pattern of housing development in the
study area as it relates to the wetland zone, determine the relationship between
housing development and wetland loss, the rate and amount of wetland loss was
determined in view to develop management strategies for the preservation,
conservation and sustainable utilization of the wetland zones.

RESEARCH METHODOLOGY
Primary Data Sources: - Questionnaires.

Both quantitative and qualitative data were sourced for this research, from both
primary and secondary sources. Primary data was sourced from the field, two sets of
questionnaires and Focus Group Discussion (FGD) along with observation method.
Secondary data was collected through an extensive literature review.

The first set of questionnaires contained questions on socio-economic profile of
selected households, housing characteristics, effects of housing delivery on wetland,
means of coping with wetland environment and encroachment as well as suggestions
for sustainable management of water catchment areas. This was served on household
heads that have been living within designated water catchment areas for at least five
years. Structured household head questionnaire was used because of its relative merit
of impersonal nature, comprehensiveness and standard instruction for recording
responses that ensure uniformity. Its impersonal nature provided anonymity, which is
almost absent in all other forms of data collection, and thus likely to yield a higher
rate of responses. The second set of questionnaire, namely the stakeholders’
questionnaire contained general specific questions that were asked which revolved
around the goals and objectives of these selected actors, land reclamation exercises
and physical development policies as it affects wetlands. Questions were also asked on sustainable management of wetland areas. It was prepared for selected stakeholders in the public and private sector in managing and developing the wetlands.

A multi-stage, cluster sampling technique was used for the purpose of administering the household head questionnaire. At the first stage, all private residential estates in Eti-Osa LGA a total of 38 residential estates were identified out of which one-third of all the estates, that is, 13 estates were randomly selected using systematic method. Next, all the streets, lanes and roads were identified and listed alphabetically. These streets, lanes and roads were arranged alphabetically at the fourth stage and systematic sampling technique was used to select 32 streets. At the fifth stage, the resulting number of streets obtained was divided by the number of questionnaires to be administered. Finally, since the arrangements of all buildings in most streets are linearly homogenous, random sampling technique of every 10th building on a streetdespite the length of the street (because some areas are still being developed). 329 houses within the 13 residential estates were interviewed as the sample size, to whom questionnaires were administered out of the 3296 identified sample frame, but only 322 were adequately completed and returned. Concerning the stakeholders’ questionnaire, purposive sampling was used to select 24 representatives of the relevant stakeholders.

Secondary Sources: Literature Review

Access to land in any society embraces the possibility of members of a community to have bundles of rights to ownership and use of land. Land is basic to human activities and is a key component of poverty alleviation strategies. However this could be a major source of conflict in a human society. The importance of land economy and environmental sustainability for the survival of man cannot be over-emphasized. What we do on land today sets the shape of the environment tomorrow. The prevailing features of increase cost of access to land, misuse, and overuse, conflicts over land, land degradation and wetland reclamation. The statutory on land in Nigeria is embedded in the Land Use Decree 1978. A critical assessment reveals that the Act to a great extent achieved the unification and streamline of the management and ownership of lands in the country.

A few recent studies have revealed the alarming rate at which wetlands are disappearing in some areas, but reliable data over large areas and over many years are generally lacking (Scott, 1993). Moser et al (1996) showed that in the Cauca River Valley system (Colombia), 88 per cent of mapped wetlands were lost between the 1950s and 1980s. Land reclamation, drainage, river regulation and pollution (Restrepo and Naranjo, 1987) were cited as the major causes. The extent of wetland loss in Europe was provided by Jones and Hughes (1993), and little new information has been published since while many published accounts exist at national and local scales, this was the first attempt to collate information at a Pan-European level. As revealed by Jones and Hughes (1993); and European Commission (1995), the overall wetland losses exceeding 50 per cent of regional area have been reported by the Netherlands, Germany, Spain, Greece, Italy, France and parts of Portugal. In the UK, loss rates of 23 per cent of estuaries and 50 per cent of salt marshes were recorded since Roman times (Davidson et al, 1991) and 40 per cent of wet grassland (RSPD 1993) have been reported lost.

Little published quantitative information exists for the extent of wetland loss in the small south Pacific islands. For New-Zealand, Cromarty (1996) estimates a loss of 90
per cent of the regional wetland area. For Australia, loss estimates are given for Victoria (26.8%), the south eastern part of South Australia (89%) and the Swam Plain Coast of South Australia in the recently published national wetland directory (Usback and James, 1993). Davis and Froend(1999) reveal that many wetlands estimated to be about 70 per cent have been lost in the coastal plain region of South Western Australia since British settlement, primarily as a result of infilling or drainage to create land for agricultural use or urban development. The most detailed study for Victoria shows losses of fresh water marshes exceeding 70 per cent, whilst there have been gains through the creation of artificial wetlands such as sewage ponds and salt works.

The situation concerning wetlands losses in Africa is characterized by an extreme paucity of published quantitative studies, similar to South America. This may reflect both the generally lower rates of losses than in industrialized regions, but also the lack of capacity to undertake such studies in many countries (Moser et al, 1996). However, a review of wetland inventories in Southern Africa as documented by Taylor et al (1995) gave some information on the extent of wetland loss in two areas in Nata. The affected areas are the Tugela basin, where over 90 per cent of the wetland resources have been lost in part of the basin; and the Mfolozi catchment (10,000 sq. km) where 58 per cent of the original wetland area (502 sq. km) had been lost. Quantitative information which arose from the wetland inventory of Tunisia showed an overall loss of 15 per cent of wetland area and 84 per cent loss in the Madjerdah catchment (Hollis, 1992).

The Niger Delta region of Nigeria covers an area of about 70,000 sq km and accounts for 7.5% of total landmass of the country. It covers a coastline about 560 km (2/3) of the Nigeria coastline. It said to be very active wetland made up of marshland, creeks, tributaries, lagoons which drains into the Atlantic. The region is noted for oil exploration and refining, spillage and high rate of wetland loss due to land reclamation for development. The biodiversity of the region is very high both in flora and fauna with an estimated population of 20 million of diverse socio-economic activities (WCED 1987).

STUDY AREA

Eti-Osa Local Government Area (LGA) is one of the 20 recognized LGAs in Lagos State of Nigeria. Lagos State is one of the thirty-six states in the Federal Republic of Nigeria. Lying in the south-western portion of Nigeria, Lagos state stretches for more than 180 kilometres along the Guinea Coast of the Atlantic Ocean and it is bounded on the North and East by the sister state of Ogun, and on the West by the neighbouring Republic of Benin (IBLL, 1998).The unique topographical pattern of Eti-Osa LGA explains the reference to the LGA as a wetland environment. Of its entire geographical area (154 km²), creeks, lagoons, rivers and swamps take up 145 square kilometres or 94.2%. Notable wetlands in the area are the Lagos and Lekki Lagoons, Kuramo Waters as well as several swamps and marches. The area is also blessed with a mesh of creeks. The wide expanse of water, as it were, constitutes a major constraint to residential development. However, with the emergence of Lekki, Victoria Island, Ikoyi and Aja as prime residential areas along Lagos-Lekki-Epe axis, Eti-Osa LGA is witnessing heavy concentration of residential housing estates. This has serious implication on the wetland environment of the LGA. Among other major resident communities are Obalende, Ilado, Badore, Oke-Ira, Igbo-Efon, Ajiran, Ikate-Elegushi, Ilasan and Sangotedo.

HOUSING DEVELOPMENT AND WELAND LOSS IN ETI OSA
Housing development in Eti-Osa LGA can be traced back to the emergence and occupation of Kuramo. The growing economic activity around Kuramo, which attracted immigrants, increased demand for lands for farms and for the resettlements of the growing population. In addition, the British Colonial Acquisition of parts of Obalende, Ikoyi and Victoria Island for quarters and Government Reservation Areas (GRAs) fuelled the invasion of the present Lekki by traditional chiefs and families of Lagos Island who then apportioned the region into farmlands. The designation of the Lagos Territory as the seat of Nigerian Government encouraged the widespread land acquisition by government and the revocation of titles. The natural harbour and the Atlantic foreshore that endeared the area to the British Colonial Administrators also led to the establishment of GRAs at Ikoyi and Victoria Island, which dislocated many long existing settlements with the concomitant migration of people to new locations.

The migration of people to new locations increased the demand and supply of housing facilities as needed for various uses in the study area of Eti-Osa Local Government. This culminated in government excision of 24 settlements in October 1991. The various villages/settlements approved for excision within the local government also increased the rate of housing development are shown in Table 1.

Table 1: Village/Settlement Approved for Excision

<table>
<thead>
<tr>
<th>S/N</th>
<th>Village/Settlement Excision</th>
<th>Land Area (Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gbara</td>
<td>8.91</td>
</tr>
<tr>
<td>2.</td>
<td>Osapa</td>
<td>18.05</td>
</tr>
<tr>
<td>3.</td>
<td>Araromi-Agungi</td>
<td>12.08</td>
</tr>
<tr>
<td>4.</td>
<td>Igbo-Efon</td>
<td>50.02</td>
</tr>
<tr>
<td>5.</td>
<td>OkunIbeju/Afa</td>
<td>20.06</td>
</tr>
<tr>
<td>6.</td>
<td>Ologolo</td>
<td>6.51</td>
</tr>
<tr>
<td>7.</td>
<td>Ajiran</td>
<td>28.06</td>
</tr>
<tr>
<td>8.</td>
<td>Ikota</td>
<td>52.05</td>
</tr>
<tr>
<td>9.</td>
<td>Aja</td>
<td>93.89</td>
</tr>
<tr>
<td>10.</td>
<td>Sangotedo</td>
<td>79.04</td>
</tr>
<tr>
<td>11.</td>
<td>Addo</td>
<td>73.00</td>
</tr>
<tr>
<td>12.</td>
<td>Lafiaji</td>
<td>21.00</td>
</tr>
<tr>
<td>13.</td>
<td>Ikate</td>
<td>33.00</td>
</tr>
<tr>
<td>14.</td>
<td>OkunLafiaji</td>
<td>16.00</td>
</tr>
<tr>
<td>15.</td>
<td>Oke-Ira</td>
<td>10.00</td>
</tr>
<tr>
<td>16.</td>
<td>Langbasa</td>
<td>70.00</td>
</tr>
<tr>
<td>17.</td>
<td>Badore</td>
<td>78.00</td>
</tr>
<tr>
<td>18.</td>
<td>Ogombo</td>
<td>55.00</td>
</tr>
<tr>
<td>19.</td>
<td>Mapo-Akinlade</td>
<td>40.00</td>
</tr>
<tr>
<td>20.</td>
<td>Olugborogun</td>
<td>55.00</td>
</tr>
<tr>
<td>21.</td>
<td>OrilelBamo</td>
<td>15.00</td>
</tr>
<tr>
<td>22.</td>
<td>Olokonla</td>
<td>15.00</td>
</tr>
<tr>
<td>23.</td>
<td>OkunAja</td>
<td>50.00</td>
</tr>
<tr>
<td>24.</td>
<td>Maiyegun</td>
<td>15.16</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>914.83</td>
</tr>
</tbody>
</table>
Housing development involves with two major participants in the field. These participants are the private and the public (State) sectors. The State intervenes in housing delivery with a view to achieving a significant increase in supply and brings relief especially to the low-income groups who are the most affected by the current shortage (FRN, 1975), while the public intervention in housing with a view of achieving quality housing though profit oriented and expensive, it is justified because housing is a necessity that must be provided.

Eti-Osa LGA falls within the Lagos wetlands ecosystem of Nigeria which is inundated by a network of Lagoons stranded behind sandbars, creeks separating Islands and water depressions acting especially along the Lekki Peninsula as wetlands. As revealed in Table 2 below, the LGA has the highest percentage of water area when compared with the remaining 19 LGAs in Lagos State. Out of the total land mass of 299.1 sq km (29,910 hectares), 154.1 square km (15,410 hectares) is firm land (51.52%), while 145 square kilometres(14,500 ha)is made of wetland (48.48%). The wetland environment of Eti-Osa LGA has been has been used for various development and this has resulted to wetland loss.

Table 2: Area of Land/Water of Twenty Local Government Areas in Lagos State

<table>
<thead>
<tr>
<th>S/N</th>
<th>Local Govt.Area</th>
<th>Land Mass (Km²)</th>
<th>Water Area(Km²)</th>
<th>Total (Km²)</th>
<th>% Water Area (Km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agege</td>
<td>17</td>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Ajeromi-Ifelodun</td>
<td>13</td>
<td>0.9</td>
<td>13.9</td>
<td>6.47</td>
</tr>
<tr>
<td>3</td>
<td>Alimosho</td>
<td>137.8</td>
<td>0</td>
<td>137.8</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Amuwo-Odofin</td>
<td>153</td>
<td>26.1</td>
<td>179.1</td>
<td>14.57</td>
</tr>
<tr>
<td>5</td>
<td>Apapa</td>
<td>25.5</td>
<td>13</td>
<td>38.5</td>
<td>33.77</td>
</tr>
<tr>
<td>6</td>
<td>Badagry</td>
<td>363</td>
<td>80</td>
<td>443</td>
<td>18.06</td>
</tr>
<tr>
<td>7</td>
<td>Epe</td>
<td>641</td>
<td>324</td>
<td>965</td>
<td>33.58</td>
</tr>
<tr>
<td>8</td>
<td>Eti-Osa</td>
<td>154.1 (15,410 ha)</td>
<td>145 (14,500 ha)</td>
<td>299.1 (29,910 ha)</td>
<td>48.48</td>
</tr>
<tr>
<td>9</td>
<td>Ibeju-Lekki</td>
<td>645</td>
<td>10</td>
<td>653</td>
<td>1.53</td>
</tr>
<tr>
<td>10</td>
<td>Ifako-Ijaiye</td>
<td>43</td>
<td>0</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>Ikeja</td>
<td>49.92</td>
<td>0</td>
<td>49.92</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>Ikorodu</td>
<td>200</td>
<td>145</td>
<td>345</td>
<td>42.03</td>
</tr>
<tr>
<td>13</td>
<td>Kosofe</td>
<td>74.4</td>
<td>10</td>
<td>84.4</td>
<td>11.85</td>
</tr>
<tr>
<td>14</td>
<td>Lagos-Island</td>
<td>5.2</td>
<td>4.06</td>
<td>9.26</td>
<td>43.84</td>
</tr>
<tr>
<td>15</td>
<td>Lagos Mainland</td>
<td>19.62</td>
<td>0</td>
<td>19.62</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Mushin</td>
<td>14.05</td>
<td>0</td>
<td>14.05</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Ojo</td>
<td>163</td>
<td>19</td>
<td>182</td>
<td>10.44</td>
</tr>
<tr>
<td>18</td>
<td>Oshodi-Isolo</td>
<td>41.98</td>
<td>0</td>
<td>41.98</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>Shomolu</td>
<td>12.1</td>
<td>2.5</td>
<td>14.6</td>
<td>17.12</td>
</tr>
<tr>
<td>20</td>
<td>Surulere</td>
<td>27.05</td>
<td>0</td>
<td>27.05</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2797.72</td>
<td>779.56</td>
<td>3577.28</td>
<td>21.79</td>
</tr>
</tbody>
</table>

In the course of developing land for housing construction, organized private property developers have sand filled some of the existing wetlands in the study area. Table 3 below shows the amount of wetland that has been reclaimed in the area.
Table 3: Total Wetland Reclaimed for Residential Development in Eti-Osa Local Government Area

<table>
<thead>
<tr>
<th>S/N</th>
<th>Location</th>
<th>Residential Estate</th>
<th>Wetland Reclaimed (Ha)</th>
<th>Date Approval of Reclamation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lekki</td>
<td>Beach Resort</td>
<td>60.04</td>
<td>19/11/98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beavet Securities</td>
<td>5.60</td>
<td>13/01/03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elegushi Garden</td>
<td>75.05</td>
<td>19/11/98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chevron</td>
<td>27.90</td>
<td>13/06/03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pinnock Beach Estate</td>
<td>70.040</td>
<td>10/12/08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urshaday S.I.</td>
<td>20.00</td>
<td>10/03/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alpha Beach</td>
<td>1.90</td>
<td>06/09/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Birrel Estate (for Chevron)</td>
<td>200.143</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Palm Beach</td>
<td>3.072</td>
<td>29/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lekki View</td>
<td>26.03</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crest Mortgage</td>
<td>5.007</td>
<td>21/02/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Senic Ventures</td>
<td>9.718</td>
<td>31/03/07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Victory Park Estate</td>
<td>47.33</td>
<td>14/04/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dormant Investment limited Estate</td>
<td>6.397</td>
<td>12/08/98</td>
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<tr>
<td></td>
<td></td>
<td>Greenland Estate</td>
<td>86.00</td>
<td>14/01/02</td>
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<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>644.227</td>
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</tr>
<tr>
<td>2</td>
<td>Sangotedo</td>
<td>AjayiApata</td>
<td>250.056</td>
<td>20/06/02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FITC</td>
<td>6.40</td>
<td>11/05/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beautiful Gate</td>
<td>100.00</td>
<td>29/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fountain Spring Villa</td>
<td>40.00</td>
<td>03/05/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peninsula Garden</td>
<td>8.05</td>
<td>31/06/03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diamonds</td>
<td>16.08</td>
<td>12/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>420.586</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>248.3</td>
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</tr>
<tr>
<td>3</td>
<td>Ilasan</td>
<td>Mayfair Garden (H.F.P)</td>
<td>48.143</td>
<td>21/02/08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sapphire Garden Estate</td>
<td>200.157</td>
<td>14/10/08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>248.3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ilasan</td>
<td>Clarimont Beach</td>
<td>15.719</td>
<td>03/03/06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Romay Estate</td>
<td>15.428</td>
<td>19/11/98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>31.147</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Igbokusu</td>
<td>NICON Town</td>
<td>57.022</td>
<td>22/10/03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Palm Springs Residence Limited Estate</td>
<td>20.12</td>
<td>29/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>77.142</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Olokunla</td>
<td>Abass Organization</td>
<td>21.902</td>
<td>25/03/97</td>
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<tr>
<td></td>
<td></td>
<td>Emerald Co-operative</td>
<td>19.318</td>
<td>1/08/02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>41.22</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lafiaji</td>
<td>Ocean Bay</td>
<td>33.40</td>
<td>21/02/08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light House Co-operative Society</td>
<td>7.37</td>
<td>29/04/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OkunAfa Estate</td>
<td>43.143</td>
<td>29/04/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>83.913</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ajiran</td>
<td>Royale Residential</td>
<td>10.030</td>
<td>20/04/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UACN Estate</td>
<td>10.03</td>
<td>12/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>20.06</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ikate</td>
<td>Treasure Garden Residential Scheme</td>
<td>5.110</td>
<td>12/07/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Belavista Estate</td>
<td>69.899</td>
<td>10/03/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>75.090</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Abijo</td>
<td>NAL Estate</td>
<td>82.752</td>
<td>14/09/09</td>
</tr>
<tr>
<td>11</td>
<td>Aja</td>
<td>Royal Garden Estate</td>
<td>145.274</td>
<td>20/05/09</td>
</tr>
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<td></td>
<td></td>
<td>Victoria Garden City</td>
<td>350.25</td>
<td>14/09/22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>495.524</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Ikota</td>
<td>EleganzIndustries Ltd Residential Estate</td>
<td>12.738</td>
<td>24/05/05</td>
</tr>
<tr>
<td>13</td>
<td>Oke-Ira Nla</td>
<td>Good Homes</td>
<td>9.094</td>
<td>31/03/03</td>
</tr>
<tr>
<td>14</td>
<td>Igbo-Olofini</td>
<td>Agita</td>
<td>10.220</td>
<td>24/12/08</td>
</tr>
<tr>
<td>15</td>
<td>Awe/Ise</td>
<td>Eden Garden</td>
<td>23.00</td>
<td>03/03/06</td>
</tr>
<tr>
<td>16</td>
<td>Okeetiri-Addo</td>
<td>XTADOK Estate</td>
<td>10.34</td>
<td>08/04/08</td>
</tr>
<tr>
<td>17</td>
<td>Igbo-Efon</td>
<td>Oluwanisola</td>
<td>15.44</td>
<td>09/10/08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SubTotal</td>
<td>163.584</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grand Total</td>
<td>2421.856</td>
<td></td>
</tr>
</tbody>
</table>

DATA ANALYSIS AND PRESENTATION

This section presents the analysed data obtained from household questionnaire as well as questionnaire for land allocation agencies, private property developers and planning authorities. It discusses the views of these major stakeholders on how residential
Housing development influence wetland loss. This is in addition to baseline information, which covers socio-economic as well as housing characteristics of the respondents/responding officers surveyed.

**Socio-Economic Characteristics of Respondents**

A total of 322 households were interviewed with the heads of households responding to the household questionnaires. From Table 4, it is observed that majority of the respondents (80.4%) are male. Female constitute only 19.6%. This is a typical reflection of any Yoruba setting where male usually constitute the majority of household heads (Fadayomi, 1988; Akinola, 1997).

<table>
<thead>
<tr>
<th>Sex</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>259</td>
<td>80.4</td>
</tr>
<tr>
<td>Female</td>
<td>63</td>
<td>19.6</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5 depicts household size. Majority of the households (62.4%) selected for interview consist of 2-5 members. This high frequency of low household size might be due to the fact that most of the selected housing estates consist of low and medium density residential plots. Another factor that may be attributed to this is the nucleated family structure that is being practiced by significant proportion of the residents. Following the group with household size of between 2 and 5 is another group consisting of 6-9 members. The latter group constitute 36.7% households. While 0.6 per cent households consist of not less than 10 members, only 0.3% has 1 household member.

<table>
<thead>
<tr>
<th>Household Size</th>
<th>No of Households</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>2 – 5</td>
<td>201</td>
<td>62.4</td>
</tr>
<tr>
<td>6 – 9</td>
<td>118</td>
<td>36.7</td>
</tr>
<tr>
<td>10+</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The main occupations of the respondents are shown in Table 6. From the table, it could be observed that 35.4% respondents are company workers, traders constitute 13.0%, and those that are involved in various craft activities or that are self-employed constitute another 35.4%. While 15.5% respondents claimed to be civil servants, the percentage that is not in workforce, that is, the retirees and unemployed account for 1.9% 1.2 per cent respectively.

<table>
<thead>
<tr>
<th>Household Size</th>
<th>No of Households</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>2 – 5</td>
<td>201</td>
<td>62.4</td>
</tr>
<tr>
<td>6 – 9</td>
<td>118</td>
<td>36.7</td>
</tr>
<tr>
<td>10+</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The annual income distribution of the respondents is contained in Table 7. A glance at the table shows that about 19.9% of the total respondents selected earned N100, 000.00 or less per annum. Relative higher incomes were recorded with 20.5% earning between N100, 001 and N200, 000 and 41.9% earning between N200, 001 and N300, 000. Another 15.5% earned between 300,001 and 400,000 but, only 0.6% earned between 400,001 and 500,000. Only 0.3% claimed to be earning over N500, 000 per month. The remaining 1.2% belongs to the unemployed group and thus, is not
presently earning anything. If converted to the US dollar at the present parallel exchange rate of about N150 to US $1.0, then it implies that not less than 82.3 per cent are earning US $2000 or less per month or less than US $68 per day.

Table 6: Occupation

<table>
<thead>
<tr>
<th>Occupation</th>
<th>No. of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craftsmanship/self employed</td>
<td>108</td>
<td>35.4</td>
</tr>
<tr>
<td>Public service</td>
<td>50</td>
<td>15.5</td>
</tr>
<tr>
<td>Trading</td>
<td>42</td>
<td>13.0</td>
</tr>
<tr>
<td>Company workers</td>
<td>114</td>
<td>35.4</td>
</tr>
<tr>
<td>Unemployed</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Retiree</td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 7: Monthly Income

<table>
<thead>
<tr>
<th>Income (₦)</th>
<th>No. of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 100,000</td>
<td>64</td>
<td>19.9</td>
</tr>
<tr>
<td>100,001-200,000</td>
<td>66</td>
<td>20.5</td>
</tr>
<tr>
<td>200,001-300,000</td>
<td>135</td>
<td>41.9</td>
</tr>
<tr>
<td>300,001-400,000</td>
<td>50</td>
<td>15.5</td>
</tr>
<tr>
<td>400,001-500,000</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>Above 500,000</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>No income</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Respondents’ Access to Land

Access to land means the ability to procure and possess land/plot for housing development. Out of the 322 land owners that were interviewed, 168 (52.1%) stated that they have been able to obtain land for housing construction through private purchase from private property developers. 10.9% house owners obtained their plots for residential development through traditional land owners and speculators. 0.9% respondents obtained residential land from the State government through statutory (normal) allocation process. Other methods are through land speculators (2.7%) and inheritance (31.9%). See Table 8

Table 8: Access to Land for Housing

<table>
<thead>
<tr>
<th>Access</th>
<th>No. of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private purchase</td>
<td>34</td>
<td>10.9</td>
</tr>
<tr>
<td>Inheritance</td>
<td>103</td>
<td>31.9</td>
</tr>
<tr>
<td>Private Property Developer</td>
<td>168</td>
<td>52.1</td>
</tr>
<tr>
<td>Statutory allocated</td>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>Land speculators</td>
<td>9</td>
<td>2.7</td>
</tr>
<tr>
<td>None</td>
<td>5</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The numbers of months taken to acquire residential land by respondents are contained in Table 9; 89 respondents (27.6%) claimed to have acquired their residential plots between one to three months. 6.5% respondents acquired their residential plots between 4-6 months, 7 to 9 months (22.6%), 10-12 months (11.4%), and more than 12 months are (31.97%).

Table 9: Time Taken to Acquire Residential Land (in months)

<table>
<thead>
<tr>
<th>Time Taken (months)</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 3</td>
<td>89</td>
<td>27.6</td>
</tr>
<tr>
<td>4 – 6</td>
<td>21</td>
<td>6.5</td>
</tr>
<tr>
<td>7 – 9</td>
<td>73</td>
<td>22.6</td>
</tr>
<tr>
<td>10 – 12</td>
<td>36</td>
<td>11.4</td>
</tr>
<tr>
<td>Above 12</td>
<td>103</td>
<td>31.9</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

After acquired residential plots, some owner occupiers have applied for and obtained statutory right of occupancy also known as Certificate of Occupancy from the government. Legal title documents possessed by the respondents as shown in Table 10 include C of O for state land, private C of O and ratification with C of O (41.0%); Governor’s Consent (9.9%) and Deed of Conveyance (2.2%). 20.8% respondents possess papers/receipts from the people that sold the plots. Only 32 respondents, that is, 9.9% respondents do not possess any legal title document.

Table 10: Legal Title Documents Processed

<table>
<thead>
<tr>
<th>Legal Title</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>C of O</td>
<td>132</td>
<td>41.0</td>
</tr>
<tr>
<td>Family receipt</td>
<td>52</td>
<td>16.2</td>
</tr>
<tr>
<td>Governor’s Consent</td>
<td>32</td>
<td>9.9</td>
</tr>
<tr>
<td>Deed of Conveyance</td>
<td>7</td>
<td>2.2</td>
</tr>
<tr>
<td>Paper/receipt from the persons who sold the plot</td>
<td>67</td>
<td>20.8</td>
</tr>
<tr>
<td>None</td>
<td>32</td>
<td>9.9</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

RESPONDENTS’ VIEWS ABOUT THE RELATIONSHIP BETWEEN RESIDENTIAL DEVELOPMENT AND WETLAND LOSS

Table 11 shows that more than 50% of the entire home owners in the studied estates sand filled their residential plots before the commencement of building construction. Only 44.4% home owners claimed that they did not sand filled their residential plots before the commencement of housing construction. What this implies is that more than 50% of the entire land areas in Eti-Osa LGA need to be sand filled before residential development. This high percentage might be because of the nature of land (wetland) that characterized the study area. In addition, majority of those respondents that did not fill their residential sites (44.4%) revealed that their sites have been sand filled before they purchased them.
Table 11: Filling of Residential Site before Building Construction

<table>
<thead>
<tr>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand filled</td>
<td>179 55.6</td>
</tr>
<tr>
<td>No Sand filling</td>
<td>143 44.4</td>
</tr>
<tr>
<td>Total</td>
<td>322 100.0</td>
</tr>
</tbody>
</table>

Sites that have been filled residential development were formally swamps (47.2%), marshland (5.6%) and extension of Lagos lagoon (2.8%). Only 44.4 per owner occupier built his house in already built-up area (See Table 12). Materials used for filling residential sites as indicated in Table 13 are Hard core (46.6%), Sand (6.5%), clay (2.5%) and built up firm land site (44.4%). However, some property developers used combination of two or three infilling materials. It is the instability of soil that prompted developers of housing estates to use hard core in filling their sites.

Table 12: Status of Residential Site before Sand filling

<table>
<thead>
<tr>
<th>Status</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swamp</td>
<td>152</td>
<td>47.2</td>
</tr>
<tr>
<td>Marshy</td>
<td>18</td>
<td>5.6</td>
</tr>
<tr>
<td>Part of Lagoon</td>
<td>9</td>
<td>2.8</td>
</tr>
<tr>
<td>Built up area</td>
<td>143</td>
<td>44.4</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 13: Materials used in filling Residential Site

<table>
<thead>
<tr>
<th>Rationale</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard core</td>
<td>150</td>
<td>46.6</td>
</tr>
<tr>
<td>Sand</td>
<td>21</td>
<td>6.5</td>
</tr>
<tr>
<td>Clay</td>
<td>8</td>
<td>2.5</td>
</tr>
<tr>
<td>Built up</td>
<td>143</td>
<td>44.4</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 14: Rationale for Filling Residential Site

<table>
<thead>
<tr>
<th>Rationale</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevent building collapse</td>
<td>66</td>
<td>20.6</td>
</tr>
<tr>
<td>Prevent incessant flooding</td>
<td>70</td>
<td>21.7</td>
</tr>
<tr>
<td>Prevent submerging of house</td>
<td>61</td>
<td>18.9</td>
</tr>
<tr>
<td>None</td>
<td>125</td>
<td>38.8</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 14 shows that 20.6% per cent home owners filled their sites or got their sites filled to prevent building collapse. While another 21.7% filled their sites with a view to prevent incessant flooding, 18.9% believed that filling of sites in the study area is meant to prevent houses from sinking, while others 38.8% did nothing. Study also
Housing development revealed that in wetland environment, strip or raft foundation is the rule rather than exception. From Table 15, more than 50% of the entire houses surveyed are built on raft foundation. Other major type of foundations that was used in the area is the normal blinding foundation by 38.8% of the respondents while houses with pile foundation are 2.8%.

Table 15: Type of Building Foundation

<table>
<thead>
<tr>
<th>Type</th>
<th>No of Building</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raft foundation</td>
<td>180</td>
<td>55.9</td>
</tr>
<tr>
<td>Pile foundation</td>
<td>9</td>
<td>2.8</td>
</tr>
<tr>
<td>Normal foundation</td>
<td>125</td>
<td>38.8</td>
</tr>
<tr>
<td>No Response</td>
<td>8</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 16 depicts the reasons why at an alarming rate, the wetland ecosystem is lost to land speculators and developers basically on profit making ventures. Thirty-six (11.2%) respondents said wetland is lost due to rapid population growth. 10.9% of the entire respondents’ favoured rapid urbanization. Majority of the respondents (39.1%) argued that residential development is responsible for wetland loss in the study area. The remaining 38.8 per cent argued in favoured of all the earlier mentioned reasons. Poor monitoring of the wetland ecosystem by relevant authorities has aggravated the rate at which wetland and buffer zones are lost to residential development.

Table 16: Reason for Wetland Loss

<table>
<thead>
<tr>
<th>Reason</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid population growth</td>
<td>36</td>
<td>11.2</td>
</tr>
<tr>
<td>Rapid urbanization</td>
<td>35</td>
<td>10.9</td>
</tr>
<tr>
<td>Residential development</td>
<td>126</td>
<td>39.1</td>
</tr>
<tr>
<td>All of the above</td>
<td>125</td>
<td>38.8</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Effects of residential development on wetland environment are contained in Table 17. Two hundred and seventy-three respondents noted that flooding is a major consequence of residential development on wetland environment. Only 15.2 per cent respondents acknowledged the effect of residential development on erosion.

Table 17: Effect of Residential Development on Wetland Loss

<table>
<thead>
<tr>
<th>Effect</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>49</td>
<td>15.2</td>
</tr>
<tr>
<td>Flooding</td>
<td>273</td>
<td>84.8</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Goals of the housing development stake holders

The goals of the organizations interviewed are to develop site and service schemes, allocate serviced residential plots in affected sites and services schemes, approve building plans and develop and allocate residential land and houses in private and public residential estates. The main administrative machinery for the allocation of serviced residential plots on state’s sites and services schemes as stated by one of the responding officers is the Land Use and Allocation Committee (LUAC). The LUAC was established under the enabling Act of Section 2 of the Land Use Decree of 1978 to take charge of the management of land in the entire Lagos state, Eti-Osa LGA included. The LUAC performs the following functions:

Consider the best and maximum use of land before allocation is made;

Ensures that land is speedily made available at reasonable costs for successful implementation of all projects at all times;

Permit a mechanism which allows the correct values to be placed on land at all times and in all places; and

Allocate land in all the sites and services schemes that are developed by the Lagos State Government.

Study revealed that within Eti-Osa LGA, four sites and services schemes can be identified. These sites and services schemes are Lekki Peninsula Schemes I & II, Abijo GRA and Orisan Waterfront. The number of plots allocated to different uses in the affected sites and services schemes. The various uses to which these schemes have been put are residential, commercial/industrial, place of worship, petrol filling station and hospital/clinic. The total number of residential plots in Lekki Peninsula Scheme I is 4437, Lekki Peninsula Scheme II (2968), Abijo GRA (1830). A glance at Table 4.40 shows that at Lekki Peninsula Scheme I, 4298 (96.87%) plots are meant for residential development, Lekki Peninsula Scheme II (2920 or 98.38%) and Abijo GRA (1678 or 91.69%). What this implies is that not less than 90 per cent in the three sites and service schemes are meant for residential development.

Another responding officer revealed that the goal of Lagos State Planning and Physical Development Authority LASPPDA is to make Lagos State the reference point of harmonious physical development in Nigeria through best practices in physical planning and development. The power to approve or disapprove building plan is the responsibility of district and local planning offices which operate within the activities of LASPPDA. Table 18 show summaries of activities of Eti-Osa District and Local Planning Authority LPA offices in 2006. In the said year, a total of 1048 building plans were registered at the District and LPA offices, 567 (54.10%) were approved, and 134 (12.79%) disapproved while 165 (15.74%) building plan applications remain pending.

Government Officers’ Views on Residential Development and Wetland Loss

Table 19 depicts the rationales behind wetland loss in the study area as revealed by the responding officers. While residents stated that residential development is the major factor responsible for wetland loss, the opinions of the responding officers indicate that urbanization is the most important factor responsible for the alarming rate at
which wetland is lost. 75% of the entire responding officer’s surveyed said wetland is lost due to rapid urbanization/population growth, infrastructure development (12.5%) and infrastructure development, rapid urbanization/population growth (8.3%). About 96 (95.8%) responding officers interviewed acknowledge the effect of sand filling for residential development on flooding.

Table 18: Summary of Activities of Eti-Osa District and Local Planning Authority Office for 2011

<table>
<thead>
<tr>
<th>S/N</th>
<th>Office</th>
<th>Building Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Submitted</td>
</tr>
<tr>
<td>1.</td>
<td>District</td>
<td>433</td>
</tr>
<tr>
<td>2.</td>
<td>Local Planning</td>
<td>615</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1048</td>
</tr>
</tbody>
</table>

Source: Development Permit Department (DPD) of Lagos State Physical Planning & Development Authority, 2012.

Table 19: Reasons for Wetland Loss as Perceived by Responding Officers

<table>
<thead>
<tr>
<th>Reason</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Development</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>Rapid urbanization/population growth</td>
<td>18</td>
<td>75.0</td>
</tr>
<tr>
<td>All of the above</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Some of the responding officers stated that with a view to mitigating the effects of housing development on wetland environment, government has put different measures in place. As contained in Table 20; 5 (20.8%) responding officers stated that with a view to mitigating the impact of housing development on wetland environment, the government has embarked on the construction of drainage channel in various parts of the study area. While 16.7% respondents viewed landscaping as a means of mitigating the impact of wetland loss, the remaining 62.5% argued that government intend to mitigate the impact of housing development on wetland environment through the establishment of conservation zones. These measures are possible because of the “calibre” of people living in the selected housing estates. The influential people living in the area as have been able to attract government necessary intervention.

Table 20: Government Efforts at Mitigating the Effect of Residential Development on Wetland Loss

<table>
<thead>
<tr>
<th>Effort</th>
<th>No of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of Drainage Channel</td>
<td>5</td>
<td>20.8</td>
</tr>
<tr>
<td>Landscaping</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Conservation Zone</td>
<td>15</td>
<td>62.5</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100.0</td>
</tr>
</tbody>
</table>
IMPACT OF WETLAND LOSS ON THE ENVIRONMENT

Housing development in wetland areas of Eti-Osa LGA has led to serious consequences. Infilling of wetlands for residential development has triggered off the prices of buildable plots in Ikoyi (Parkview), Osborne, Banana Island and Dolphin, Victoria Island and Lekki/Aja axis running into millions of naira in hundreds. In these locations, private property developers have spent substantial amount of money on land reclamation. This economic impact is reflected in table 21.

Table 21: Five Top Prime Reclaimed Areas in Lagos

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ikoyi(Parkview) Osborne and</td>
<td>N50m-150m per acre</td>
<td>N400m and N450m per</td>
</tr>
<tr>
<td></td>
<td>Banana Island Dolphin</td>
<td></td>
<td>acre especially in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parkview, Osborne</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and Banana Island.</td>
</tr>
<tr>
<td>2</td>
<td>Victoria Island</td>
<td>N30m-N40m per acre</td>
<td>N100m and above per</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>acre</td>
</tr>
<tr>
<td>3</td>
<td>Lekki/Ajah axis</td>
<td>N12m-N17m for a</td>
<td>N35m-N40m for a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>standard plot</td>
<td>standard plot</td>
</tr>
<tr>
<td>4</td>
<td>Ikeja GRA</td>
<td>N100m per acre</td>
<td>N250m-N300m per</td>
</tr>
<tr>
<td>5</td>
<td>Magodo</td>
<td>N5m-N6m per</td>
<td>N12m-N15m standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>acre standard plot</td>
<td>plot</td>
</tr>
</tbody>
</table>

Source: Ministry of Lands, 2008

Wetland loss has not only reduced the ability of wetlands to provide good and services to human kind but it has also reduce the ability of wetlands to support biodiversity. The eco system of Nigeria is of vital importance in the sense that it harbours different types of flora and fauna. The two principal threats to biodiversity are the habitat destruction and hunting. Both factors are directly tied to physical and housing development. Through land reclamation several species of both fauna and flora and wetland has been reduced or lost into extinction.

The impact of wetland loss to residential development affects wetland resources and natural environment. When, reclaimed and converted into residential, commercial, industrial or any use; species, habitat and ecosystem are lost or fragmented, disrupting the natural systems network. For instance, if not disturbed, rainfall would naturally seep into the ground and replenishes the ground water table or drains into the water bodies naturally available. But when altered rainfall gets stuck on ground with nowhere to go causing flooding and is delayed to seep into the ground. Other impacts includes, Water supply for domestic use are impaired, due to altered ground level Water supply to an aquifer or to another wetland higher becomes difficult, Water flow regulation and flood control is impaired; Prevention of saline intrusion to both ground and surface water is reduced; Protection against natural forces such as coastal erosion and flooding is discouraged; Ability of the remaining wetlands to retain sediments and nutrients is reduced; ability of the remaining wetlands to remove toxins from effluent/polluted water is impaired; Availability of natural wetland products such as fish, snail and other aquatic species are facing gradual extinction.

The study area falls within the Lagos wetlands ecosystem of Nigeria which is inundated by a network of Lagoons stranded behind sandbars, creeks separating
Islands and water depressions acting especially along the Lekki Peninsula as wetlands. The findings of this study, however, showed that wetland loss is caused by a variety of factors. These include urbanization, industrial expansion, agriculture, dredging for navigation channel and boat traffic, personal greed, uncontrolled wetland exploitation, general neglect and a failure to recognize that these natural features are of great economic value to communities. Settlement growth/urbanization as well as residential development is also major contributory factors to wetland loss. In all, a total 2421.856 hectares of wetland was lost to private land reclamation to housing development, 914.83 hectares lost to village excision while 840.87 hectares of wetland lost to public (government) site and services project; in all a total of 4,185.56 hectares (28.86%) was lost to land reclamation as against the initial 14,500 hectares of wetland leaving a balance of 10,314.44 hectares (71.14%) of wetland in Eti Osa.

Thus increasing the rate of housing provision and delivery in Eti Osa Local Government Area of Lagos State at the detriment and loss of aquatic life and wetland ecosystem at an alarming rate that needs to be checked and attended to urgently. During the rainy season, most of the reclaimed areas are prone to flooding and erosion. In addition, the occasional ocean surge culminates in flooding. The major environmental problems besetting the study area, especially during the wet season are traffic congestion, erosion and flooding. Also, wetland loss has not only reduced the ability of wetlands to provide aquatic food, good and services to human kind but it has also reduced the ability of wetlands to support biodiversity. Loss of wetlands to residential development, therefore, means denying the wetlands from contributing to sustainable development. What this implies is that while existing wetlands are used to meet need of the present generation, the needs of the future generation are in jeopardy.

The constant loss of wetlands to housing development has been exacerbated by inadequate protection measures, lack of integrated management structures and policies and conflict between competing user groups. While further loss is almost universally acknowledged as undesirable, wetland loss has continue with little public recognition of the causes or consequences. The loss of wetlands to residential development has, therefore, raised questions regarding the effectiveness of current effort at promoting sustainable development. The unique topographical pattern of the study area explains the reference to it as a wetland environment. Notable wetlands in the area are the Lagos and Lekki Lagoons, mesh of creeks, Kuramo Waters as well as several swamps and marches. Of its entire geographical area, creeks, lagoons, rivers and swamps take up 94.2%.

The major causes of wetland loss, as reported by the residents are rapid population growth, urbanization as well as residential development. According to them, more than 90% per cent of the entire residential plots in the studied residential estates were sand filled for residential development were formally swamps, marshland and part of Lagos lagoon. Materials used for filling residential sites are sand, rubbles, clay and hard core.

Residents argued that infilling of wetland environment before the commencement of residential estates is meant to prevent building collapse, incessant flooding and houses from submerging. Findings revealed that in wetland environment, raft or pile foundation type the rule rather than exception. Strip foundation is not used at all. Effects of residential development on wetland environment are flooding and erosion. With a view to mitigating the effects of residential development on wetland environment, government has embarked on the construction of drainage channel and it has established conservation zones in Lekki-Epe axis. Inadequate measures for
preventing further wetland lost to residential development as well as poor monitoring of the wetland ecosystem by relevant authorities has aggravated the rate at which wetland and buffer zones are lost to residential development.

However, in sustaining the remaining wetland from further loss, Opportunity for effective water transport development should be encouraged; The significance of wetlands for conservation of species, landscape and habitats should publicised; Recreation and tourism opportunities should be developed; social-cultural significance of wetlands should be established; the contributions of wetlands to the maintenance of existing processes and natural systems at global, regional and local levels (e.g. micro-climates, carbon cycling etc.) should be made public through public awareness; and Opportunity for research and education should be encouraged. Plates 1 and 2 below shows the different land coverage of Eti Osa wetland zone before (plate 1) encroachment in 1980 and Current extent of housing development (plate 2) and land coverage after wetland encroachment and loss.

PLATE 1: Extent of physical development in Eti Osa Local Government Area in 1980 source: Google earth 2009


CONCLUSION

Wetland loss to physical development can no longer be treated lightly especially in view of many advantages which can be tapped without destroying or degrading wetlands. For sustainable development of human settlements, there must be an
improvement on environmental management practices relating to wetland preservation and conservation. The three tiers of government as well as other stakeholders such as private property developers and civil societies need to make sustainable utilization of wetlands for residential development their watchword. Against this backdrop, the following recommendations are proposed for implementation.

Government policies on physical development and sustainable management of wetlands need to be re-oriented. These policies should ensure that towns and cities will continue to grow and it will continue to take place. Thus, sustainable management of residential development and urban growth need to be given adequate consideration by the policies. The Ministry of Physical Planning and Urban Development can help in reducing the negative impact of physical development on wetland environment by given adequate consideration to effective residential development control in such an environment. The extent to which the Ministry can achieve this goal will be a function of the quality of wetland management or conservation strategies adopted. Endangered wetland resources need to be preserved by the various authorities saddled with the responsibility of environmental management.

In the area of wetland preservation, there should be cordial relationship between the government, civil society organizations and citizens. Joint management of wetlands will prevent further degradation and loss of wetlands. Physical development within wetland zone must be effectively monitored by these stakeholders. This will ensure that there is no further encroachment on the remaining wetlands. It is obvious that wetland areas in Eti-Osa local government area of Lagos State is fast giving way to more complex uses especially housing development on a daily basis at alarming rates. Citizen participation is a prerequisite for any meaningful planning. For sustainable wetland management, public awareness through the media houses should be encouraged. People should be enlightened on the adverse effects of wetland loss. Intensive media campaign should be mounted on settlements along the Lekki-Epe Expressway where the impact of residential development on wetland loss is most intense.

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Wilbur Smith and Associate (n.d).*Master Plan of Metropolitan Lagos*.

This paper examines land policies on acquisition and compensation practice in Nigeria with the aim of minimizing conflicts in land acquisition and compensation. It further explains the implications of uncoordinated land allocations arising from informal transactions. The paper used self administered questionnaires on all the (15) fifteen registered estate firms in the 2009 NIESV Directory in Benin City, Edo state to obtain information that helped to determine the fairness of compensation practice and causes of conflict in some communities in the state. The paper revealed that the compensation on acquired landed properties in Nigeria violated the principles of good governance as against what is obtainable in advanced countries. It also observed that inadequacy of compensation paid and delay in payment are the causes of conflict between the acquiring authorities and the affected community / people. The paper concluded that a review of land policies on acquisition and compensation will be a panacea for achieving the principles of good governance.

Keywords: Good Governance, Acquisition, Compensation

INTRODUCTION

Public land accounts for a large portion of public wealth of both the advanced and developing countries, hence, there is a need for good governance. Good governance is a means of establishing a sound policy regarding how government should intervene in land matters (Zimmermann, 2007). It deals with the decisions that are made about access to land and its use, the manner in which the decisions are implemented and the way competing interests are managed (Kironde, 2009).

Land registration is one of the ways/policies in which government intervene in land matters. According to Huber et al (2009) and a study conducted by de Soto (2008) government intervention in terms of property registration can not be taken for granted because absence of such intervention result in under utilization of over twenty nine billion dollars in Tanzania. Thus, it is logical to assume that without strong property institutions many countries may not achieve economic success.

Right to land has become an important factor in many nations which implies that assured property right is a fundamental cornerstone for achieving national, social and economic stability. In Nigeria, the existing order of land governance is not in tune with the existing customary laws and traditional attachment because it has proved unable to cope with the demands of rapid urban growth which impacts negatively on urban spatial structure (Owei et al, 2008).
There are several land use policies in Nigeria, such as; Land Use Decree 1978, Oil Pipeline Cap 338 LFN and Petroleum Act etc. The Land Use Decree of 1978 which suppose to be the arrow head of land reforms for good governance in Nigeria according to Butler (2009) has only generated three distinct land market; the primary market for direct state allocation, the secondary market for statutory land rights documented by official certificate of occupancy, and the third is the market for pre-1978 land rights which has not been converted to statutory rights and which no formal statutory certificate of occupancy exists. These scenarios further deepen the negative impact of the existing land governance in the country’s urban centres. This led to congressional hearing on the activities such as land allocation and demolition decisions by a formal management of Federal Capital Territory (FCT), Abuja (Owei, 2008).

This mismatch between the existing order of governance and customary laws and customs are major sources of social strife and conflict in Nigeria.

STUDY AREA

The State has a land mass of 19,794 km square. Lying on 05 44 N and 07 34 N latitudes, 05 4 E and 06 45 E longitudes. Edo State is low lying except towards the north axis where the Northern and Esan plateaus range from 183 metres of the Kukuruku Hills and 672 metres of the Somorika Hills.

It is so located that it forms the nucleus of the Niger Delta region. It is bordered by Kogi state to the North and Delta State to the East and South, Ekiti and Ondo States to the West. The climate is typically tropical with two major seasons- the wet (Rainy) and the dry (Harmattan) seasons. The wet season lasts from April to November and the Dry Season December to March (Edo State Government, 2013).

LITERATURE REVIEW

Land Acquisition and Compensation Practices/Problems

Land acquisition by government is global and government’s police power is normally exercised in the process. According to the People’s Republic of China (PRC) Thematic Report No. 2 (2008) it was revealed that low compensation level is the main reason causing social conflicts in land acquisition in the PRC, and it is the main challenge in the country’s land reform. Also, the study showed that the living standards of affected farmers have in fact been degraded after land acquisition. The, basic principle guiding the reform efforts (as stated in the report) must be to ensure that the living standards of those affected do not decline and their long-run livelihoods are safeguarded (Thematic Report No. 2, 2008).

For instance, in Papua New Guinea land owners resulted to damaging infrastructure being built on their land or threaten violence due to exploitation traceable to poor record system (Manning and Hughes, 2011).

It was also revealed that Tanzania is suffering from problems of poor land governance as regards her; procedure of registering land and improving land information systems, urban land management, the management of public land, expropriation and dispute resolution (Kironde, 2009).

Though the issue of adequate compensation has been addressed in Kenya, they are bedevilled with the problem of decision making process which leads to process and detail that still beg for attention (Nabutola, 2009).
Land governance

In the developed countries of France and United States of America, just compensation for expropriation according to Darling and Wu, (2006) has traditionally been based on fair market value based majorly on comparable sales approach that uses sales data on recent market transactions of similar properties within the vicinity taking into consideration the condition of the property. Thus, in most cases, they were able to put affected persons to the initial position before the acquisition.

In Nigeria, government has always acquired land for a series of public purposes such as; roads, housing estates, industrial use etc with appropriate laws to back up such actions. Such laws include Land Use Decree (1978), State Land (Compensation) Decree (No.38), 1968, Public Land Acquisition (Miscellaneous Provision) Decree No. 33 of 1976 etc. Each of the laws among other provisions makes provisions for assessment of compensation payable to the victims of such actions (Adebayo, 2004).

Although, government pays compensation to original landowners for crops, economic trees and buildings, compensation has been inadequate and more often characterized by considerable delay with inflationary losses owing to devaluation (Akaninyene et al, 2010). This is in consonance with Adeleke (2011) that revealed further that despite the laudable objective of government on the acquired land, it failed due to factors arising from poor finance, underpayment and so on.

For instance, Nuhu (2006) cited in Nuhu (2011), revealed that compensation assessed with respect to the acquisition of site for University of Abuja in 1990 was yet to be paid as at the period of the research in 2006. Again, according to Nuhu (2007) cited in Nuhu (2011), the implementation of the Land Use Decree governing public land acquisition and payment of compensation in Nigeria has generated controversies, lapses and disputes because, claimants whose interest had been revoked are always at the losing end and usually left in a position far worse than they were before the revocation.

Good Governance Principles

A major indicator of good land governance is the ease of access to the records and transparency of the processes and procedures involved together with the time cost of acquiring the land (Ukaejiofo, 2009). Effective and fair compulsory acquisition cannot exist without good governance and adherence to the rule of law FAO (2008). But the power of compulsory acquisition can be abused. Unfair procedures for the compulsory acquisition of land and inequitable compensation for its loss which surely negates the ethics of good urban governance according to Nuhu (2008) and can reduce land tenure security, increase tensions between the government and citizens, and reduce public confidence in the rule of law. For instance it is the lack of confidence according to Owei (2008) that made the local land owners in Port-Harcourt to prefer selling to individual than to the government. Good governance is therefore necessary to provide a balance between the need of the government to acquire land rapidly, and the need to protect the rights of people whose land is to be acquired (FAO, 2008). Conflict is reduced when there are clear policies that define the specific purposes for which the government may acquire land, and when there are transparent, fair procedures for acquiring land and for providing equitable compensation (FAO, 2008, Nuhu, 2008, and Ukaejiofo, 2009).

Failures in governance according to Nuhu (2011) among others could be due to the following six identified causes;
Laws which may be poorly designed or implemented, inconsistent or outdated
Inappropriate policies and procedures
Complex institutional structures, where mandates are unclear, overlapping or duplicated
Incorrect or inadequate information, especially spatial data, to support decision making
Inadequate civil service resources
Lack of capacity in the civil services

Good governance has eight major characteristics which are; participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law.

![Diagram of Good Governance]

Figure 1. Source: Nabutola (2009).

Characteristics of good governance according to UNDP (1997) are as discussed below;

Participation
All men and women should have a voice in decision-making, either directly or through legitimate intermediate institutions that represent their interests. Such broad participation is built on freedom of association and speech, as well as capacities to participate constructively.

Rule of law
Legal frameworks should be fair and enforced impartially, particularly the laws on human rights.

Transparency
Transparency is built on the free flow of information. Processes, institutions and information are directly accessible to those concerned with them, and enough information is provided to understand and monitor them.

Responsiveness
Institutions and processes try to serve all stakeholders.
Consensus orientated
Good governance mediates differing interests to reach a broad consensus on the best decision on policies and procedures.

Equitable and inclusive
All men and women have opportunities to improve or maintain their well-being.

Effectiveness and efficiency
Processes and institutions produce results that meet needs while making the best use of resources.

Accountability
Decision-makers in government, the private sector and civil society organisations are accountable to the public, as well as to institutional stakeholders. This accountability differs depending on the organisations and whether the decision is internal or external to an organisation.

THEORETICAL AND CONCEPTUAL FRAMEWORK
The concept of governance entails the process of decision making and the process by which decision are implemented or not implemented and bad governance is believed to be one of the causes of crisis within our society (Nuhu, 2009). Moreover, FAO (2007) defined good governance as the way in which society is managed and how the competing priorities and interest of different groups are reconciled and it includes formal institutions of government and citizen’s participation in governance decision making process.

Section 29(1) of the Land Use Act provided that if a right of occupancy is revoked for the cause set out in paragraph (b) of subsection (2) of section 28 or (c) of subsection (3) of the same section, the holder and the occupier shall be entitled to compensation for the value at the date of revocation of their unexhausted improvements.

Thus, Land Use Act provides for the payment of compensation for right of occupancy revoked to both the holder and occupier for the value of their unexhausted improvement. However, the Act exempted the compensation for revocations made for the purposes of mineral exploitation and provides in Section 29(2) that the appropriate minerals Act provision shall apply. It is because of this provision that made the provision of Oil Pipeline Cap 338 LFN and Petroleum Act though not revised to date are still current.

Section 29(4) specified the basis for computation of compensation for rights of occupancy revoked under Section (28)(2)(b) and Section 28(3) (a) as set out below:

a. The land, for an amount equal to the rent, if any, paid by the occupier during the year in which the right of occupancy was revoked. Thus, Kalu (2001) opined that the law did not specify that it is the rent paid to government; which would have reinforced the earlier assumption that ground rent specified in the certificate of occupancy is what is intended here. This and many other ambiguities have resulted to the numerous criticisms levelled against the Act.

The Act provides that replacement cost of building, installation or improvement shall be the replacement cost. Kalu (1995) cited in Kalu (2001) opined that the law dictate the basis of valuation and the methodology as indicated under Section 29(4)(b) when computing compensation for building which is against the principles of valuation because is more of costing. A major criticism with specified methodology is the fact that locational attributes of the property is made inconsequential.
Crops on Land; apart from buildings, installation and improvements on land, compensation payable is to be an amount equal to the value of the crops as prescribed and determined by the appropriate officer as indicated in the act. But the determination of the value of crops is to be done through investment approach. The practice of using one set of predication rates for all agricultural belts of Nigeria adopted for either Federal acquisition or State acquisition has no valuation basis. Also the rates used by Oil Companies, the so called OPTS rates has no valuation basis although it is higher than the rates used for either State or Federal Government acquisition.

**RESEARCH METHODOLOGY**

The study used self administered questionnaires to elicit information from all the 15 practicing estate firms registered in 2009 directory of Nigerian Institution of Estate Surveyors and Valuers recently involved in compensation exercises in some communities in Edo state, Nigeria. The researcher ‘s choice of Edo state being an oil producing state was based on frequency of compensation exercises in oil producing states in Nigeria. The scope of the study was restricted to examining the adequacy of compensation paid on landed properties compulsorily acquired with a view to determining the impact of acquisition on the affected land owners.

**DATA ANALYSIS AND INTERPRETATION**

Different authors have written on similar issues in other states and there is no known work on this subject in the state. The perception of respondent estate firms on adequacy of compensation paid in Edo state was examined using frequency and percentage. In addition, the frequency of conflict between host communities and the acquiring authority and causes of the conflicts are also examined using frequency and percentage. Features of compensation in Edo state were first examined by looking at the frequency of compensation exercises and the level of participation of respondent firms in the last three years. The data reveals that all the respondent firms were actively involved in compensation in Edo state. This confirms the reliability of our data that they are derived from active firms as shown in Table 1

*Perception on Adequacy of Compensation Payment.*

<table>
<thead>
<tr>
<th>Period of Past Experience (Years)</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>4-6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7-9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: field survey (2011)

In a recent survey conducted on adequacy of compensation after acquisition in Edo state, 67% as evidenced from Table 2 were not satisfied with the compensation, while only 33% were satisfied with compensation. This is an indication that the compensation is not fair to most of the affected people which violated the principle of effectiveness, efficiency and equitability criteria of good governance.
Table 2. Adequacy of Compensation

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: field survey (2011)

Table 3. Conflict Experience between Host Community and Acquiring Authority

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: field survey (2011)

Information from Table 3 on respondents’ estate firms experience on conflict between host community and acquiring authority revealed that 67% of the firms have experienced conflicts between host community and the acquiring authority. This position further reveals the level of satisfaction of the host communities with the acquiring authority’s compensation.

Table 4. Causes of Conflict

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate Payment</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>Delay in Payment</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: field survey (2011)

Evidence in Table 4 established that inadequacy of payment and delay in payment which accounted for 53% were the causes of conflict while others such as; omission of some claims, demolition before payment and failure to give relocation time are 47%. This implied that there would be increase in acceptability of compensation if adequacy of payment and delay are given the needed boost.

**RECOMMENDATIONS**

The provision in the Act should make compensation valuation rely on comparable sales as a starting point in determining fair market value (FMV) but may apply other techniques, including replacement costs to ensure adequacy of compensation. Therefore it is necessary to introduce other methods, most especially those using market information in the compensation valuation in Nigeria.

The conflict situations with indigenous groups who would rather sell off their land to private individuals could be significantly minimised if the compensation put the affected person back to the initial position. Conflicts can also be controlled by ensuring that compensation is paid promptly without delay.

For the objective of acquisition purpose to be achieved and to ensure its smooth execution, there is need for a review of the valuation methodologies in the Land Use Act for compensation valuation to reflect a fair market value. This will however reduce the problem arising from low compensation and conflict with affected community or individual.
CONCLUSION

In conclusion, good governance in acquisition and compensation would encourage improvement in the quality of life of everybody including those affected by the development. Be that as it may, land reform policies on acquisition and compensation should be reviewed to enable enjoyment of its maximum benefits and also eradicate or reduce to insignificant level conflict situations with indigenous groups, and the problems faced by affected citizens of the country. In doing so, the government would enjoy people’s support and public projects would have wider acceptability.

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IMPROVING THE STRUCTURAL CHARACTERISTICS OF EARTH BLOCKS AS AN INPUT OF AFFORDABLE HOUSING FOR LOW-INCOME NORTHERN COMMUNITIES OF GHANA

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There is a high incidence of poverty in the three northern communities of Ghana and that many of the inhabitants cannot afford the high cost of cement-based building materials such as sandcrete blocks. Buildings are therefore predominantly constructed with earth occasionally stabilized with cow-dung. Such buildings suffer rapid deteriorations due to the prevalent adverse weather conditions and rampant events of flooding especially in low-lying areas. To forestall this perennial problem, the study investigated into the structural characteristics of earth blocks stabilized with cement and cow-dung. Three different types of earth blocks were prepared from cow-dung only; cow-dung and cement and cement only. For the cow-dung-only earth blocks, four samples were prepared with cow-dung additions of 5%, 10%, 15% and 20% by volume. Also, for the cow-dung and cement earth blocks, four samples were prepared with cow-dung additions of 3%, 8%, 13% and 18% with 2% cement added to each sample; whilst for the cement-only earth blocks, one sample was prepared by adding 2% cement to earth. The blocks were cured for 28 days and tested for compressive strength. The 28-days average compressive strength of cow-dung-only earth blocks were 0.36N/mm², 0.37N/mm², 0.53N/mm², and 0.43N/mm² respectively for 5%, 10%, 15% and 20% cow-dung additions. Similarly, for the cow-dung and 2% cement earth blocks, the results were 0.85N/mm², 0.95N/mm², 0.62N/mm², and 0.33N/mm² respectively for the 3%, 8%, 13% and 18% cow dung additions. Finally, for the 2% cement-only earth blocks, the compressive strength was 0.72N/mm². It was concluded that the compressive strength of earth blocks improves significantly when nominal amounts of cement are added to cow-dung; and hence should be adopted for affordable and sustainable housing delivery in the three northern regions of Ghana where cow-dung abounds.

Keywords: Earth blocks, Cow-dung, Cement, Affordable housing, Compressive strength

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INTRODUCTION

All African countries regardless of their social, economic and political conditions are confronted with an acute problem of housing, because they all face similar developmental challenges (Hammond, 1990). The spiralling growth of population, low Gross Domestic Product and the general lack of purchasing power are some of the factors that contribute to progressive deterioration of housing situation in developing economies, including Ghana.

As part of the efforts geared towards finding solution to the housing problem in low-income communities of developing economies, the use of un-stabilised earth (laterite) is likely to continue in rural areas where it is freely available (dug on site) and the cost of construction is primarily determined by the cost of labour, which is considered free in a self-build situation (Gooding and Thomas, 1995).

A larger proportion of the people of the three Northern regions of Ghana cannot afford the high cost of conventional building materials such as cement and other inputs of concrete due to the high incidence of poverty in the area. Buildings are therefore mostly constructed with earth blocks, sometimes partially stabilized with cow-dung, a material that abounds in the area as a result of extensive cattle rearing which is one of the dominant occupations of the inhabitants. However, structures erected with earth blocks moulded in this fashion suffer rapid deteriorations, and almost every year the inhabitants keep on labouring to maintain or put up new houses as a result of serious deteriorations in existing ones resulting from the effects of the weather. Also, in the events of flooding resulting from the heavy down pours, which are common characteristics of the area, many of these earth buildings, especially in low-lying areas, experience total collapse since the earth blocks used in the construction of the houses cannot withstand wet conditions.

This frustrates the inhabitants a lot and hence the need to come out with appropriate technologies that can fairly improve and expand the life span of earth buildings constructed, especially, in low-lying areas whilst maintaining affordability cannot be over-emphasized. This study sought to investigate the structural characteristics of earth blocks manufactured by combining cement and cow-dung, with the view of improving the strength and durability characteristics of buildings constructed with earth for the three northern communities of Ghana, viz. Northern, Upper West and Upper East regions. Specifically, the compressive strength as well as permeability of earth blocks manufactured by adding cement and cow-dung were determined and compared with blocks made from cow dung or cement only.

EARTH (LATERITIC) MATERIALS

Earth materials for walling construction are usually based on a material called laterite. It consists of natural gravels as well as sand, clay and silt (Gidigasu, 2005). It is usually found in hot and wet tropical areas where natural drainage is impeded (Lasisi and Osunade, 1984). Laterite is a product of tropical weathering with red, reddish brown and dark brown colour, with or without nodules or concretions and generally (but not exclusively) found below hardened ferruginous crusts or hard pan (Joshua and Lawal, 2011). Generally, the degree of laterization is estimated by the silica sesquioxides (S-S) ratio (SiO2/ (Fe2O3). S-S ratio less than 1.33 are indicative of laterites; those between 1.33 and 2.00 are lateritic soils and those greater than 2.00 are non-laterite types (Lasisi and Ogunjimi, 1984).
Laterite as a material has been used extensively for wall construction around the World, particularly in developing countries. It is the most readily available and affordable material for the construction of walls in rural housing construction (Appiah, 2009). According to Gidigasu (2005), 70% of the land surface of Ghana is covered by laterite. It is also estimated that approximately 30% of the world’s present population still lives in earth (laterite) structures (Confirman, et al. 1990). It is easy to work with, requires less skill and as such, encourages and facilitates unskilled individuals and group of people to participate in the housing construction process on self-help basis.

**PROPERTIES OF COW-DUNG**

Cow dung is the undigested residue of plant matter which has passed through the animal’s gut. The resultant faecal matter is rich in minerals. Colour ranges from greenish to blackish, often darkening soon after exposure to air. It is a material that is rich in nitrogen, potassium, phosphorous and calcium (Smith and Wheeler, 1979). A study carried out by Garg and Mudgal (2007) concluded that cow-dung has a relatively high carbon to nitrogen ratio. According to the study, chemical composition of cow-dung reveals that there is no difference in the organic matter (OM), nitrogen (N), and manganese (Mn). Contents of calcium (Ca), phosphorus (P), zinc (Zn) and copper (Cu) were higher by 10.8, 10.0, 84.1 and 21.7 per cent respectively in the dung.

According to Chandy (2010), the chemical composition of cow dung is as shown in Table1 below. The table indicates that, the highest composition of cow-dung is water. However, the most important chemical element found in cow-dung that possesses cementitious properties is lime with a composition of 0.36%. Thus, cowdung when added to earth improves the structural performance by increasing the compressive strength and durability of the wall by virtue of the addition of lime. Notwithstanding, according to Autonopedia (2009), lime stabilised mortars become susceptible to weathering when they are used for outside rendering on walls. This explains why cowdung stabilised earth block houses, especially in low-lying areas, usually fail during heavy downpours in the three northern regions of Ghana where the technology is commonly in use.

<table>
<thead>
<tr>
<th>Item</th>
<th>Ingredient</th>
<th>Percentage Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water</td>
<td>82.4</td>
</tr>
<tr>
<td>2</td>
<td>Organic matter</td>
<td>15.2</td>
</tr>
<tr>
<td>3</td>
<td>Mineral matter</td>
<td>3.6</td>
</tr>
<tr>
<td>4</td>
<td>Nitrogen</td>
<td>0.30</td>
</tr>
<tr>
<td>5</td>
<td>Phosphorus</td>
<td>0.18</td>
</tr>
<tr>
<td>6</td>
<td>Potash</td>
<td>0.18</td>
</tr>
<tr>
<td>7</td>
<td>Lime</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Source: Chandy (2010)

**COW DUNG AS A BUILDING CONSTRUCTION MATERIAL**

Cow dung has been used traditionally as a construction material by low-income communities in many developing countries. Basically, it is used for two purposes: as a binder in moulding of earth blocks and in other instances as a plaster on walls. As a plaster on walls, the people of the three northern communities of Ghana have used a mixture of cow-dung, mud (earth) and the juice from the boiled empty locust bean tree pods for a very longtime (Schreckenbach, and Abankwa, 1983). As a binder, it is added to earth to stabilize it for walling purposes in earth (adobe) block production.
Soil stabilization is a technique that uses other materials to improve the durability of soil by increasing its strength and resistance to water (Simango and Lyson, 2005). Conventionally, materials used to stabilize soils include cement and lime. Other materials, usually waste products that can be added to cement or lime for soil stabilization are called pozollans and they include Pulverized Fuel Ash (PFA), Ground Granulated Blast Furnace Slag (GBFS), Silica Fume, Rice Husk Ash, Natural Pozzolana, and Volcanic Pozzolans (TRL, 1993: Mehta, 1992, Adinkrah-Appiah, 2012). Cow dung when added to clay improves the plasticity of the clay and acts as reinforcing agent reducing concentrated cracks that can lead to breakage within freshly moulded bricks (Majzoub, 2001).

In a study by Simango and Lyson (2005), cow dung was used as a soil stabilizer in a soil stabilization investigation for the construction of adobe bricks. The investigation consisted of mixing cow dung with sandy clay soil in the cow dung/soil ratio 0:1, 1:6, 1:5, 1:4, 1:3, 1:2, and 1:1. The adobe bricks were evaluated for compressive strength, permeability, erosion and cracking. The results showed that the 1:4 ratio had the highest compressive strength and the highest resistance to erosion. The highest resistance to water penetration after a period of three hours was shown by the cow dung/soil ratio 1:5, and there was minimum cracking in all the treatments.

Also, comparing the performance of various farm waste materials in clay bricks, cow dung recorded the highest compressive strength of 16.7 – 17.7 N/mm$^2$ amongst groundnut shells, sawdust and garad seeds respectively (Majzoub, 2001). Thus, it can be concluded from the foregoing that cow dung when added to earth (laterite) stabilizes the earth material, which contains some amount of clay, to produce more efficient building blocks than earth-only blocks.

**MATERIALS AND METHODS**

Series of activities and different materials were used to carry out moulding of earth block samples for subsequent laboratory testing under the study. The various types of materials used as well as methods employed are outlined below.

**MATERIALS USED**

The under- listed materials were used in moulding the earth block samples:

Cement - ordinary Portland cement from Ghacem, Tema,

Earth (laterite) materials – samples were obtained from Zuarungu in the Upper East Region of Ghana,

Cow dung - samples obtained from a kraal in Zuarungu,

Water - drinking water sample was obtained from Sunyani Polytechnic BT Department laboratory stand pipe from the Ghana Water Company main distribution system.

**THE MOULDING PROCESS OF EARTH BLOCKS**

Three different block samples were moulded which were as follows:

Earth (laterite) and cow dung,

Earth, cement and cow dung,

Earth and cement.
Computation of Volume of Earth Block Constituent Materials
The volume of materials which constitute each type of earth block sample was computed for the purpose of batching as follows:

Materials required for a block sample:
Volume of one block = 450mm x 225mm x 150mm
= 0.450m x 0.225m x 0.150m = 0.015 m³

Allowing 30% for wastage and compaction, the volume required for one block = 0.015 x 1.3
= 0.0195 m³.

Therefore volume of 2 blocks = 2 x 0.0195
= 0.039 m³ = 0.039 m³ x 1000
= 39 litres

Batching of Materials
Tables 2, 3, and 4 below show the ratios and quantity of each component material, in litres, used for moulding two blocks for each type of the three categories of blocks. Also each table contains the amount of water used for each mix.

Mixing of Constituent Materials
The constituent materials were initially measured according to their required volumes and were placed on a clean concrete platform for mixing. Mixing of materials was carefully carried out to ensure uniform distribution of components for each mix. In the case of the earth and cow dung

Table 2: Volume of Constituent Materials for Cow-dung:Earth Block Sample

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Volume of Material (Cow-dung: Laterite) in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5:95</td>
</tr>
<tr>
<td>Cow-dung</td>
<td>2.0</td>
</tr>
<tr>
<td>Earth</td>
<td>38.0</td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: Volume of Constituent Materials for Cow-dung:Cement:Earth Block Sample

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Volume of Material (Cow-dung: Laterite) in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow-dung</td>
<td>2.0</td>
</tr>
<tr>
<td>Cement</td>
<td>0.8</td>
</tr>
<tr>
<td>Earth</td>
<td>38.0</td>
</tr>
<tr>
<td>Water</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 4: Volume of Constituent Materials for Cement:Earth Block Sample

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Volume of Material (Cement:Earth) in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2:98</td>
</tr>
<tr>
<td>Cement</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Figure 1: Mixing of Cow-dung with Laterite

sample, the cow dung was first added to the earth and carefully kneaded together by hand until there was a uniform mix (Figure 1). Water could not be added since the moisture content of the fresh cow-dung was enough to produce the required workability in the mix.

For the earth, cow-dung and cement sample, the earth and cow-dung were first kneaded with the hand, followed by the introduction of the cement, when the mix was carefully turned several times until there was a uniform mixture. This was to ensure that the cow dung, being moisture laden, was made to coat the earth particles adequately before cement was introduced for hydration to begin. Visual inspection was used to ascertain the amount of water to be sprinkled taking cognisance of the water content of the cow-dung. For the cement and earth sample, the constituents were dry-mixed with the use of a shovel until there was a uniform mix. Water was then sprinkled on the mixture and mixing continued until the sample became adequately damp for moulding.

**Moulding of Blocks**

The manual block moulding machine was positioned on a hard level surface and the inner face of the mould oiled. The mould was half-filled with the already mixed material and the corners compacted with a piece of metal. The mould box was filled completely and again the corners compacted with a piece of metal rod. Further compaction was done on the material by repeatedly banging the heavy metal lid on the sample until the lid fitted exactly in its lowest position. The lid was then opened wide and the handle pressed downwards to push the moulded block out of the mould (Figure 2). The block was then removed by holding the pallet under it and set in place for hardening and curing under a shed. To avoid rapid hardening or excessive loss of moisture from the blocks, the samples were cured by sprinkling water on them for the first 14 days and allowed to dry up till 28 days when they were assembled for compressive strength testing.
COMPRESSIVE STRENGTH TEST ON BLOCK SAMPLES

Compressive strength test was conducted on the sample blocks at 28 days. Testing apparatus used include the following:

- Electronic balance
- Automatic compressive strength testing machine

**Testing Procedure**

The blocks were first cut into two to produce blocks with dimensions 225mmX165mmX150mm. The blocks were then placed in the compressive strength testing machine, one after the other, as shown in Figure 3 and their dimensions entered into the machine’s transducer. Load was then applied by pressing a knob until they were crushed. The compressive strength of the sample blocks was displayed on the transducer of the machine which was read and recorded for each sample.

PERMEABILITY RATIO TEST

To test for the permeability, and to determine the suitability of the blocks for out-door use, the uncrushed half of each of the sample blocks were weighed and recorded as $W_1$, after which they were placed on a metallic pan and immersed in water for 24 hours (Figure 4). The blocks were later removed and re-weighed and recorded as $W_2$. The quantity of water
absorbed, which is a measure of the permeability of the block, was obtained by subtracting $W_1$ from $W_2$. This was then expressed as a ratio of the weight of the original block as the permeability ratio (PR) of the block as follows:

$$PR = \frac{(W_2 - W_1)}{W_2} \times 100\%$$

Figure 4: Blocks Placed in Water for Permeability Tests

RESULTS AND DISCUSSIONS

Compressive Strength Test Results

Compressive strength is the resistance of a unit to crushing forces and it is the major parameter for measuring the strength and robustness of load carrying walling units such as building blocks.

Compressive Strength of Cow-dung:Earth Blocks

The 28-days compressive strength test performed on the cow-dung:earth block samples yielded results as portrayed in Table 5 below. The average compressive strength of the blocks with cow-dung percentages of 5%, 10%, 15% and 20% to earth were 0.36N/mm$^2$, 0.35N/mm$^2$, 0.53N/mm$^2$, and 0.43N/mm$^2$ respectively. The results show that, at 5% and 10% cow-dung contents, the block recorded very low average compressive strengths of 0.36N/mm$^2$ and 0.37N/mm$^2$ respectively. The strength however increased to a maximum of 0.53N/mm$^2$ when the cow-dung percentage was increased to 15%. The average compressive strength began to fall again at cow-dung percentage of 20% which recorded an average value of 0.43N/mm$^2$.

Table 5: 28-Days Compressive Strength Test Results for Cowdung:Earth Blocks

<table>
<thead>
<tr>
<th>Mix ratio</th>
<th>5:95</th>
<th>10:90</th>
<th>15:85</th>
<th>20:80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of moulding</td>
<td>18/09/12</td>
<td>18/09/12</td>
<td>18/09/12</td>
<td>18/09/12</td>
</tr>
<tr>
<td>Date of test</td>
<td>16/10/12</td>
<td>16/10/12</td>
<td>16/10/12</td>
<td>16/10/12</td>
</tr>
<tr>
<td>Age of sample</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>225x150x230</td>
<td>225x150x230</td>
<td>225x150x230</td>
<td>225x150x230</td>
</tr>
<tr>
<td>Compressive strength (N/mm$^2$)</td>
<td>0.33</td>
<td>0.35</td>
<td>0.57</td>
<td>0.40</td>
</tr>
<tr>
<td>Average compressive Strength (N/mm$^2$)</td>
<td>0.38</td>
<td>0.39</td>
<td>0.48</td>
<td>0.47</td>
</tr>
</tbody>
</table>
This implies that, the compressive strength of earth blocks increases as cow dung is added but begins to fall after a certain optimum content of cow dung. The initial strength increase can be explained by the presence of lime in the cow dung which possesses binding properties (Chandy, 2010; TRL, 1993; BS 5628-1, 2005). However, as the cow dung percentage is increased beyond the optimum value, the strength begins to fall as a result of increased organic content of the mix.

**Compressive Strength of Cow-dung:Cement:Earth Blocks**

Again, the 28-days compressive strength test performed on the cow dung:cement:laterite block samples yielded results as recorded in Table 6. For each of the cow dung:cement:earth block samples, the cow dung proportion was reduced by 2% by volume and was replaced by similar volume of cement, whereas the earth proportions remained unchanged. The cow dung percentages of 3%, 8% 13% and 18%, with 2% cement by volume, recorded average compressive strength values of 0.85 N/mm$^2$, 0.95 N/mm$^2$, 0.62 N/mm$^2$, and 0.33 N/mm$^2$ respectively.

Here, the strength increased initially from 0.85 N/mm$^2$ to a maximum of 0.95 N/mm$^2$ at 3% and 8% cow dung proportions respectively. It, however, began to fall as the cow dung percentage was increased to 13% and 18% when the strength recorded values of 0.62 N/mm$^2$ and 0.33 N/mm$^2$ respectively. Thus, when 2% cement was made to replace similar proportions of the cow dung, the blocks developed a maximum average compressive strength of 0.95 N/mm$^2$ which occurred at 8% cow dung.

**Compressive Strength Test Results for Cement:Laterite Blocks**

The last sample of cement:laterite combination recorded a 28-day average compressive strength of 0.72 N/mm$^2$ at 2% cement input as shown in Table 7. This indicates that the average compressive strength of this sample is only 75% of the highest recorded strength value for the cow dung:cement:earth block samples.

<table>
<thead>
<tr>
<th>Mix ratio</th>
<th>2:98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of moulding</td>
<td>18/09/12</td>
</tr>
<tr>
<td>Date of test</td>
<td>16/10/12</td>
</tr>
<tr>
<td>Age of sample</td>
<td>28</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>225x150x230</td>
</tr>
<tr>
<td>Average Crushing Load (KN)</td>
<td>37.0</td>
</tr>
<tr>
<td>Compressive Strength (N/mm2)</td>
<td>0.85</td>
</tr>
<tr>
<td>Average Compressive Strength (N/mm2)</td>
<td>0.72</td>
</tr>
</tbody>
</table>

**Comparison of Compressive Strength Results of the Samples**

Comparing the compressive strength values obtained for the three different mixes of cow dung:earth, cow dung:cement:earth and cement:earth; it could be said that the
combination of cowdung:cement:earth offers the best assurance as far as affordable and sustainable housing construction is concerned (Figure 5). This is because, the highest compressive strength of this material combination, with a compressive strength value of 0.95N/mm², is about 80% higher than the highest compressive strength recorded for the cow-dung:Earth blocks with a value of 0.53N/mm² (p-value = 0.08). It is also 30% higher than the cement:earth blocks which recorded a strength value of 0.72N/mm² (p-value = 0.28), although the cement content in both samples was 2% by volume. This high strength could be attributed to the combination of lime from the cowdung and cement which according to BS 5628-1 (2005), produces higher strength mortar than any of the two materials used sparingly. Also at this cowdung content, water was not added to the mix but it was still workable by the plasticity of the cowdung. This may also account for the higher compressive strength recorded for this mix.

This indicates that, when a nominal amount of cement is added to cow-dung, a stronger earth block is formed. Thus, replacing a certain minimal content of cow-dung with cement will lead to substantial improvements in the compressive strength characteristics of earth blocks. This offers hope for affordable and sustainable housing construction for the people of the three northern regions of Ghana, since stronger earth blocks can be produced at minimal costs by adding cow-

![Figure 5: Comparison of Compressive Strength of the Strongest Samples among the three Categories of Blocks](image)

...dung and nominal amounts of cement to earth. The production of earth blocks in this way for the housing sector will increase the robustness of earth houses built in this area of the country, where cowdung abounds but the high cost of cement and incidence of poverty discourage builders from using cement blocks for housing construction, resulting failure of structures during heavy downpours that lead to flooding.

**PERMEABILITY OF BLOCKS**

Permeability of blocks is an indication of how porous the block is or the extent to which it can absorb water. The permeability of a building block is a measure of its durability characteristics, since water absorption usually leads to deterioration of the block. The higher the permeability ratio (PR) of a block sample, the greater the permeability of the block and hence, the lower its resistance to deterioration (Kerali, 2001).
Table 8 below shows the permeability ratio of cow-dung:laterite blocks. For the first three percentages of cow-dung:laterite samples of 5%, 10% and 15%, the block weight could not be measured at the end of the 24 hours, since they completely dissolved in the water. This means that the permeability ratio is 100% and that the blocks are too permeable and hence not durable.

Table 8: Permeability Ratios (PR) for Cow-dung:Laterite Blocks at 28-days

<table>
<thead>
<tr>
<th>Mix ratio</th>
<th>Cow-dung : Laterite</th>
<th>Initial Wt.</th>
<th>Ave. Initial Wt. (W₁) Kg</th>
<th>Final Wt.</th>
<th>Ave. Final Wt. (W₂) Kg</th>
<th>W₂-W₁ Kg</th>
<th>PR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:95</td>
<td></td>
<td>13.4</td>
<td>13.3</td>
<td>0.0</td>
<td>0.0</td>
<td>-13.3</td>
<td>-100.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.2</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:90</td>
<td></td>
<td>13.4</td>
<td>13.3</td>
<td>0.0</td>
<td>0.0</td>
<td>-13.3</td>
<td>-100.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.2</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15:85</td>
<td></td>
<td>12.5</td>
<td>12.6</td>
<td>0.0</td>
<td>0.0</td>
<td>-12.6</td>
<td>-100.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.7</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20:80</td>
<td></td>
<td>12.8</td>
<td>12.8</td>
<td>14.4</td>
<td>14.3</td>
<td>1.4</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.8</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The only sample that could be weighed under this type of blocks was the 20% cow-dung sample which recorded a permeability ratio of 11.7%. This could be explained by the high contents of cowdung in this sample that provided relatively higher amounts of lime for bonding of the earth particles. This further explains why building structures made of earth and cowdung collapse when there is a heavy downpour that leads to flooding in the three northern regions of Ghana (Autonopedia, 2009).

For the cowdung:cement:earth blocks, the results show that for the cow-dung percentages of 3%, 8%, 13% and 18%, the permeability ratios of the blocks were 5.5%, 11.0%, 11.8% and 12.7% respectively as shown in Table 9 below. This indicates that when 2% cement was made to replace portions of the cowdung, a relatively less permeable earth blocks were produced, which further implies that the resulting blocks will be more durable than earth blocks formed from cowdung only.

Table 9: Permeability Ratios (PR) for Cowdung:Cement:Laterite Blocks at 28-days

<table>
<thead>
<tr>
<th>Mix ratio</th>
<th>Cow-dung : Cement: Laterite</th>
<th>Initial Wt.</th>
<th>Ave. Initial Wt. (W₁) Kg</th>
<th>Final Wt.</th>
<th>Ave. Final Wt. (W₂) Kg</th>
<th>W₂-W₁ Kg</th>
<th>PR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:2:95</td>
<td></td>
<td>13.0</td>
<td>12.7</td>
<td>13.1</td>
<td>13.4</td>
<td>0.7</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.4</td>
<td>12.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:2:90</td>
<td></td>
<td>12.9</td>
<td>12.7</td>
<td>14.0</td>
<td>14.1</td>
<td>1.4</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.5</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:2:85</td>
<td></td>
<td>13.2</td>
<td>13.0</td>
<td>14.9</td>
<td>14.5</td>
<td>1.5</td>
<td>11.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.8</td>
<td>14.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:2:80</td>
<td></td>
<td>12.8</td>
<td>13.1</td>
<td>14.4</td>
<td>14.8</td>
<td>1.7</td>
<td>12.9</td>
</tr>
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<td></td>
<td></td>
<td>13.3</td>
<td>15.2</td>
<td></td>
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</tr>
</tbody>
</table>

Table 10: Permeability Ratio (PR) for Cement:Earth Blocks at 28-days

<table>
<thead>
<tr>
<th>Mix ratio</th>
<th>Cement : Laterite</th>
<th>Initial Wt.</th>
<th>Ave. Initial Wt. (W₁) Kg</th>
<th>Final Wt.</th>
<th>Ave. Final Wt. (W₂) Kg</th>
<th>W₂-W₁ Kg</th>
<th>PR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:92</td>
<td></td>
<td>14.8</td>
<td>14.6</td>
<td>14.5</td>
<td>15.0</td>
<td>0.4</td>
<td>2.7</td>
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<td></td>
<td></td>
<td>14.4</td>
<td>15.5</td>
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</tbody>
</table>

Also, for the 2% cement only earth blocks the permeability ratio was 2.7% as portrayed in Table 10 below. Comparing this value to the other samples, it could be
inferred that, relatively, cement-only earth blocks produce very low permeability ratios as opposed to blocks with cow-dung inclusion.

Figure 6: Comparison of Permeability Ratios of the Strongest Samples among the Three Categories of Blocks

Again, comparing the strongest samples of the three categories of blocks, being cowdung:earth, cowdung: cement:earth and cement:earth, it could be concluded that cement-only earth blocks are less permeable and hence more durable than when cowdung is added (Figure 6). This further proves that, the permeability of earth blocks improves (decreases) with the addition of cow- dung. However, when cement is added to cowdung to form earth blocks, the permeability of the blocks begin to increase with increasing cowdung contents, making the blocks less durable. This suggests that whilst the addition of cow-dung and cement improves the strength of earth blocks, increasing amounts of cow dung impacts negatively on the permeability of the blocks.

CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The study focused on improving the engineering characteristics of earth blocks for affordable housing for the inhabitants of the three northern regions of Ghana. The major findings are as follows:

The 28-days average compressive strength of cow-dung-only earth blocks were 0.36N/mm², 0.37N/mm², 0.53N/mm², and 0.43N/mm² respectively for 5%, 10% 15% and 20% cow-dung additions. Similarly, for the cow-dung and 2% cement earth blocks, the compressive strength results were 0.85N/mm², 0.95N/mm², 0.33N/mm², and 0.62N/mm² respectively for the 3%, 8% 13% and 18%. Finally, for the 2% cement-only earth block, the compressive strength was 0.72N/mm².

For the permeability of the various block samples, the ratios were 100%, 100%, 100%, and 11.7% for the cow-dung-only earth blocks. The ratios were 5.4%, 11.0%, 11.8% and 12.7% for the cow-dung plus cement earth blocks whereas for the 2% cement-only earth blocks, the permeability ratio was 2.7%.

Conclusions

From the results obtained in the study, the following conclusions can be drawn:

The highest average compressive strength obtained in the study was 0.95N/mm² and this was recorded for the 8% cow-dung with 2% cement earth blocks.
The average compressive strength recorded for the strongest cow-dung with 2% cement block was 80% higher than the strength of the highest recorded earth block formed from cow-dung-only earth blocks. It was also 30% higher in strength than the 2% cement-only earth blocks. This indicates that combining nominal amounts of cement and cow-dung to form earth blocks improves the compressive strength characteristics of the blocks more than using cow-dung or cement only. This offers hope for affordability since the cost of walling units could be reduced appreciably by adding cow-dung and nominal amounts of cement to form earth blocks for the housing sector in the three northern regions of Ghana where cow-dung abounds.

For cow-dung only earth blocks, maximum compressive strength occurs at 15% cow-dung content. However, for more

Cow dung-only earth blocks are very permeable to water and this accounts for the reason why building structures made of earth and cowdung collapse whenever there is a heavy downpour that leads to flooding in the three northern regions of Ghana.

The permeability of earth blocks with cowdung decreases with increasing additions of cow dung to the laterite. However, when cement is added to the cow dung, the permeability of the resulting earth block increases with increasing cow-dung contents, making the blocks less durable at higher percentages of cow-dung.

**Recommendations**

Based on the above conclusions, the following recommendations are made:

Earth blocks made from cow-dung and nominal amounts of cement should be adopted to produce affordable and durable buildings in the three northern communities of Ghana to reduce the cost of housing and fast deterioration of building structures in the area, especially during heavy downpours which lead to flooding.

In forming earth blocks with 2% cement content, optimum amount of cow-dung required is 8% to produce the maximum compressive strength.

When using cow-dung only for earth block production, relatively higher percentages of cow-dung are required to form stronger and less permeable blocks.

Further studies should be carried out on the topic with wider scope of material combinations to ascertain the proportion of cement and cow-dung that may produce higher strength blocks.

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INFLATIONARY TRENDS AND THE PRICES OF SOME SELECTED CONSTRUCTION PLANTS

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This research presents data on the prices of some selected construction plants. (Excavator, Concrete Mixer, Grader and Wheel Loader) and the inflationary indices for the period (2001-2010) which have impacted negatively on goods and services, causing variations in tender and post contract figures. Data for the prices of the plants were obtained from vendors situate in Port Harcourt metropolis (Nigeria), while data on inflationary indices are national figures obtained from the Federal Office of statistics. Using the statistical technique of regression set at 5% significance level, the research analyzed the relationship between the research parameters. The annual mean values of prices of each of the plant types and the inflationary indices within the research period were used for the analysis. Research findings established that the degree of relationship between the tested parameters were significant, recording R-Square and P-Values that ranged between (88–96%) and (0.00 – 0.004) respectively. The dependent variable price, can be predicted from the independent variable inflation, for time series outside the research period. The research concludes that the inflationary indices explain the unstable price trends of the selected construction plants. This trend can be minimized through the formulation of macro-economic stability policies (Monetarist and Keynesian), to curb excessive liquidity and to fine tune the economy. Programmes on import dues, taxes and license concessions are other potent complementary stabilization measures.

Keywords: construction plants, price concept, price determinant, inflation, macro-economic instruments.

INTRODUCTION

Construction plants are majorly imported through the Lagos or Port Harcourt sea ports in Nigeria. Local consumers, clients and contractors get their supply from depots and outlets situate in states capital metropolis through vendors. The quantum of plants which vendors are willing to supply either through outright purchases or hire services are influenced by macro-economic variables, government stabilization instruments, socio-economic demographics and other direct and indirect measures, Mogbo (2002), documented that the forces of supply and demand, the demographics of population densities, the volume and frequencies are potent variables that explain the possible increases in the prices of construction resources. This is why Mac-Barango (2011), made a case that variations in economic matrices of population structure, total population, the volume of economic activities as variables that influence the price of construction resources, plants inclusive. The Nigerian macro-economic environment from the early 1980s has been turbulent, characterized by incessant inflationary rates, down sliding foreign exchange regimes and unfavourable balance of payments. The

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construction industry and particularly the plant market is not immune from the poor indices and performance of the Nigerian economy. Seeley (1983), however submitted and explained that time lag phenomenon which retards the reactionary periods of government policies is more on the construction industry, relative to other sectors of the economy. This scenario, according to low (1992) is explainable by two factors. The long gestation period of construction works and the forward and backward linkages which allow the construction industry to be used by government as a stimulus to pump-prime the economy. This concomitantly leads to lower bid prices for public sector projects as competition becomes more intense among the Job hungry construction firms. Inspite of the two advantages mentioned above the construction plants prices were affected by the economic down of the period.

The inclusion of fluctuation clause by the Joint Contract Tribunal JCT (1980), serve as a relevant example of the possible inflationary trends in the prices of construction. Kolawole (1995), submits that clauses in building contracts provide basis for claims arising by virtue of some contingencies. This is what has led Achuenu (1998), to conclude that clauses in conditions of contract are for the administration of contractual claims. Huv (1989) and Onyechi (1990), documentation are examples of the existence of worldwide increases in contract prices. This is what led Giwa (1988), as cited by Onyechi (1990), to observe that cost overruns are common manifestations of inflationary trends. This corroborates the submission of Nsam (1984), as it relates to the high construction cost in Nigeria. The differentials have become excessive to the extent that the dependence on initial contract sums are baseless exercises. Abiola (2000), further comments that the cost of buildings were astronomical between 1989 and 1999, this gave rise to unusual increase in price index. Nwuba (2004), research work on the relationship between cost and inflation is a relevant case study. The reviews of the study indicated that during the period of the structural adjustment (1986 - 2002) costs maintained upward trends. Obadan (1996) attributes the Nigerian economic crisis to a monolithic oil based economy. This submission corroborates Iyoha (1992) that the collapse and the dwindling in the nation’s revenue and foreign reserves are resultant of the collapse in the world oil market. Edo (2002), documents further economic problems. Obadan and Edo (2004), in a related perspective emphasized that the economic and social indicators have continued to show increasing deterioration in the economy. It would seem however still unclear at this stage how the prices of construction plants were affected by the low economic indices.

In view of this, the research explored, reviewing economic theories which explain the prices of construction plants resultant of inflationary trends. It also appraised how government economic stabilization instruments impacted on construction plant prices. The research focuses on the establishment of relationship between inflationary indices and the prices, for the following plants: excavator, concrete mixer 10/7, grader (CAT 16) and wheel loader within the period (2001-2010). The prices of construction plants were obtained from vendors of construction plants in Port Harcourt metropolis, a state capital in Nigeria. Port Harcourt lies on latitude 4°46’3”N and longitude 7°00’48”E (date and time.info/city coordinates). Nigeria lies on latitude 8°0’0”N and longitude 10°0’0”E (www.google.com.ng). The inflationary indices are national level figures. The research assumed that though the prices of plants of obtained were only from a location, it represents a near mean price of the other state capital cities within the country. The research results of Mogbo (2002) and Mac-Barango (2011), as they relate to distance and prices of construction material in Nigeria serve as good example. The research will help to control, and stabilize forecast the prices of
construction projects. The documentations of Bathurst and Butler (1980) which emphasizes the place of building industry in gross fixed investment and domestic product of nations is a good example. The submission of Adams (1988), cited in Achuenu et-al (2000) reiterates the prominence, of the industry in national development; it is an economic barometer. The industry produces and maintains the relevant infrastructure for development. Harris (1981), further recognizes the construction industry as a major sector of the economy and that the application of mechanical plants catalyze productivity on sites. The submission of Ogunsemi (1995), reaffirms the place of construction works relative to other sectors. This stems from the percentage contribution of plants in complex high rise and most civil engineering works. According to Ademoroti (1996), erring national economies have been be restored through the robust activities of construction industry. Further developmental statistics on the economic indices of gross domestic product and annual growth confirm the above assertion.

Plant is one of the important resources in construction works, its inputs particularly in civil and heavy engineering works can be significantly high. This is what has led Holmes (1995) to submit that plants relatively have high efficiency and effectiveness indices when compared with manual operations. The plant department will be responsible for the provision of the requisite plant and equipment once a contract is signed. This corroborates Ogunsemi (1995), assertion as it concerns the economics of acquisition and purchase of plants by firms.

**PLANT PRICE DETERMINANTS**

The prices of construction plants are influenced by several variables. Plant departments adopt approaches or methods in arriving at prices. This collaborates Best (1997), submission that philosophies and strategies guide the pricing of plants which can be categorized into cost based or market based strategic pricing. Skitmore et-al (2006), documentation, classified pricing philosophies into full-cost (cost based) and neo classical micro-economic (market based). Laryea (2012), is not a proponent of the above submissions. The approaches, Laryea argued would be appropriate to be viewed as pricing methods or methods of arriving at a price. Mochtar and Arditi (2001), as proponents of Laryea’s submission forward an array of factors that influence a contractor’s pricing strategy. This has led Laryea (2012), to conclude that a cost based pricing is in essence an appendage and derivative of market based pricing, which are influence by micro-economic variables. This is why Harrison (1991) made a case for Adjudication during tender reviews. Smith (1986) Peak et-al (1993) and Brook (2004) advocate for the analysis of overheads and profit margins. Fischer and Jordan (1996) made a case for the analysis of the impact of risk and uncertainties on profit and overhead margins. This has informed Hall (1987), in the identification of constituents of a unit price build-up. Mudorch and Hughes (2008), documented that a unit price build up is an aftermath of the analysis on contractual and risk premium. The Basic prices form an integral part of the algorithmic procedure in the build up of the tender unit rates and/or the tender prices. (For example, see Wood 1982, Smith 1986 and Akitonye and Fitzgerald 2000). This is what led Buchen (1993), to submit that the contractor’s estimating task is to price the produce and produce an estimate. Arditi (2001), research work on 400 top US construction firms, concerning cost-based pricing mechanism, is a relevant case study. Tah et-al (1994) documents differences between direct and indirect costs. Laryea (2012), research work on how prices are calculated is also a relevant case. The findings debunk a theoretical notion as it relates
to establishment of unit price. The study also debunks Tah et-al 1993, concerning the establishment of bidding prices.

**MACRO-ECONOMIC POLICIES AND IMPACT ON PLANT PRICES**

Plant prices are reflective of the general economic environment and the prevailing macro-economic policies of governments: This corroborates Shut (1988), submission that macro-economic polices aid government in achieving improved standard of living, employment and low inflation and good balance of payments; observing further that however, no economic policy can encourage an increased standard of living with high employment and low inflation. This is why Rivera-Batiz (1985) made a case for the balance of payment as an instrument that stabilizes economic performance through trade patterns. Batiz-Rivera (1985), submits that the Keynesian assumption as it relates to production outputs of firms, unemployment and price level would appear too simplistic. the real scenario is that changes in output is brought about changes in aggregate demand which is a function of the price level. This is what influenced Shut (1988) submission that the dynamics and interplay between and amongst the above mentioned factors, influence the quantum of imports or exports; which is a function of the prevailing government exchange regime. The government derives its currency in terms of other currencies during a fixed or pegged regime and the floating tendencies through interventions during periods of floating exchange rate are regulated; this is to allow for the market forces of demand and supply to result in a state of equilibrium.

This is why Wahab (1986) and Powell (1989), advanced a exceptional definition of inflation as a market forces. The extent of rise of price levels, expressed in percentages describe the types of inflation (for example creeping inflation is ranges between 1-5%, rapid inflation about 6%, strato inflation above 100% annually and hyper inflation, above several hundred percent per day). Deflation connotes a persistent fall in price level. Further conceptional explanation of inflation as documented by Sharp- et (1988), borders on the causative factors of inflation: (cost push theory and the quantity theory of money). These theories are based on the premise that growth in the money supply is the basic cause of inflation and that increases or decreases in money (m), will cause increases or decreases in price level (P) and national output (Q) respectively. Thus \( mv = PQ \). An increase in money supply will certainly increase prices unless either velocity of money decreases and/or output increases. There would seem a relationship between cost and demand (for example see Powell 1989), illustrates that the interplays amongst the variables of government transfer payments, taxes and aggregate demand in both monopolistic and perfect situations. In both market situations, the willingness to offset increase in resource prices by increases in productivity counter balances a cost – push inflation.

The above explains the submission of Wahab (1986), as it relates to the Nigeria nation over dependence on foreign materials and products. The occurrence of stagflation of the UK economy as documented by Powell (1989), is also a good example. Government uses fiscal, monetary and other direct and indirect measures to fine tune macro-economic variables and re-direct the economy (for example see Hillibrandt (1974), which elucidates the impact of monetary and fiscal measures on construction development. Seeley (1983) and Shutt (1988) advance reasons why this application of these measures (fiscal and monetary) can be potent. Powell (1989), submits that the impact of monetary and fiscal policies are to be well appraised, for instance the
argument on the application of the conventional Keynesian demand management policies and the stagflation in the UK economy in the 1970s is a good example. This what has led to the emergence of monetarist and “new classical” theory and policy in the 1980s.

This is why Ayeni (1988), Jagboro (1992) and Adegoro (1992), made a case that distortions in foreign exchange, corresponding inflation account for expensive nature of finished or raw imported goods. This is what led Begg (1991), Omole (1998) and Samuelson and Nordhaus (2005) to make a case that fiscal instruments (taxes and spending levels) can stimulate or retard the economy using component of basic demand as basis. The reports of the Federal Office Statistics (Nigeria), on distortions in exchange regimes and depreciations in the country’s currency between 1991 and 1992 serve as further manifestations. Government aside Keynesian and monetarist instruments can attempt to stimulate or retard the economy for example see Ajanlekokoko (1990), on the structural adjustment programme (SAP) of 1986 and see Abiola (2000) and Nwuba (2004) for corresponding escalations on the cost of housing, resultant of the SAP and political programmes of the early 1990s. Government policies, Keynesian, monetarist or direct programmes take some time before their full effect can felt on the economy. For example see, Shutt (1988) and Begg (1991) on the time lag factor. Government can adopt intervention strategies to complement Keynesian or monetarist policies, moreso with the time lag factor. For example, see Bathurst and Butler (1980) and Nordhaus (2005) on direct and indirect measures used by government to control output of the construction industry. See also the submission of Nyong (1994) on stabilization policies and the lingering economic crisis. This corroborates Obadan and Edo (2004), submission as it relates to the Nigerian structural programme (1986 – 1994) and the economic problems. The several Keynesian monetarist other economic programs targeted towards stabilization of the economy did not yield desired results for example see Jogbore (2004) on the formulation of post SAP economic programmes like national vision 2010. This scenario would depict a lingering inflationary trend in a country, with the attendant negative impacts on both the national and subsectoral economies. For example see Sharp et-al (1988).

COPING STRATEGIES FOR INFLATION

The above postulation, assertions and documentation by Sharp et-al (1988), Nyong (1994) and Obadan (2004) would appear to suggest that curbing inflationary trend and its impact need some specific stereotyped, focused and deliberate efforts, this would be more objective and results oriented. For example, see Wahab (1986), advocacy on coping strategies. Strategic responses of construction firms to the Asian crisis 1997-1998 (for example, see Peng and Hua 2000) and strategic survival of firms during financial crisis. For example see Townsend 1983 and Cordova and Dror 1984). King (1997), documents the movement of Japanese and American firms overseas; Kozminski (1977) made a case for down sizing and Tinge (1994), supports outsourcing from larger firms to smaller ones. Some complementary economic measures like changing top management are necessary when firms restructure. (For example see Kozinski 1997 and Whilitating 1989). Employment of people (see Slatter 1992). Selective shrinkage. (For example see Shilling 1988 and Whilitating 1989). Firms are to withdraw from unprofitable market agreements. (for example see Palmer 1991). Morine (1980), advised firms to embark on sale of investment having higher returns to secure funds. Palmer (1991), advocates for rigorous and enhanced marketing, for instance Kozinski (1977), documentation of post communist central
and eastern European benefits from marking, serves as good example. Moraine (1990), however, supports cost reduction as a more potent measure. This corroborates Slatter (1992), submission that the essence of cost cutting is to minimize wastage and unnecessary expenditure. This had led Cordova and Dror (1984), Chen (1985) and Nueno (1993) submission of measures result in cost cutting. The benefits of firm resturing, shrink and marketing programs not withstanding the place of long term strategies of cannot be over stated. This has led Morine (1980) to support the leasing of plants and equipment rather than purchasing, this allows flexibility in business cash flow. This corroborates Palmer (1991) submission that firms are to maintain good relationship with their funding sources. Nueno (1993), makes a case for Research and Development (R & D) programs. Chen (1985) and Wellington (1989) advances the focal areas of the R & D department, as diversification in overseas and upstream and down stream so that risk can be mitigated. The successful applicability of the coping strategies will also be beneficial to plants and equipment departments as subunits of firms during downturn economic periods, the generic nature of the literature review notwithstanding.

RESEARCH METHOD

The research examines the influence of the macroeconomic variable of inflation on the prices of some selected construction plants. The research is analytically inferential in nature, adopting the quantitative technique of regression, as well as descriptive analysis which adopted time series (using charts as graphs) for the analysis of data. The research adopted the technique of regression because of the inherent tendency of natural linearity between the parameter of the tested relationships. (Koutsonyiannis 1977, Hamburg 1979 and David 1981). Time series was adopted because of the period base nature of the inflationary indices. The research using secondary source, obtained raw data values for the two parameters of interest, the inflationary indices and the prices of the selected plants within the research period. (2001-2010). Data for the annual inflationary indices were obtained from the federal office of statistics reports), whilst the prices of the construction plants were obtained from plant vendor firms in port – Harcourt metropolis, situate in Niger Delta region of Nigeria. The mean annual values of the parameters (for the research period 2001 – 2010) were used for the analysis of data. The mean values of the prices of each of the selected plants were adopted, these were obtained from the monthly mean values of each plant. For the inflationary parameter, the collated monthly mean values formed the basis for the annual means of inflationary indices, which were used for the analysis of relationships between the parameters. The essence of using the mean values for the research data was to obtain a line of better fit from the scatter diagrams. The statistical computer package (Spss) was used for the analysis of data. The essence of the inferential statistics is to predict the values of the dependent variable (prices of the selected plants) from the independent variable the inflationary indices for time series that are outside the research period. The established relationships from the tested parameters were put at 95% confidence limit levels. Four relationships were established between the parameters. The variable of inflationary indices as independent variable was regressed against the price variables (dependent parameter) for the following plants. Excavator, Concrete Mixer, Grader CAT 16 and wheel loaders.
RESULTS:
The inferential research findings established that the prices of the selected construction plants and inflation had positive correlations establishing R – square values between (78.6-95%). See table 4.1 below.

<table>
<thead>
<tr>
<th>Ana 1</th>
<th>Dep. Var.</th>
<th>Indep. Var.</th>
<th>Typ. of Model</th>
<th>Results of Experiment</th>
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<td>Regression Equation</td>
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<td></td>
<td>Excavator</td>
<td>Inflation</td>
<td>Linear</td>
<td>Y=2.903+0.323(x)</td>
<td>R=0.950</td>
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<td></td>
<td>Linear</td>
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<td>R2=0.902</td>
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<td></td>
<td>Grader</td>
<td>Inflation</td>
<td>Linear</td>
<td>Y=0.450+0.130(x)</td>
<td>F-tab=5.32</td>
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<td></td>
<td>F-cal=73.4</td>
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<td>Grader</td>
<td>Inflation</td>
<td>Linear</td>
<td>Y=3.687+0.692(x)</td>
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<td>T=8.568</td>
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<td>Grader</td>
<td>Inflation</td>
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<td>Y=8.997+0.599(x)</td>
<td>Strength</td>
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The pattern and trends between the research variables are as indicated in fig. 4.1.

The established trend between variables of inflationary indices and prices of the selected plants are generally in tandem with the results of the inferential analysis over the time series. Increase in the inflationary rates gave rise to increase in the prices of the plants...
over the research period. Generally, the price trends of plants within the period (2001-2002) recorded the highest. The period (2002-2005) was characterized by upward and downward unstable price trends, so also was the period 2005-2008. The period 2008-2010 however, indicated almost a steady rise in prices.

The results of the analysis depict the following implications on the economy and on the construction industry. (i) The inflationary trend impacted on the prices of the construction plants. (ii) The prices escalated in relation to the inflationary trends within the research period. (iii) The research findings would appear to explain the frequency in changes between the tender rates and contract rates within the research time series. (iv) The inflationary trend within the study period has also led; price fluctuations and subsequently cost overruns of projects. (v) The result also explains the distorted macro economic variables of exchange rate, balance of payments and their impact on the supply of construction rated goods and services. (vi) The values of the dependent variables (prices of plants) can be predicted from the values of the independent variable (inflation). This notwithstanding construction cost estimates have lost their usefulness within short periods. Forecast of prices can hardly be relied upon and therefore the effectiveness of plans are adversely affected.

CONCLUSION

The research concludes that the inflationary indices explain the unstable price trends of construction plants, this has a concomitant negative impact on project costs. The government of Nigeria should put in place macro-economic stability measures to reduce inflation. Keynesian and monetarist policies are to be directed to curb excess liquidity, import dues and license concessions on construction plants. Long-term procurement strategies are to be adopted for the purchase of construction plants, this will minimize the impact of escalating inflationary trends of an unstable economy. Some tailored strategic and coping measures to include the sitting of construction plant assembling/manufacturing, this will reduce the pressure on the country’s foreign exchange and boost favorable balance of payments.

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Price of construction plant


INFLUENCE OF ORGANISATIONAL CULTURE ON CONSTRUCTION WORKERS’ COMMITMENT IN LAGOS, NIGERIA

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Culture is a unique characteristic of any organization and it is the result of common learning experiences among the workers in any organisation. Organisational culture through its dimensions has remarkable influence on the commitment of construction workers and this engenders organisational outcomes. Despite extensive research into organisational culture and workers’ commitment in the manufacturing, hospitality, financial and healthcare sectors very little attention has been received by the construction sector in this genre. The purpose of this study is to investigate the influence of selected dimensions of organisational culture on construction workers’ commitment in Lagos. Questionnaire survey was conducted on different management cadres in the construction companies in order to obtain the data for the determination of the influence in selected construction companies in Lagos. The results demonstrate that organisational culture has fairly strong and positive influence on workers commitment and that power culture and normative commitment is dominant among majority of the companies. The study concludes that culture and workers’ commitment in construction companies matter as both co-vary and can affect organisational outcomes through their interaction. The paper recommends among others that affective commitment and people culture should most attract organisational attention in order to reap positive organisational outcomes.

Key words: Organisational culture, dimensions, workers’ commitment, construction companies

INTRODUCTION

The phenomenon of organisational culture (OC) has so much aroused the interest of both the academia and practitioners since the publication by Peters and Waterman in 1982. It has become one of the major management tools to emerge in recent decades and has therefore been an important area of research in management. Organisational culture has been viewed by scholars (Willmott, 1993; Ray, 1988) as the "ultimate managerial control". This being so, it can be argued that culture represents a potent tool that can be wielded to cultivate employees’ commitment. However, despite the tissues of research on the phenomenon as a management tool especially in the manufacturing (Lather, Puskas, Singh and Gupta, 2010), insurance (Geldenhuys, 2006), healthcare sectors (Isaacson et al., 2009), hospitality (Ogbonna and Harris, 2002) and financial sectors (Amah, 2012), very little attention has so far been given to it in the construction sector.

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Its relationship to commitment from which its influence can be determined has not received the much needed attention. Despite large number of studies on organisational commitment (Lok and Crawford, 1999), little attempt has been made to determine the strength of relationship between the two constructs. In an earlier attempt by Lahiry (1994) at establishing a relationship between organisational culture and commitment, Lok and Crawford (1999) note that a weak relationship was found. This paper will look at the link between organisational culture (OC) and employee commitment (EC) with a view to establishing the basis upon which employers can choose appropriate type of organisational culture that can cultivate the desired commitment in workers. The purpose of this study therefore is to investigate the link between orgaisational culture and employees’ commitment in Lagos, Nigeria. A survey was conducted using the organisational commitment scale and the organisational culture questionnaire to determine the link.

ORGANISATIONAL CULTURE

Diverse definitions of organisational culture have been given by many researchers. However these definitions revolve around the same issue which is the way things are done in a particular workplace in conformity with the established standards and norms. These norms normally affect the way organisations go about implementing their organisational goals through their employees. These norms are transmitted generationally within the organisation. Leaders in organisations are concerned with these norms. Nystrom (1993) views OC as a system of managing an organisation in order to achieve success and improve performance using cultural dimensions to influence important outcomes like employees’ commitment.

Culture knits a collection of individuals with different backgrounds into an integrated entity called "organisation." A collection of a number of key elements and factors that have been recognized as being inherent within organisations is known as “organisational culture”. According to Schein (1985), organisational culture is understood as a pattern of basic assumptions which is invented, discovered, or developed by a group since it learns to cope with its problems of external adaptation and internal integration that has worked well to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. The dimensions of culture that have been found in previous studies to have important outcomes for organisations are dominant characteristics, organisational leadership, management style, organisational glue, strategic emphasis and criteria for success.

Types of Organisational Culture

According to Berrio (2003), organisational culture can be classified into four types namely: people culture, task culture, power culture and role culture. The people culture is viewed as a family type of organization in which almost all the attributes that make up a good family are found such as friendliness, concern for members, loyalty, teamwork and participation. People culture is also regarded as supportive type of culture (Lok and Crawford, 2004). The task type of organisational culture refers to an organisation with non-existent or temporary charts with key values as creativity and risk taking. It is a non permanent organization. The power type of culture is the one that focuses on external maintenance with a need for stability and control in order to have a competitive advantage and profits (Cameron and Quinn, 1999). An organization that runs role culture is one that values tradition, consistency,
cooperation and conformity. It focuses on internal maintenance with the need for stability and control.

**Employees’ commitment**

Commitment is a condition in which members of a group give their abilities and loyalties to the organisation and the pursuit of its goals in return for satisfaction (Hodge and Anthony, 1991). It is an attitudinal issue reflecting an employee's loyalty to the organisation; and expression of concern for the organisation’s continued success and well being (Northcraft and Neale, 1996). It is a multidimensional work attitude (Meyer and Allen, 1997). Research evidence proves that committed and loyal employees have a direct impact on company's performance and profitability. Commitment therefore is a very important measure for many areas of effectiveness in the organisation (Steers, 1975, Barbara, 2003). The commitment of employees to organisations is therefore of prime importance to all organisations because it focuses on the attitudes of employees towards the entire organisation (Adeyinka, Ayeni and Popoola, 2007). Furthermore it is important because committed employees are less likely to leave for another job and are more likely to perform at higher levels.

Meyer and Allen (1991) and Meyer, Allen and Smith (1993) have identified three aspects of commitment as affective commitment or desire-based (wanting to stay with the organization no matter the situation), normative commitment or obligation-based (feeling obliged to stay as a way of reciprocating a kind gesture), and continuance commitment or cost-based (staying because of the high cost associated with leaving the organization due to uncertainty outside). Employees’ commitment is determined by personal, organisational and non-organisational factors (Northcraft and Neale, 1996). The personal factors include age, tenure in the organisation, disposition, internal or external control attributions. The organisational factors comprise job design and the leadership style of the supervisor while the non-organisational factors include availability of alternatives.

Meyer (1991) and Meyer and Allen (1997) opine that employees with strong affective commitment would be motivated to higher levels of performance and make more meaningful contributions than employees who expressed continuance or normative commitment and it equally measures employees’ commitment more effectively. According to Fornes (2008), when employee is committed, organization and individual performs optimally with increased individual employee satisfaction. Lahiry (1994) further confirms that employee commitment has an effect on how well an organization performs and delivers its services.

**Organisational culture and commitment**

Some scholars (Rashid, Sambasivan and Johari, 2003) have noted that organisational culture can be used to escalate the level of employees’ commitment and thereby ensuring success. It can as well be used to instill employee commitment, satisfaction, quality perception and safety (EMRL, 2003). Bath Consultancy Group (2006) argues that this is possible through the powerful cultural forces in the organisation. These cultural forces can be regarded as the dimensions of organizational culture.

From the foregoing, there appears to be a relationship between organizational culture and commitment in such that culture influences commitment which has positive organisational outcomes. Since it appears that culture has crucial roles to play in organisations as a facilitator of commitment, it could be an answer to mitigating the performance problem of the industry (Adeyemi, Oladapo and Akindele, 2005). As a
result, there is need to know the relationship between the types of organizational culture and forms of employee commitment. This will enable construction organisations harness the potential of culture to precipitate the desired form of employees’ commitment that is compatible with the culture in the organisation. In addition, Nazir (2005) and Silverthorne (2004) state that organisational culture also affects the commitment of employees within an organisation and that the strength of organisational commitment is correlated with the strength of organisational culture.

**Relationship between organisational culture and employees’ commitment.**

There has been little empirical investigation to substantiate the relationship between organisational culture and employee commitment (Silverthorne, 2004; Westwood and Crawford, 2005). However, in other industries aside from the construction industry, a relationship has been established between organisational culture and employees’ commitment. In 2006, Boon and Arumugam examine the effects of corporate culture on employees’ organisational commitment in Malaysian semi-conductor industry and find that there is a relationship. In 2009, Zain, Ishak and Ghani replicate the same research using the same industry and affirm a relationship between the two constructs. Equally in 2006, Boon, Safa and Arumugam consider Total Quality Management as a culture in Malaysian manufacturing companies and investigate its influence on employees’ affective commitment and find that a strong relationship exist between them.

A recent study by Majeed et al (2012) examine the impact of four dimensions of corporate culture on employees’ commitment with their organization in Pakistan banking industry and reveal that all the four dimensions of culture are positively associated with employees’ commitment to their organisation. According to Westwood and Crawford (2005), there is a stronger positive relationship between supportive cultures (people culture) and commitment than a bureaucratic type (role type) of culture. Corroborating this view, Chen (2004) states that when the culture is supportive it will correlate positively with commitment resulting in greater employee commitment and involvement. Odom et al (1990) also note that supportive environment impacts greater degree of organisational commitment. However, Rashid, Sambasivan and Johari (2003) believe that it is only when there is an appropriate match between the type of organisational culture and the type of organisational commitment that the interaction of the two constructs can be beneficial to the performance of the organisation.

**Defining the size of construction companies**

The size of construction firms is often described in terms of its turnover, capacity and the number of employees. The number of employees is commonly preferred because it is easily defined unlike capacity and turnover (Phillips, 1968; Ward, 1979; Mittelstaedt, Harber and Ward, 2001; Paez, 2003). In his study of the effects of firm size on wages in Colorado, Paul (2003) finds it convenient to use employee-based standard to classify the firms into three different sizes using 150 workers and above for large firms and between 5 and 149 workers for small to medium-sized firms. In a related study, Mittelstaedt, Harben and Ward (2001) used 20-99 workers for small, 100-499 workers for medium and more than 500 workers for large firms.

In Lagos, the category of registration of companies with government ministries and parastatals may suggest their size. This is however not reliable as their registration is
based only on the financial ability to pay the registration fees for the category of choice. There is no inquest into their size in terms of turnover, capacity and the number of employees. Therefore a small firm may impersonate the large firm through its financial ability to pay the registration fee meant for large firms in anticipation of getting a large contract. In view of this, employee-based standard is preferably used especially as the Federal Office of Statistics (now Bureau of Statistics) (1997) employed the same employee-based standard in categorizing the Nigerian construction companies into nine.

RESEARCH METHODOLOGY

According to Wilson (1993) it takes a minimum of five (5) years to achieve a self-sustaining organisational culture. Therefore the research focuses on construction companies that have been in operation for five years and above. Data collection was confined to Lagos being Nigeria’s centre of commerce with a large number of construction companies. The sample population was taken from the Federation of Construction Industry (FOCI) and Nigerian Business Directory (NBD). Both sources had 234 registered companies as shown in Table 1. After eliminating double registration, 176 companies which formed 79% of the population were found to be duly registered. This 176 constituted the number of questionnaires that was sent out. The OC as well as the EC constructs were measured on a five point Likert type scale with a score of (5) to indicate strongly agree and a score of (1) to indicate strongly disagree with statement on the two constructs. Modified organisational culture assessment instrument (OCAI) developed by Cameron and Quinn (1999) as well as Meyer and Allen (2004) organisational commitment instrument (OCI) were used to collect the data.

The reliability of the instruments based on Cronbach alpha coefficient as suggested by Tan (2004) ranges from 0.65 to 0.97 which indicates a good level of internal consistency. Data on dominant characteristics, management of employees, organisational glue, organisational leadership, strategic emphases and success criteria were used to determine OC reliability. EC reliability was determined by collecting data on organisational investment, side bets, turnover intention, involvement, socialisation and sense of belonging. The management and supervisory staff of the companies supplied the data for both constructs by filling the questionnaire administered on them. The data collected for the study was analysed using percentile, mean score and Spearman rank correlation.

Table 1: Distribution of construction companies by location

<table>
<thead>
<tr>
<th>SN</th>
<th>Location</th>
<th>Registration with FOCI Only</th>
<th>Registration with NBD Only</th>
<th>Total FOCI+NBD</th>
<th>Double Registration (FOCI + NBD)</th>
<th>Actual number/Percentage duly registered by location (FOCI + NBD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lagos</td>
<td>91</td>
<td>94</td>
<td>185</td>
<td>9</td>
<td>176 (79%)</td>
</tr>
<tr>
<td>2</td>
<td>Abuja</td>
<td>13</td>
<td>9</td>
<td>22</td>
<td>2</td>
<td>20 (9%)</td>
</tr>
<tr>
<td>3</td>
<td>Other Nigerian</td>
<td>18</td>
<td>9</td>
<td>27</td>
<td>0</td>
<td>27 (12%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>122</td>
<td>112</td>
<td>234</td>
<td>11</td>
<td>223 (100%)</td>
</tr>
</tbody>
</table>
Definitions
Based on the review of literature and the categorization of Bureau of statistics (1997), the definitions of small, medium and large construction firms are as follows:

Small-sized firms
These are construction companies employing not more than 50 workers. There were 32 companies that fell into this group and they constituted 24% of the sample.

Medium-sized firms
These are construction companies whose staff strength ranges from 51 workers to 300 workers. The number of such companies involved in the study was 73 which gave 56% proportion of the sample.

Large-sized firms
These are those construction companies that have more than 300 workers in their employ. There were 26 companies in this category and they constituted 20% of the sample.

RESULTS AND DISCUSSIONS
Response rate and the profile of the respondents
Out of 176 questionnaires administered, 131 representing 74.4% was returned indicating a good response rate. From Table 2, male respondents (87.7%) are more than the female respondents (12.3%). This demonstrates that the construction industry is masculine in nature. Those that have normal married life were 70.8% while 29.2% aberration was recorded. The distribution of the management cadre varies between 28.9% and 37.5%. With this distribution, the responses cut across various job positions and marital status. This gives a balanced opinion. Table 2 also indicates that the respondents are educationally qualified with 74% not below Bachelor degree and are equally professionally qualified. This suggests that they are competent to give reliable information. In terms of the number of years of experience in current company, 64.1% has had more than five (5) years of experience. This implies that they had had sufficient time to learn and imbibe the culture of their work place in agreement with Wilson (1993) and as such should be able to give reliable information.

6.2 Types of organisational culture as exhibited by construction companies in Lagos, Nigeria

The midpoint of a Likert scale is a useful means of determining what might otherwise be a more or less random choice between agreement and disagreement (Johns, 2010). From Table 3, it can be seen that the small-sized construction companies (SSCC) (1-50 employees) exhibit all the four types of culture but predominantly operate task culture with a mean score (MS) of 3.85 while the role culture with MS of 3.56 appears to be relegated because privately owned companies abhor bureaucracy. The standard deviation (SD) values farthest from the MS for each of the culture types exhibited by the SSCC show low variability. In establishing the SD, the coefficient of variance (CV) reveals how the SD relates to the MS and ranges from 0.04 (4%) to 0.17 (17%).

The role culture with a MS of 3.75 is preferred among the medium-sized construction companies (MSCC) (51-300 employees) while the task culture with MS of 3.59 is
Organisational culture

demoted because of the need to formalise the rules and procedures guiding their operations. There is low variability in the SD values farthest from the MS for each of the culture types exhibited by the MSCC. In affirming the SD, the CV reveals how the SD relates to the MS and ranges from 0.01 (1%) to 0.22 (22%).

Table 2: Respondents’ profile

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender (N=130)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>114</td>
<td>87.7</td>
</tr>
<tr>
<td>Female</td>
<td>16</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>Marital status (N=130)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>92</td>
<td>70.8</td>
</tr>
<tr>
<td>Single</td>
<td>35</td>
<td>26.9</td>
</tr>
<tr>
<td>Divorced</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Separated</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Job position (N=128)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate/top management</td>
<td>37</td>
<td>28.9</td>
</tr>
<tr>
<td>Middle management</td>
<td>48</td>
<td>37.5</td>
</tr>
<tr>
<td>Lower/executive management</td>
<td>22</td>
<td>17.2</td>
</tr>
<tr>
<td>Supervising/non-managers</td>
<td>21</td>
<td>16.4</td>
</tr>
<tr>
<td><strong>Educational qualifications (N=131)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; guilds or below</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Diploma</td>
<td>33</td>
<td>25.2</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>50</td>
<td>38.1</td>
</tr>
<tr>
<td>Masters degree</td>
<td>47</td>
<td>35.9</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Professional designation (N=131)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architect</td>
<td>17</td>
<td>13.0</td>
</tr>
<tr>
<td>Builder</td>
<td>24</td>
<td>18.3</td>
</tr>
<tr>
<td>Engineers</td>
<td>45</td>
<td>34.4</td>
</tr>
<tr>
<td>Estate Surveyors</td>
<td>6</td>
<td>4.6</td>
</tr>
<tr>
<td>Quantity Surveyors</td>
<td>26</td>
<td>19.8</td>
</tr>
<tr>
<td>Others</td>
<td>13</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>Membership of professional bodies (N=128)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate membership</td>
<td>49</td>
<td>38.3</td>
</tr>
<tr>
<td>Corporate membership</td>
<td>74</td>
<td>57.8</td>
</tr>
<tr>
<td>Fellow</td>
<td>5</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Years of experience in present company (N=131)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>47</td>
<td>35.9</td>
</tr>
<tr>
<td>5 – 10 years</td>
<td>53</td>
<td>40.4</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>11</td>
<td>8.4</td>
</tr>
<tr>
<td>16 – 20 years</td>
<td>14</td>
<td>10.7</td>
</tr>
<tr>
<td>21 – 25 years</td>
<td>4</td>
<td>3.1</td>
</tr>
</tbody>
</table>
Large-sized construction companies (LSCC) (> 300 employees) appear to prefer power culture with the highest MS of 3.90 while people culture with MS of 3.67 is pushed to the rear. From the Table 3 it can also be seen that there is low variability in the SD values farthest from the MS for each of the types of culture exhibited by the LSCC. In confirming the SD, the CV demonstrates how the SD relates to the MS and ranges from 0.05 (5%) to 0.24 (24%). In general it can be said that the Nigerian construction companies will exhibit either power culture (MS=3.73) or task culture (MS= 3.72). People culture (MS=3.63) and role culture (MS=3.66) appear to be relegated

Table 3: Types of organisational culture exhibited based on size of companies

<table>
<thead>
<tr>
<th>Distribution of companies by size</th>
<th>Statistics measures</th>
<th>Types of organisational culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-sized construction companies (SSCC)</td>
<td>Mean score 3.59</td>
<td>People culture 3.68</td>
</tr>
<tr>
<td>Rank 3rd</td>
<td>Task culture 3.85</td>
<td>Power culture 3.56</td>
</tr>
<tr>
<td>Standard deviation 0.32</td>
<td>Role Culture 4th</td>
<td></td>
</tr>
<tr>
<td>Variance 0.1 (10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium-sized construction companies (MSCC)</td>
<td>Mean score 3.64</td>
<td>People culture 3.6</td>
</tr>
<tr>
<td>Rank 2nd</td>
<td>Task culture 3.59</td>
<td>Power culture 3.75</td>
</tr>
<tr>
<td>Standard deviation 0.25</td>
<td>Role Culture 4th</td>
<td></td>
</tr>
<tr>
<td>Variance 0.07(7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large-sized construction companies (LSCC)</td>
<td>Mean score 3.67</td>
<td>People culture 3.91</td>
</tr>
<tr>
<td>Rank 4th</td>
<td>Task culture 3.74</td>
<td>Power culture 3.75</td>
</tr>
<tr>
<td>Standard deviation 0.22</td>
<td>Role Culture 1st</td>
<td></td>
</tr>
<tr>
<td>Variance 0.05(5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall mean score 3.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall rank 4th</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard deviation 0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variance 0(0%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1=strongly disagree; 2=disagree; 3=somehow agree; 4=agree; 5=strongly agree. Decision rule ≥ 2.5 (= decided midpoint)

**Form of commitment as exhibited by Nigerian construction employees.**

Using Johns (2010) idea, employees in construction companies in Lagos exhibit all the three forms of commitment. However, the SSCC prefer normative form of commitment (MS=3.38) which ranks 1st to affective commitment and continuance commitment which ranks 2nd and 3rd respectively as indicated in Table 4. The SD values farthest from the MS for each of the types of commitment exhibited by the SSCC show high variability. The CV reveals how the SD relates to the MS and ranges from 0.37 (37%) to 0.83 (83%). However the results imply that the employees are more committed in terms of normative than affective (MS=3.21) and continuance (MS=2.90).
In the MSCC, normative commitment (MS=3.39) is mostly exhibited in preference to affective commitment (MS=3.22) and continuance commitment (MS=2.90) which comes 2nd and 3rd respectively. The commitment pattern of the employees in the LSCC is also similar to both the SSCC and the MSCC. The SD and the CV values exhibit the same characteristics as seen in the SSCC. The overall mean score for each of the three types of commitment shows that normative type of commitment (MS=3.38) is prevalent in the construction companies in Lagos. This is followed by affective commitment (MS=3.21) while continuance commitment (MS=2.90) is least exhibited.

Table 4: Types of employees’ commitment exhibited based on size of companies

<table>
<thead>
<tr>
<th>Distribution of companies by size</th>
<th>Types of Commitment</th>
<th>Mean score</th>
<th>Rank</th>
<th>Standard deviation</th>
<th>Variance</th>
<th>Overall mean score</th>
<th>Overall rank</th>
<th>Standard deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-sized Construction Companies (SSCC)</td>
<td>Affective commitment</td>
<td>3.21</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
<td>3.21</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
</tr>
<tr>
<td></td>
<td>Normative commitment</td>
<td>3.38</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
<td>3.38</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
</tr>
<tr>
<td></td>
<td>Continuance commitment</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
</tr>
<tr>
<td>Medium-sized construction companies (MSCC)</td>
<td>Affective commitment</td>
<td>3.22</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
<td>3.22</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
</tr>
<tr>
<td></td>
<td>Normative commitment</td>
<td>3.39</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
<td>3.39</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
</tr>
<tr>
<td></td>
<td>Continuance commitment</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
</tr>
<tr>
<td>Large-sized construction companies (LSCC)</td>
<td>Affective commitment</td>
<td>3.21</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
<td>3.21</td>
<td>2nd</td>
<td>0.60</td>
<td>0.37 (37%)</td>
</tr>
<tr>
<td></td>
<td>Normative commitment</td>
<td>3.39</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
<td>3.39</td>
<td>1st</td>
<td>0.88</td>
<td>0.78 (78%)</td>
</tr>
<tr>
<td></td>
<td>Continuance commitment</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
<td>2.90</td>
<td>3rd</td>
<td>0.91</td>
<td>0.83 (83%)</td>
</tr>
</tbody>
</table>

1=strongly disagree; 2=disagree; 3=somehow agree; 4=agree; 5=strongly agree. Decision rule ≥2.5 (= decided midpoint)

Relationship between the dimensions of organisational culture and employees’ commitment in the construction companies.

The results shown in Table 5 indicate that all the dimensions of organisational culture and those of employees’ commitment are generally significantly and positively correlated at p < 0.05 with the highest correlation coefficient (r = 0.592, p =.000) between management of employees and motivation and the lowest correlation coefficient (r = 0.227, p = 0.009) between dominant characteristics and marital status. There is a significant relationship between the dimensions of organisational culture and employees’ commitment.
Table 5: Spearman correlation between the dimensions of organisational culture and dimensions of employees' commitment

<table>
<thead>
<tr>
<th>Dominant characteristics</th>
<th>Management of employees</th>
<th>Organisational glue</th>
<th>Organisational leadership</th>
<th>Strategic emphases</th>
<th>Success criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>.424**</td>
<td>.531**</td>
<td>.479**</td>
<td>.446**</td>
<td>.459**</td>
</tr>
<tr>
<td>Management style</td>
<td>.443**</td>
<td>.528**</td>
<td>.378**</td>
<td>.510**</td>
<td>.501**</td>
</tr>
<tr>
<td>Cooperation and</td>
<td>.402**</td>
<td>.495**</td>
<td>.383**</td>
<td>.536**</td>
<td>.446**</td>
</tr>
<tr>
<td>communication Relationships</td>
<td>.372**</td>
<td>.382**</td>
<td>.346**</td>
<td>.348**</td>
<td>.277**</td>
</tr>
<tr>
<td>Common values and vision</td>
<td>.518**</td>
<td>.540**</td>
<td>.473**</td>
<td>.518**</td>
<td>.451**</td>
</tr>
<tr>
<td>Motivation</td>
<td>.394**</td>
<td>.592**</td>
<td>.574**</td>
<td>.566**</td>
<td>.491**</td>
</tr>
<tr>
<td>Training and development</td>
<td>.281**</td>
<td>.502**</td>
<td>.458**</td>
<td>.299**</td>
<td>.466**</td>
</tr>
<tr>
<td>Employees welfare and</td>
<td>.330**</td>
<td>.559**</td>
<td>.545**</td>
<td>.292**</td>
<td>.339**</td>
</tr>
<tr>
<td>concerns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job position</td>
<td>.361**</td>
<td>.574**</td>
<td>.516**</td>
<td>.318**</td>
<td>.399**</td>
</tr>
<tr>
<td>Length of service</td>
<td>.315**</td>
<td>.444**</td>
<td>.464**</td>
<td>.414**</td>
<td>.300**</td>
</tr>
<tr>
<td>Age and tenure</td>
<td>.273**</td>
<td>.473**</td>
<td>.387**</td>
<td>.270**</td>
<td>.403**</td>
</tr>
<tr>
<td>Marital status</td>
<td>.227**</td>
<td>.401**</td>
<td>.419**</td>
<td>.403**</td>
<td>.331**</td>
</tr>
<tr>
<td>Affective commitment</td>
<td>.216*</td>
<td>.430**</td>
<td>.412**</td>
<td>.325**</td>
<td>.463**</td>
</tr>
<tr>
<td>Normative commitment</td>
<td>.144</td>
<td>.361**</td>
<td>.358**</td>
<td>.375**</td>
<td>.464**</td>
</tr>
<tr>
<td>Continuance commitment</td>
<td>.154</td>
<td>.258**</td>
<td>.192*</td>
<td>.108</td>
<td>0.245**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed)

In terms of relationship between organisational culture dimensions and forms of employees’ commitment the Table 5 also reveals that the highest correlation coefficient is between strategic emphases (r = 0.464, p = .000) and normative commitment while the lowest is between management of employees (r = 0.108, p = .221) and continuance commitment.

6.5 Relationship between the types of organisational culture and forms of commitment

Table 6 shows that all the types of organisational culture are positively correlated with all the three forms of employees’ commitment. Task culture has the highest positive coefficient of correlation with affective commitment (desired-based type of commitment) (r = 0.522, p = .000) and is also more correlated with normative commitment (obligation-based) (r = 0.461 p = .000) than with continuance commitment (cost-based type of commitment) (r = 0.273, p = .013). People and role culture are similarly more correlated with affective and normative commitment than with continuance commitment. Power culture appears different as it is more correlated with continuance commitment (r = 0.263, p = .013) than with affective and normative
Table 6: Spearman correlation between the types of organisational culture and forms of employees’ commitment

<table>
<thead>
<tr>
<th>Types of organisational culture</th>
<th>Affective commitment</th>
<th>Normative commitment</th>
<th>Continuance commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>People culture</td>
<td>.448**</td>
<td>.373**</td>
<td>.216*</td>
</tr>
<tr>
<td>Task culture</td>
<td>.522**</td>
<td>.461**</td>
<td>.273**</td>
</tr>
<tr>
<td>Power culture</td>
<td>.204*</td>
<td>.216*</td>
<td>.263**</td>
</tr>
<tr>
<td>Role culture</td>
<td>.346**</td>
<td>.334**</td>
<td>.175*</td>
</tr>
</tbody>
</table>

P < 0.01

Discussion of Results

Types of organisational culture and forms of employees’ commitment exhibited

From the results, the dominant type of OC culture in the study area is the power culture with MS of 3.73. Closely following is the task culture which has MS of 3.72. This is inconsistent with the findings of Zhang and Liu (2006) that find role culture (hierarchy culture) dominant in the Chinese construction enterprises. However, the results seem to be consistent with the present situation of the Nigerian construction industry which calls for informed directives, goal getting, quick response and control. Zhang and Liu (2006) reflecting Brown (1998) note that three important factors shape the culture of an organisation namely: the societal or national culture within which an organisation functions; the vision, management style and personality of the founding father of an organisation and the type of business an organisation does; and the nature of its business environment.

With more than a decade of democratic rule and reforms there appears to be increased competition in the Nigerian construction industry which, in turn, reflects the power culture of majority of construction companies. It is therefore not surprising that power culture dominates the organisational landscape of the construction companies in Lagos, Nigeria. The leader in a power-culture-oriented company is directive, goal oriented and emphasises short-term accomplishment and control of work process (Maloney and Federle, 1991). The second dominating culture, task culture, suggests that innovation and risk-taking spirits are being embraced by some construction companies. This is consistent with the economic situation in the country.

The poor overall rating of people culture suggests that concerned and supportive spirit that permits a leader to be mentor and facilitator is virtually absent among the construction companies. This is also in contrasts with the findings of Zhang and Liu (2006) which shows people culture as the second dominating culture of the Chinese construction enterprises. Many construction companies in Nigeria are not disposed to having people culture mainly because of its hindrance to management practices of hiring and firing at will. The large number of unemployed and the ease with which recruitment can be done afford the construction companies the opportunity to hire and fire at will. In addition they are not interested in human capital development which is one of the characteristics of the people culture (Cameron and Quinn, 1999).

The role culture leader functions as a monitor. He ensures that procedures are followed and he collects information on the performance of his subordinates and
utilises technical knowledge to confirm their subordinates’ performance (Maloney and Federle, 1991). The findings from this research contrasts sharply with the findings of Zhang and Liu (2006) which reveals role culture as the dominant culture in the Chinese construction enterprises. This not unusual as virtually all the construction companies are privately owned and they abhor bureaucracy (red tape).

Generally, there is variation based on the size of company in the type of culture being exhibited. In the SSCC, task culture predominates. This type of culture is generally associated with small-sized companies (Rashid, Sambasivan and Johari, 2003). Hence, the SSCC can be described as dynamic, entrepreneurial and creative (Berrio, 2003). The binding force among the SSCC employees would most likely be a commitment to experimentation and freedom of thought. This is consistent with the views expressed by Tharp (2009) that experimentation and thinking differently is a unifying force of employees in the small companies.

In the MSCC, role culture is predominant. This could be attributed to the need to have formal laid down rules and procedures to govern business conduct as well as the behaviour of their employees (Zhang and Liu, 2006). This suggests that the MSCCs are concerned with stability, predictability and efficiency in the long term (Cameron and Quinn, 1999). Hence managers in such companies are expected to be seen as good coordinators and organizers having efficiency at the back of their mind (Tharp, 2009). Of course, experience has shown that this is the case with most MSCCs. However, the finding is inconsistent with the findings of Rashid, Sambasivan and Johari (2003) that medium-sized companies are associated with task culture.

The LSCC favours the power culture possibly due to its appropriateness for its large size and the superior performance of power culture to other types of culture. The preference of power culture to other types of culture could be explained in the context of attainment of business development maturity level. Hence they need not only to prospect and maintain customer relationships but also put in place business development entrepreneurship. Organisations operating power culture greatly value productivity and efficiency as end result (Buckner and Williams, (1995). Such companies are equally competitive and success means market share and penetration (Tharp, 2009). These attributes are evident in the ways and manners the few LSCCs in Nigeria conduct their businesses which make them the preferred choice in contract award.

In terms of commitment, the employees in the sample construction companies appear to exhibit the three forms of commitment but the normative form of commitment predominates in all the companies irrespective of the type of culture being operated. This is not in agreement with Rashid, Sambasivan and Johari, (2003) that find affective commitment as the most dominant form of commitment in Malaysian companies as against being the second most dominant in this study. One observable reason why normative commitment is prevalent in the industry is because many construction employees are engaged informally through links from the family members and friends. They therefore feel obligated or considered it morally appropriate based on their personal beliefs and values to stay with their companies.

**Relationship between the dimensions of organisational culture and forms of employees’ commitment**

The correlation analysis reveals that 83.3% (5 out of 6) and 66.7% (4 out of 6) of the dimensions organisational culture are positively correlated with normative and
continuance commitment respectively. However all the dimensions (100%) are positively correlated with affective commitment at $p < 0.01$. This is in accord with Dunham, Grube and Castaneda (1994) that the level of employees’ affective commitment in organisations is stronger than both continuance and normative commitment.

**Relationship between the types of organisational culture and forms of employees’ commitment**

It is necessary to know which form of employees’ commitment should be expected in each of the organisational culture types. Table 6 shows that all the types of organisational culture are positively correlated with the three forms of employees’ commitment. People culture is more positively related to affective commitment than normative and continuance which is in agreement with Rashid, Sambasivan and Johari (2003) that find affective commitment positively related to consensual (people) culture. This means that affective commitment could be expected in organisations running people culture. Values like loyalty and team work which is associated with this type of culture encourages this type of commitment. However, the positive correlation between people culture and normative and continuance commitment negates the findings of Rashid, Sambasivan and Johari (2003) which reveals negative relationship. This could be due to environmental and socio-cultural factors in the study areas.

The task culture is more positively related to affective commitment than with normative and continuance commitment. Rashid, Sambasivan and Johari (2003) find that task culture is negatively correlated with affective commitment but more positively related to continuance commitment than normative commitment. There is therefore no agreement between the two findings. The study shows that employees in task-culture oriented companies tend to exhibit affective commitment than normative and continuance commitment. Where normative commitment is more pervasive than the other two forms of commitment, values in task culture such as creativity, risk taking and commitment to innovation could be responsible for the emotional attachment of the employees to the companies.

The power culture (competitive Culture) is more positively related to continuance commitment than others. This validates Rashid, Sambasivan and Johari (2003) findings in part and contrasts it in part that negative relationship exist between power culture and affective commitment and that no relationship exist between it and normative commitment. This implies that in power culture, continuance commitment should be expected. The result indicates that employees who exhibit continuance commitment remain in the power-culture oriented company due to the cost associated with leaving the company and also to values in the power culture that relate to competitive advantage and profits (Cameron and Quinn, 1999). The results further show that the employees would stay with the company as a matter of necessity and not based on emotional factors. This means that managers need to focus attention on boosting the morale of the employees including their dedication to work so as to make them emotionally attached (Rashid, Sambasivan and Johari, 2003) in order to improve performance.

In role culture, affective commitment appears most correlated. This runs contrary to Rashid, Sambasivan and Johari, (2003) that find no relationship between role culture (bureaucratic culture) and the three forms of commitment. Values in role culture like cooperation, traditions and; formal rules and policies would influence the employees
to be emotionally attached to companies that operate this type of culture. Alternative to this affective commitment is the normative type of commitment which can bring about the same results if properly channeled. Therefore either types of commitment can be cultivated in role-culture oriented companies.

CONCLUSIONS

The results show that majority (80.8%) of the construction companies in Lagos is small and medium-sized; and they exhibit different types of organisational culture with all the three forms of employees’ commitment. The type of culture exhibited is dictated by the size of construction companies. The results further reveal that power culture and normative commitment are dominant as they ranked first respectively in overall ranking. A relationship which contrast in some respect with previous findings has also been established between organisational culture and employees’ commitment. This relationship has some implications for the management of construction companies as it directs attention to how to develop and motivate employees. The results further reveal that power culture and normative commitment are dominant as they ranked first respectively in overall ranking. A relationship which contrast in some respect with previous findings has also been established between organisational culture and employees’ commitment. This relationship has some implications for the management of construction companies as it directs attention to how to develop and motivate employees. The results further reveal that power culture and normative commitment are dominant as they ranked first respectively in overall ranking. A relationship which contrast in some respect with previous findings has also been established between organisational culture and employees’ commitment. This relationship has some implications for the management of construction companies as it directs attention to how to develop and motivate employees.

Since power culture is the dominant culture in the industry most employees will exhibit continuance commitment. This is consistent with the present situation in the construction industry in the study area which calls for informed directives, goal getting, quick response and control. The results suggest that leadership in most of the construction companies is directive, goal oriented and emphasises short-term accomplishment and control of work schedule with little or no supportive spirit. The second most dominant culture, the task culture which was ranked 2nd, suggests that innovation and risk-taking spirits are being embraced by some construction companies. This is also consistent with the economic situation in Lagos as the hub of commercial activities in the country.

Leaders in the construction companies seem not to have concerned and supportive spirit that permits a leader to be mentor and facilitator since people culture is relegated to the background as it ranked 4th. Anecdotal evidence has shown that many construction companies in Lagos are not disposed to having people culture mainly because of its hindrance to management practices of wilful ‘hire and fire’. This is because there is large pool of unemployed hands in the labour market. Hence they are not interested in human capital development which is one of the characteristics of the people culture.

The results of the study have also provided important implications on the relationship between organisational culture and employees’ commitment. The results show that employees in the sample construction companies appear to exhibit all the three forms of commitment but the normative form of commitment predominates in all the companies irrespective of the type of culture being operated and the size. Affective commitment is more related to people, task and role culture than normative and continuance commitment meaning that affective commitment should be expected in organisations running people, task and role culture. Regarding power culture, continuance commitment is more related implying that this type of commitment should be expected in any company that is power-culture oriented.
RECOMMENDATIONS

Consequent upon the findings that majority (80.8%) of the construction companies in Nigeria is small and medium-sized, and characterised by various types organisational culture, there is need to encourage mergers among the construction companies in order to foster positive synergy that will reduce cultural variability and impact more positively on employees commitment. People culture and affective commitment should be cultivated by the management of construction companies. This may be achieved by showing concern for the employees, providing them an environment that is supportive and fair where they would feel that their contributions are important, their needs are satisfied and their expectations met. These would make them develop productive behaviours and have emotional attachment to the organization. Since certain types of organisational culture are more related to certain forms of commitment, management of construction companies should audit the extant organisational culture and employees’ commitment in order to determine compatibility, and if not compatible, a process of culture change should be initiated followed by installation and maintenance of the new culture.

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Abiola-Falemu


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INVESTIGATION INTO THE COSTS OF PRELIMINARIES AND RELATIONSHIP BETWEEN THESE COSTS AND TOTAL COST OF BUILDING PROJECTS

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This study investigates the costs of preliminaries and their relationship with the total cost of building projects. Bill of Preliminaries is made up of components and items of work and it describes the work the contractor shall do in order to carry out the actual construction work successfully. The study set out to find out the extent of pricing of the components and items in the bill of preliminaries and whether there is any relationship between the cost of preliminaries and the total costs of building projects. Questionnaires were designed and administered to respondents who are mainly consultants in the construction industry. Priced bills of quantities for projects were also collected to get data for this study. Data collected from the questionnaires and the priced bills of quantities were analyzed using descriptive statistics and Pearson correlation. The result of the study shows that only about 21 and 13 percent of the components and items of preliminaries in the bill of quantities respectively are priced; most of the contractors priced the bill of preliminaries rather than insert lump sum or percentage of the cost of the project. The location and nature of the site of the project rank first and second respectively among factors affecting the nature and extent of pricing of preliminaries and it reveals that water for works, temporary store/workshop temporary office, lighting/security as well as scaffold/plants in that order are the frequently priced components of preliminaries. The study finally concludes that there is high correlation between total costs of projects and costs of preliminaries and this correlation is very high for high rise building project. The study therefore recommends that only the components and items of Preliminaries relevant to the proposed projects are included in the preliminaries bill in order to reduce the volume of computer and paper work and save time and cost. It is also recommended that pricing of preliminaries should be properly done by pricing all the relevant items in preliminaries bills so that contracting organizations do not loose money due to non-pricing of these items.

Key words: Cost, Preliminaries, relationship components and items.

INTRODUCTION AND NEED FOR THE STUDY

Bills of quantities are documents which are used to obtain competitive bids for project execution. When one of the bids is accepted, the cost therein then form the total cost of procurement of such project. One of the major contents of a typical bill of quantities is the preliminaries. Preliminaries normally form Bill No 1 in a typical bill of quantities produced in Nigeria. The preliminaries form a substantive volume in a

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typical bill of quantities. The cost of preliminaries could be substantive too depending on the nature and type of project.

Preliminaries are made up of components and items of work just as the main portion of the bill of quantities covering the actual construction project to be carried out. However, preliminaries items do not have quantities and units as the items under the components in the main portion of the bills of quantities. The components and items of preliminaries only describe what the contractor shall do in order to carry out the actual construction work successfully. The components are the sub-headings and the items are various work description to be carried out. For example “water for the work” as a component of preliminaries may have three items of work such as (i) providing all the water required (ii) executing all temporary arrangement for plumbing and (iii) ensuring all necessary application and paying all fees for water supply. The Contractor is expected to price these items of work in the main bills. It is the cost of preliminaries together with the cost of the actual construction work which make up the total cost of the building project.

Jagboro (1989) confirmed that preliminaries costs are included in the bill of quantities on lump sum basis and this poses particular problems for valuation purposes. The lump sum pricing is problematic to valuation because some of the items under preliminaries are time related and others are work related. So if they are not individually priced, it would be difficult for the consultant to carry out realistic valuation of preliminaries by relating these items which are time related and value related to the time spent on the work and the value of main work carried out respectively.

The bills of preliminaries used for most projects are often standardized ones containing voluminous items of works and their descriptions some of which may not be directly or indirectly relevant to the project at hand. These items of preliminaries works are not individually priced (Jagboro 1989) and experience has shown that when they are priced, only some items are considered.

The study will help consultants involved in preparation of contract documents especially the bill of preliminaries to know those components and items which are mostly considered and priced and those which are not relevant and cost sensitive. This will help in deleting these components and items not relevant to some projects and not usually considered by contractors when pricing bill of preliminaries. This in turn will reduce the computer and paper work during the preparation of bill of preliminaries rather than just adopting a standardized bill of preliminaries for all projects. Establishing relationship between the cost of preliminaries and the total cost of building project will help in estimating the cost of preliminaries during the preparation of the preliminary estimate for proposed projects for purpose of budgets. It is on the light of above that this study is set out to examine the cost of preliminaries in bills of quantities, how these costs are arrived at and the relationship if any between this cost and the total cost of building project in Nigeria.

AIM AND OBJECTIVES OF THE STUDY

The study is set out to assess costs of the preliminaries and the relationship between these costs and the total costs of building projects. In order to accomplish this, the following objectives were established.

To find out the extent of pricing of the components and items in the preliminaries bill.
(2) To find out whether there is any relationship between the costs of preliminaries and the total costs of building projects.

Components of Preliminaries

Before, commencement, during and immediately after, the actual construction work in a project, some operations are carried out within and without the site of the project which cannot be directly linked to any of the construction elements of the project. These operations are referred to as preliminaries. Preliminaries are made up of components and these components are further sub-divided into items of work which the contractor is expected to carry out in the cause of executing the actual construction work. A cursory look at the Bill of Quantities produced in Nigeria shows that on average a typical Bill of Quantities has 86 components including general clauses. These components have 145 items on average. Some of the major components of the preliminaries include the following:

Protection of person and property.
Precautions for prevention of Nuisance trespass etc.
Noise Control
Prevention of spoil dump
Temporary offices for consultants
Programme / Progress schedule
Plants, Tools, Vehicles
Site meeting
Temporary storage accommodation
Temporary offices for contractor
Temporary mess rooms
Temporary fencing, hoarding, screens and Gantries
Scaffolding and Plant
Safety, health and welfare of work people
First Aid Box
Watching and Lighting
Protection of Public/Private Services
Test and Samples
Records
Setting out
Progress photograph
Site name Board
Defects after completion
As built drawing for record
Water for the Works
Temporary Lighting and power for works
Fire precaution
Temporary storm water drainage
Foreman-in-charge
Insurance to person/ property
Insurance of works
Commissioning
Removing rubbish and clearing on completion.
Handover of completed work

It is important to note that some of the components have more than one or two items while some have only one item.

**COST OF PRELIMINARIES**

The cost of Preliminaries as defined by CIOB Code of Estimating Practice is the cost of administering a project and providing general plant, site staff, facilities and site base services and other items not included in the rates of items in the main bill of quantities. The process of arriving at this cost for a project probably requires more judgment than any other cost area in a project. It requires that one has a clear understanding of what costs have been allowed within the various rates in the measured work items in the main bill, what general costs will be required to run the site and what costs are allowed for within overheads. Experience has shown that there are no clear cut distinctions in the costs in many organizations. As a result of this accurate pricing of preliminaries could be difficult.

For preliminaries to be accurately priced one should be able to predict and cost how a project will turn out including allowances for solving problems that will be incurred. As a result of this some contractors may allow a percentage of the total cost of the main work for preliminaries (or lump sum) based on experience on previous projects. Dagy (2010) confirmed that, the percentage varies from 4.5% for a specialist organization tendering for a large new project to 9.5% for a new housing project. It is the author’s belief that this percentage approach can be prone to risk for inexperience contractors who lack an understanding of the cost involved. This is so because the percentage used may not cover the actual cost of preliminaries and in some cases it may be too high thereby making the tender sum not to be competitive.

The accurate pricing of the preliminaries requires that the contractors anticipate all those general site costs associated with a project as this is not always given attention for the rates used for measured work. Generally speaking the more difficult a project is to manage the higher the cost of preliminaries will be and many of these difficulties and cost associated with it are reflected in project particulars.

Pricing of Preliminaries should follow a three step approach as recommended by Dagy (2010). The approach will in no small measure help to understand costs of preliminaries and any relationship between it and the cost of projects and other project parameters such as risk, profitability duration and cash flow of the project. The first step is to understand the known key factors relating to the project and carefully calculating their costs. The key factors are the ones that will definitely be incurred. The second step is to consider and cost the commercial factors. This is more difficult
factor in pricing preliminaries as there is need to balance the risk and reward against the likelihood of securing the work. This will depend upon the desire to secure the work and suitability and prestige of the work. The last step is to consider how these costs and risks are to be allowed for within the tender to be submitted. And this may be one of the reasons some items of preliminaries are not even priced by some contractors.

Experience has shown that for first step approach in arriving at cost preliminaries, contractors most commonly separate their costs of preliminaries items into three cost areas namely set up costs i.e. the initial cost involved in starting up the site, fixed cost i.e. the on/off cost of moving plant and variable costs i.e. any cost that is relative to time or value such as management, site huts etc. this helps to provide user with significant information about how variations to the duration and value of the project can affect the cost of project, as well as the risk, profitability and cash flow of the project.

**RESEARCH METHOD**

The questionnaire was the main instrument for data collection in this study. This was supported with physical inspection and abstraction of information from the preliminaries Bills of Contract bills of Quantities for different projects. The questionnaires were administered to consulting and contracting Quantity Surveyors in Nigeria using convenience sampling technique. The data collected were analysed using frequency counts, mean item scores and tables where necessary.

<table>
<thead>
<tr>
<th>Population</th>
<th>Number Sent</th>
<th>Number Returned</th>
<th>Rate of Response %</th>
</tr>
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<tbody>
<tr>
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<td>18</td>
<td>90</td>
</tr>
<tr>
<td>Contracting Quantity Surveyors</td>
<td>20</td>
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<td>60</td>
</tr>
<tr>
<td>Total</td>
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</table>

Table 2. Experience of Respondents

<table>
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<th>Years</th>
<th>Frequency (F)</th>
<th>X</th>
<th>FX</th>
<th>Mean</th>
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</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>0</td>
<td>2.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5 – 10</td>
<td>2</td>
<td>7.5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>10 – 15</td>
<td>10</td>
<td>12.5</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>15 – 20</td>
<td>7</td>
<td>17.5</td>
<td>122.5</td>
<td></td>
</tr>
<tr>
<td>Over 20</td>
<td>11</td>
<td>22.5</td>
<td>247.5</td>
<td>17 years</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>510</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DATA ANALYSIS, FINDING AND DISCUSSION**

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency (F)</th>
<th>X</th>
<th>FX</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>9</td>
<td>2.5</td>
<td>22.50</td>
<td></td>
</tr>
<tr>
<td>5 – 10</td>
<td>13</td>
<td>7.5</td>
<td>97.50</td>
<td></td>
</tr>
<tr>
<td>10 – 15</td>
<td>5</td>
<td>12.5</td>
<td>62.50</td>
<td></td>
</tr>
<tr>
<td>15 – 20</td>
<td>3</td>
<td>17.5</td>
<td>52.50</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>235</td>
<td>7.83</td>
<td></td>
</tr>
</tbody>
</table>
Table 4 – Ways of Arriving at Cost of Preliminaries in Bill of Quantities

<table>
<thead>
<tr>
<th>Approach</th>
<th>Frequency</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing each item in Preliminaries Bill</td>
<td>17</td>
<td>56.7</td>
</tr>
<tr>
<td>Using Percentage of Total Cost of Work</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>Lump Sum Approach base on Experience</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

From Table 3 above each respondent handled an average of 8 projects within the past five years of their operations.

On the issue of methods or ways of arriving at the cost of preliminaries in the Bills of Quantities, Table 4 shows that 56.70 percent of the respondents price relevant items in the preliminaries Bill while 23.3 and 20.0 percent used lump sum approach and certain percentage of the total cost of the main work respectively. Tables 5 and 6 shows the extent of pricing of components and items in the Preliminaries bill. The results show that on average there are 85 components and 150 items of preliminaries in Bill of Quantities. Of these, only 21 and 13 percent of these numbers of components and items respectively are priced.

Table 5 – Extent of Pricing of Preliminaries Components in Bills of Quantities

<table>
<thead>
<tr>
<th>Bill of Quantities</th>
<th>No. of Component</th>
<th>Preliminaries</th>
<th>No. of Preliminaries Component Priced</th>
<th>% of Preliminaries Component Priced</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOQ A</td>
<td>85</td>
<td>18</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>BOQ B</td>
<td>87</td>
<td>18</td>
<td>20.69</td>
<td></td>
</tr>
<tr>
<td>BOQ C</td>
<td>84</td>
<td>16</td>
<td>19.05</td>
<td></td>
</tr>
<tr>
<td>BOQ D</td>
<td>82</td>
<td>16</td>
<td>19.51</td>
<td></td>
</tr>
<tr>
<td>BOQ E</td>
<td>80</td>
<td>16</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>BOQ F</td>
<td>72</td>
<td>16</td>
<td>22.22</td>
<td></td>
</tr>
<tr>
<td>BOQ G</td>
<td>88</td>
<td>18</td>
<td>20.45</td>
<td></td>
</tr>
<tr>
<td>BOQ H</td>
<td>88</td>
<td>20</td>
<td>22.73</td>
<td></td>
</tr>
<tr>
<td>BOQ I</td>
<td>85</td>
<td>18</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>BOQ J</td>
<td>85</td>
<td>18</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>BOQ K</td>
<td>86</td>
<td>19</td>
<td>22.09</td>
<td></td>
</tr>
<tr>
<td>BOQ L</td>
<td>84</td>
<td>16</td>
<td>19.05</td>
<td></td>
</tr>
<tr>
<td>BOQ M</td>
<td>84</td>
<td>18</td>
<td>21.43</td>
<td></td>
</tr>
<tr>
<td>BOQ N</td>
<td>90</td>
<td>20</td>
<td>22.22</td>
<td></td>
</tr>
<tr>
<td>BOQ O</td>
<td>85</td>
<td>18</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>BOQ P</td>
<td>87</td>
<td>16</td>
<td>18.39</td>
<td></td>
</tr>
<tr>
<td>BOQ Q</td>
<td>84</td>
<td>18</td>
<td>21.43</td>
<td></td>
</tr>
<tr>
<td>BOQ R</td>
<td>85</td>
<td>18</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>BOQ S</td>
<td>85</td>
<td>20</td>
<td>23.53</td>
<td></td>
</tr>
<tr>
<td>BOQ T</td>
<td>87</td>
<td>20</td>
<td>22.99</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1693</td>
<td>357</td>
<td>421.80</td>
<td></td>
</tr>
<tr>
<td>Average Components</td>
<td>84.65</td>
<td>17.85</td>
<td>21.09</td>
<td></td>
</tr>
</tbody>
</table>
Table 6 – Extent of Pricing of Preliminaries Items in Bills of Quantities

<table>
<thead>
<tr>
<th>Bill of Quantities</th>
<th>No of Preliminaries Items</th>
<th>No. of Preliminaries Items Priced</th>
<th>% of Preliminaries Items Priced</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOQ A</td>
<td>173</td>
<td>23</td>
<td>13.29</td>
</tr>
<tr>
<td>BOQ B</td>
<td>145</td>
<td>19</td>
<td>13.10</td>
</tr>
<tr>
<td>BOQ C</td>
<td>145</td>
<td>18</td>
<td>12.41</td>
</tr>
<tr>
<td>BOQ D</td>
<td>173</td>
<td>23</td>
<td>13.29</td>
</tr>
<tr>
<td>BOQ E</td>
<td>170</td>
<td>23</td>
<td>13.53</td>
</tr>
<tr>
<td>BOQ F</td>
<td>136</td>
<td>18</td>
<td>13.24</td>
</tr>
<tr>
<td>BOQ G</td>
<td>172</td>
<td>23</td>
<td>13.37</td>
</tr>
<tr>
<td>BOQ H</td>
<td>145</td>
<td>20</td>
<td>13.79</td>
</tr>
<tr>
<td>BOQ I</td>
<td>145</td>
<td>20</td>
<td>13.79</td>
</tr>
<tr>
<td>BOQ J</td>
<td>130</td>
<td>18</td>
<td>13.85</td>
</tr>
<tr>
<td>BOQ K</td>
<td>136</td>
<td>18</td>
<td>13.24</td>
</tr>
<tr>
<td>BOQ L</td>
<td>130</td>
<td>18</td>
<td>13.85</td>
</tr>
<tr>
<td>BOQ M</td>
<td>130</td>
<td>19</td>
<td>14.62</td>
</tr>
<tr>
<td>BOQ N</td>
<td>173</td>
<td>23</td>
<td>13.29</td>
</tr>
<tr>
<td>BOQ O</td>
<td>173</td>
<td>18</td>
<td>13.24</td>
</tr>
<tr>
<td>BOQ P</td>
<td>173</td>
<td>18</td>
<td>10.40</td>
</tr>
<tr>
<td>BOQ Q</td>
<td>136</td>
<td>18</td>
<td>13.24</td>
</tr>
<tr>
<td>BOQ R</td>
<td>130</td>
<td>19</td>
<td>14.61</td>
</tr>
<tr>
<td>BOQ S</td>
<td>136</td>
<td>18</td>
<td>13.24</td>
</tr>
<tr>
<td>BOQ T</td>
<td>145</td>
<td>19</td>
<td>13.10</td>
</tr>
<tr>
<td>Total</td>
<td>2996</td>
<td>398</td>
<td>265.60</td>
</tr>
<tr>
<td>Average Components</td>
<td>149.80</td>
<td>19.90</td>
<td>13.28</td>
</tr>
</tbody>
</table>

Table 7 – Descriptive Statistics of Factors which affect the nature and extent of pricing of Preliminary bills

<table>
<thead>
<tr>
<th>Factors</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>The consultant for the project</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>2.43</td>
<td>1.104</td>
<td>6</td>
</tr>
<tr>
<td>The type of client for the project</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.97</td>
<td>.964</td>
<td>5</td>
</tr>
<tr>
<td>Nature of Project</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>3.97</td>
<td>.809</td>
<td>3</td>
</tr>
<tr>
<td>Nature of the site of the project</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.27</td>
<td>.828</td>
<td>2</td>
</tr>
<tr>
<td>Location of the project</td>
<td>30</td>
<td>3</td>
<td>5</td>
<td>4.33</td>
<td>.802</td>
<td>1</td>
</tr>
</tbody>
</table>
Inyang-Udoh

Table 8 – Descriptive Statistics of Frequency of Pricing the components of preliminaries in the Preliminary bills

<table>
<thead>
<tr>
<th>Preliminaries</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>project/contract details, works goods and materials by other, partied obligations and liabilities, etc.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.80</td>
<td>1.031</td>
<td>25</td>
</tr>
<tr>
<td>control of noise pollution</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>2.10</td>
<td>.923</td>
<td>24</td>
</tr>
<tr>
<td>Traffic regulation</td>
<td>30</td>
<td>1</td>
<td>3</td>
<td>2.30</td>
<td>.596</td>
<td>23</td>
</tr>
<tr>
<td>Schedules, charts progress</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.40</td>
<td>1.221</td>
<td>22</td>
</tr>
<tr>
<td>Record drawings/As built drawings</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.50</td>
<td>1.280</td>
<td>21</td>
</tr>
<tr>
<td>Handover</td>
<td>29</td>
<td>1</td>
<td>5</td>
<td>2.55</td>
<td>1.325</td>
<td>20</td>
</tr>
<tr>
<td>Commission</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.60</td>
<td>1.221</td>
<td>19</td>
</tr>
<tr>
<td>Temporary telephone</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.67</td>
<td>.959</td>
<td>18</td>
</tr>
<tr>
<td>Statutory compliance</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>2.93</td>
<td>.907</td>
<td>17</td>
</tr>
<tr>
<td>Temporary roads, land standing/crossing</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>3.20</td>
<td>.847</td>
<td>16</td>
</tr>
<tr>
<td>Progress Photograph and reports</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>3.30</td>
<td>1.022</td>
<td>15</td>
</tr>
<tr>
<td>Protection of works</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>3.50</td>
<td>1.075</td>
<td>14</td>
</tr>
<tr>
<td>Testing and samples of materials</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>3.90</td>
<td>.845</td>
<td>13</td>
</tr>
<tr>
<td>Removal of rubbish, debris</td>
<td>30</td>
<td>3</td>
<td>5</td>
<td>3.97</td>
<td>.669</td>
<td>12</td>
</tr>
<tr>
<td>Insurance</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.03</td>
<td>.669</td>
<td>11</td>
</tr>
<tr>
<td>Electricity for works</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.07</td>
<td>.944</td>
<td>10</td>
</tr>
<tr>
<td>Safety, health and welfare</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>4.23</td>
<td>.935</td>
<td>9</td>
</tr>
<tr>
<td>Clearing and cleaning</td>
<td>30</td>
<td>3</td>
<td>5</td>
<td>4.30</td>
<td>.750</td>
<td>7</td>
</tr>
<tr>
<td>Plant, tools and vehicles</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.30</td>
<td>.837</td>
<td>7</td>
</tr>
<tr>
<td>Site Administration</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.33</td>
<td>.758</td>
<td>5</td>
</tr>
<tr>
<td>Scaffolding</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.33</td>
<td>.884</td>
<td>5</td>
</tr>
<tr>
<td>Lightening and security</td>
<td>30</td>
<td>3</td>
<td>5</td>
<td>4.47</td>
<td>.571</td>
<td>3</td>
</tr>
<tr>
<td>Temporary office accommodation</td>
<td>30</td>
<td>2</td>
<td>5</td>
<td>4.47</td>
<td>.730</td>
<td>3</td>
</tr>
<tr>
<td>Temporary store and workshop</td>
<td>30</td>
<td>3</td>
<td>5</td>
<td>4.57</td>
<td>.568</td>
<td>2</td>
</tr>
<tr>
<td>water for works</td>
<td>30</td>
<td>4</td>
<td>5</td>
<td>4.87</td>
<td>.346</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 10 – Relationship between Total Cost of Project and Cost of Preliminaries for High rise Building.

<table>
<thead>
<tr>
<th>S/N</th>
<th>TOTAL PROJECT COST</th>
<th>COST OF PRELIMINARIES</th>
<th>GRA M²</th>
<th>PROJECT COST PER METER</th>
<th>COST OF PRELIMINARIES PER M²</th>
<th>% OF PRELIMINARIES TO PROJECT COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>287,450,000.00</td>
<td>8,607,000.00</td>
<td>1874</td>
<td>153,388.47</td>
<td>4,592.85</td>
<td>2.99</td>
</tr>
<tr>
<td>2</td>
<td>212,543,878.00</td>
<td>8,094,331.00</td>
<td>3845</td>
<td>55,277.99</td>
<td>2,105.16</td>
<td>3.81</td>
</tr>
<tr>
<td>3</td>
<td>131,683,922.94</td>
<td>5,109,397.00</td>
<td>2451</td>
<td>53,726.61</td>
<td>2,084.62</td>
<td>3.88</td>
</tr>
<tr>
<td>4</td>
<td>125,327,603.53</td>
<td>1,733,938.00</td>
<td>2511</td>
<td>49,911.43</td>
<td>690.54</td>
<td>1.38</td>
</tr>
<tr>
<td>5</td>
<td>926,795,078.78</td>
<td>56,061,236.00</td>
<td>6888</td>
<td>134,552.13</td>
<td>8,138.97</td>
<td>6.05</td>
</tr>
<tr>
<td>6</td>
<td>3,600,000,00.00</td>
<td>155,000,000.00</td>
<td>9500</td>
<td>378,947.37</td>
<td>16,315.79</td>
<td>4.31</td>
</tr>
<tr>
<td>7</td>
<td>705,600,000.00</td>
<td>40,280,000.00</td>
<td>4410</td>
<td>160,000.00</td>
<td>9,133.79</td>
<td>5.71</td>
</tr>
<tr>
<td>8</td>
<td>210,635,920.80</td>
<td>5,000,000.00</td>
<td>1284</td>
<td>164,046.67</td>
<td>3,894.08</td>
<td>2.37</td>
</tr>
<tr>
<td>9</td>
<td>650,889,000.00</td>
<td>37,506,805.00</td>
<td>5040</td>
<td>129,144.64</td>
<td>7,441.83</td>
<td>5.76</td>
</tr>
<tr>
<td>10</td>
<td>499,865,606.00</td>
<td>24,670,060.00</td>
<td>4040</td>
<td>123,729.11</td>
<td>6,106.45</td>
<td>4.94</td>
</tr>
</tbody>
</table>

TOTAL AVERAGE

|   |   | 140,272.44 | 6,050.41 | 4.12 |

Preliminaries
Correlations

<table>
<thead>
<tr>
<th></th>
<th>Project Cost per m²</th>
<th>Cost per Preliminaries Cost per m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Cost per m²</td>
<td>Pearson Correlation</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.914**</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>10</td>
</tr>
<tr>
<td>Preliminaries Cost per m²</td>
<td>Pearson Correlation</td>
<td>.914**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>10</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

\[ r(10) = .914, \ p < .01 \] this shows that there is high correlation between cost of projects and their preliminaries cost.
Table 9 – Relationship between Total Cost of Project and Cost of Preliminaries for Low rise Building.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>TOTAL PROJECT COST</th>
<th>COST OF PRELIMINARIES</th>
<th>GRA M²</th>
<th>PROJECT COST PER METER</th>
<th>PRELIMINARIES COST PER M²</th>
<th>% OF PRELIMINARIES TO PROJECT COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>406,015,000.07</td>
<td>10,000,000.00</td>
<td>1807</td>
<td>224,690.09</td>
<td>5,534.03</td>
<td>2.46</td>
</tr>
<tr>
<td>2</td>
<td>1,254,050,100.00</td>
<td>21,850,000.00</td>
<td>20213</td>
<td>62,041.76</td>
<td>1,080.99</td>
<td>1.74</td>
</tr>
<tr>
<td>3</td>
<td>139,845,871.50</td>
<td>4,000,000.00</td>
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Inyang-Udoh

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**Total**

| Average | 102,878.40 | 4,987.80 | 5.13 |

**Low rise Building**

Correlations

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**Correlations**

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**Correlations**

**Correlations**

- Correlation is significant at the 0.01 level (2-tailed).

\[
r(52) = 0.653, p < .01\]

This shows that there is a high correlation between the cost of projects and their preliminaries cost.
This outcome is not expected but the reason for this may not be unconnected with the fact that some of the cost of components and items not priced in preliminaries bills are embedded in the unit rates in the main bills. For examples in the pricing of concrete in suspended floor slabs, water may be considered as an ingredient of unit rate for concrete and other water required items and hence water for work items in bill of preliminaries may not be priced.

Table 7 shows the descriptive statistics of factors which affect the nature and extent of pricing of preliminaries in the bill of quantities. Location of the project and nature of the site of the project are ranked first and second respectively while the consultants handling the project are considered last by the contractors. Table 8 shows the frequency of pricing of the various components of preliminaries in the bills by the contractors. The result of the analysis show that Water for works, Temporary store and workshop, temporary office accommodation, light and security are frequently priced in that order while preliminaries particular – project/contract details is considered last. These outcomes show the importance attached to these factors and the components of preliminaries for all projects by the contractors.

In finding out whether there is a relationship between the costs of preliminaries and the total cost of projects, the data obtained i.e. total project costs, costs of preliminaries and gross floor area (m²) of all the project were analysed as shown in Table 9 and 10 respectively. Figure 9 deals with low rise while Table 10 deals with high rise buildings. Fifty two projects and ten projects were considered for low rise and high rise respectively.

For low rise building the result shows that on average cost of preliminaries is about 5.13% of the total cost of projects and using Pearson correlation 2 – tailed test shows that there is a high correlation between Total Cost of Projects and their preliminaries cost. For the high rise, the table 10 shows that preliminaries cost is average 4.12% of total cost and using Pearson correlation 2 – tailed test shows that there is also high correlation between the two costs.

CONCLUSION AND RECOMMENDATION

From the results of the various analysis carried on this study the following conclusions are drawn. The number of components and items of preliminaries priced in any given bill of quantities are relatively small. Only about 21 and 13 percent of the components and items of preliminaries in the bills of quantities respectively are priced by contractors. Most of the contractors priced the preliminaries bills rather than insert lump sum or percentage of the total cost of work.

The study also reveals that location of the project and the nature of the site of the project as well as nature of the project are factors that affect the nature and extent of pricing of preliminaries in that order; and that water for works, temporary store and workshop, temporary office, lighting and security as well as scaffold and plants are the frequently priced components of preliminaries in that order.

The study also concludes that there is high correlation between total costs of projects and the costs of preliminaries and this correlation is very high for high rise building projects.

In view of the fact that only very few components and items of preliminaries are priced in the bills of quantities, there is need to ensure that only the components and items of preliminaries relevant to the proposed projects are included in the bill of
quantities. This would reduce the volume of computer and paper work and save time and cost.

Estimators and those involve in pricing of bills of quantities should be properly trained and exposed in the pricing of preliminaries with a view to pricing all the relevant components and items in the preliminaries bills so that contracting organizations do not loose money due to non pricing these items.

REFERENCES


Butterworth-Heinemann


Lagos: Fancy Publication


IS THE QUALITY OF CEMENT A CONTRIBUTING FACTOR FOR BUILDING COLLAPSE IN GHANA?

Humphrey Danso¹ and Isaac Boateng²
School of Civil Engineering and Surveying, University of Portsmouth, United Kingdom

Sub-standard (poor quality) materials have been mentioned as one of the major causes of building collapse worldwide. The main materials mostly identified as sub-standard are cement, reinforcement bars, timber and aggregate. This Paper assesses whether the quality of Type I Portland cement use in Ghana contribute to the recent building collapse in Accra and Kumasi. This was achieved through experimental study by comparing the properties of Ghana cement with that of UK cement. The study found that the dry density of Ghana Grey cement was higher than both the UK Grey and UK White cements. Furthermore, the Ghana Grey cement performed better in resistance to water absorption than UK Grey cement, while the UK White was better than both Ghana Grey and UK Grey cements. In addition, while UK White cement performed better in compression than Ghana Grey and UK Grey cements, the Ghana Grey was better than the UK Grey cement. The results of the experiment clearly reveal that the quality of Ghana’s cement is comparable to that of UK. Therefore, the paper concludes that the quality of Ghana’s cement might not be the factor causing building collapses in Ghana. Further studies are therefore recommended for the identification of the sub-standard materials that contribute to building collapse in Ghana.

Keywords: Building Collapse, Cement, Compressive Strength, Concrete, Dry Density, Water Absorption.

INTRODUCTION

The frequent occurrence of building collapse worldwide is becoming a major problem. This does not only lead to loss of valuable lives but also major property loss. Incidents of building collapse have been reported from most countries and the records keep rising. The Royal Plaza Hotel in the city of Nakhon Ratchasima, Thailand collapsed on 13 August 1993, killing 137 people and injuring 227 (Worsak, 1994). According to a report from Siraj and Maha (2006), a hostel housing Muslim pilgrims performing Hajj collapsed in Mecca, Saudi Arabia on 5 January 2006 killing 76 people and injuring 62. Beaumont (2008) reported of the Petionville school collapse, which occurred on November 7, 2008, in Petionville, a suburb of Port-au-Prince, Haiti, where the church-operated College "The Evangelical Promise School" collapsed. About 700 students from kindergarten through high school attended the school. At least 93 people, mostly children, were confirmed killed, and over 150 injured. The January 25, 2012 Rio de Janeiro building collapsed which also triggered the collapse of two neighboring buildings of which 21 people were confirmed dead.

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² isaac.boateng@port.ac.uk
Ghana is no exception of building collapses, the past few years have seen some cases in both urban and rural areas which resulted in fatalities, injuries and loss of property. Table 1 presents some of the recent cases of building collapse in Ghana from 2009 to 2013, showing the suspected causes and the casualties involved. Notably among them are the recent cases of Melcom shopping mall building in Achimota, Accra and a three storey-building situated at Krofrom, Kumasi. The Melcom shopping mall building collapsed on Wednesday, November 7, 2012 around 9:00 in the morning when the shop has not opened to the general public for shopping. There were only the shop attendants who were in the building getting ready to open the shop for the day’s activities. Eighty one (81) casualties were involved in the total collapse of the building, sixty seven (67) survived with various degrees of injuries while the remaining fourteen (14) died. This was one of the fatal building collapse incidences that have happened in Ghana in the recent past.

Table 1: Recent Cases of Building Collapse in Ghana

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<td>8</td>
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<td>Residential</td>
<td>2011</td>
<td>Rain storm</td>
<td>2 Died, 3 Injured</td>
</tr>
<tr>
<td>9</td>
<td>Ayomso, B/A</td>
<td>Residential</td>
<td>2012</td>
<td>Rain storm</td>
<td>2 Died, 2 Injured</td>
</tr>
<tr>
<td>10</td>
<td>Apatrapa, Kumasi</td>
<td>Uncompleted</td>
<td>2012</td>
<td>Structural failure</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>storey building</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Kasoa, C/R</td>
<td>Public toilet</td>
<td>2012</td>
<td>Structural failure</td>
<td>1 Died, 2 Injured</td>
</tr>
<tr>
<td>12</td>
<td>Achimota, Accra</td>
<td>Five-storey</td>
<td>2012</td>
<td>Structural failure</td>
<td>14 Died, 67 Injured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>shopping mall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>building</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Krofrom, Kumasi</td>
<td>Three-storey</td>
<td>2013</td>
<td>Rain storm</td>
<td>3 Died, 5 Injured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>residential building</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

External View before Collapse                      Internal View before Collapse
Figure 1: Melcom Shopping Mall Building before Collapse

The appearance of the building before collapse is presented in Figure 1 and after the collapse can also be found in Figure 2. The building experienced a total collapse with all the structural components falling down. This accounted for the high fatality rate.

Figure 2: Melcom Shopping Mall Building after Collapse

A very recent incident of building collapse in Ghana was the three-storey residential building situated at Krofrom, a suburb of Kumasi, the Ashanti regional capital, which collapsed on Monday, April 15, due to a heavy downpour of rain trapping many people under the rubble. 3 people were confirmed dead whiles 5 others sustained various injuries. Figure 3 presents the external view after the collapse of the building.

Figure 3: Krofrom Three-Storey Residential Building after Collapse

A study conducted in Nigeria by Fakere et al. (2012) assessed the collapse of a Naval building, a two storey building in Gwarimpa, Abuja, which occurred on Saturday, 28th January in 2012. Their investigation found that the structure was defective, thus sub-standard materials were used for the construction, which included the reinforcement bars, concrete mix ratio among other things. Studies by Ede (2011) and Ayedun et al. (2012) on the causes of building failure and collapse identified the use of sub-standard building materials, poor workmanship by contractors, among others as the major causes of building collapse in Lagos State. Sub-standard materials have been mentioned as one of the major causes of building collapse.

The main materials mostly identified as sub-standard are cement, reinforcement bars, timber and aggregate. There is the need to investigate, which of the materials contribute to the collapse of buildings in Ghana. Sam et al. (2013) assessed the
chemical composition of the various brands of Portland cement products available on the Ghanaian market. This Paper assesses the quality of cement use in Ghana to ascertain whether it contributes to building collapse. The assessment was done by comparing the strength properties of Type I cements from UK and Ghana, in order to find out whether Ghana’s cement is of sub-standard or not.

EXPERIMENTAL WORK

Materials

The materials that were used for the laboratory experimental work are cement, sand and water. Three Type I Portland cements were used for this study. One was obtained from Ghana which is known as Ghacem Portland cement (Ghana Grey), and the other two were obtained from UK known as Portland cement (UK Grey) and Snowcrete white Portland cement (UK White). The Ghana Grey and UK Grey were of the same class of 32.5R and therefore are placed at the same level for comparison. The UK White has a higher class of 52.5R, but was included to find out if it will make any difference. The sand used was clay-free and obtained from Portsmouth, UK. X-Ray Diffraction (XRD) analysis of the sand showed to be pure quartz sand with no significant impurities. The water used was drinkable from the Civil Engineering laboratory tap of Portsmouth University, UK.

Methods of testing

The tests performed include dry density, water absorption and compressive strength. Concrete cylinder specimen 75 × 40 mm were made using cement sand ratio of 1:2 for mortar and only cement for cement paste with single water cement (w/c) ratio of 0.35 by mass. After 28 days of curing, the cylinders were tested for dry density, water absorption and compressive strength. Compressive strength test was performed to determine the strength of the cement specimen under the influence of compression stress. The compressive strength of the specimen was carried out by using ELE ADR-Auto compression 2000 test machine with a maximum capacity of 2000 kN. The compressive strengths were calculated as:

\[ \sigma_c = \frac{F}{A} \]  

(1)

Where: \( \sigma_c \) is compressive strength; \( F \) is the maximum force (N) applied at which the specimen failed; and \( A \) is the cross-sectional area (mm\(^2\)) of specimen on which the force was applied.

Density test was performed in order to determine how compact the specimen were. The dry density of the specimen was determined by drying the specimens at constant temperature of approximately 110 °C in an oven for 48 hours. After, the dimensions of each specimen were measured in centimeters to the nearest millimeter and the overall volume computed in cubic meters. The specimens were then weighed in kilograms to the nearest 10 gm. The density of each specimen was calculated as:

\[ \rho = \frac{m}{V} \]  

(2)

Where: \( \rho \) is the density; \( m \) is the mass (kg); and \( V \) is the volume (m\(^3\)).

Water absorption test was conducted to measure the ability of the specimen to resist the absorption and retention of water. The weights of the specimen were measured with electronic scale after drying, and then immersed in water for 14 hours. The
saturated weights of the specimen were measured, after which the water absorption percentage of the specimen was determined mathematically as:

$$WA = \frac{M_1 - M}{M} \times 100$$

(3)

Where: $WA$ is water absorption; $M_1$ is the mass of saturated specimen (kg); and $M$ is the mass of dry specimen (kg).

RESULTS AND ANALYSIS

The results obtained from the experimental work are presented and discussed. The strength properties of the cements were determined through dry density, water absorption and compressive strength tests. The results of the test are presented in Tables 2 and 3 for mortar and cement paste specimen respectively.

Table 2: Mortar Mix

<table>
<thead>
<tr>
<th>Item</th>
<th>Dry Density (kg/m$^3$)</th>
<th>Water Absorption (%)</th>
<th>Compressive strength mean (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK White</td>
<td>1824</td>
<td>8.7</td>
<td>31.7</td>
</tr>
<tr>
<td>Ghana Grey</td>
<td>1832</td>
<td>9.3</td>
<td>30.0</td>
</tr>
<tr>
<td>UK Grey</td>
<td>1779</td>
<td>9.2</td>
<td>29.9</td>
</tr>
</tbody>
</table>

Table 3: Cement Paste Mix

<table>
<thead>
<tr>
<th>Item</th>
<th>Dry Density (kg/m$^3$)</th>
<th>Water Absorption (%)</th>
<th>Compressive strength mean (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK White</td>
<td>1682</td>
<td>5.1</td>
<td>63.3</td>
</tr>
<tr>
<td>Ghana Grey</td>
<td>1795</td>
<td>8.6</td>
<td>43.8</td>
</tr>
<tr>
<td>UK Grey</td>
<td>1707</td>
<td>10.1</td>
<td>41.9</td>
</tr>
</tbody>
</table>

Dry Density

![Figure 4: Comparison of Dry Density Results](image)
The comparison of the dry density test results is shown in Figure 4. The results show that the Ghana Grey specimen increased average density of 3% and 5% for mortar and cement paste respectively than UK Grey. In addition, the density of Ghana Grey cement was higher than UK White cement both for mortar and cement past specimen. However, the density of the UK Grey was higher than that of the UK White for cement paste specimen, while it was the opposite for the mortar specimen. It could be concluded the results that the density of Ghana Grey cement is higher than both the UK Grey and UK White cements. This implies that the Ghana Grey cement when used for preparing mortar or concrete could provide more compact unit.

**Water Absorption**

Figure 5 presents the results of the water absorption test values for the specimen. The UK Grey recorded about 17% increase in water absorption than the Ghana Grey for cement paste specimen, while the Ghana Grey had an increase of 1% than that of the UK Grey for mortar specimen. On the other hand, the UK White had lower water absorption than both Ghana Grey and UK Grey specimen. This result indicates that the UK Grey cement has higher water absorption properties than that of the Ghana Grey cement, implying that Ghana Grey cement performed better in resistance to water absorption than UK Grey cement. While the UK White performed better in water absorption than both Ghana Grey and UK Grey cements. The practitioners in the construction industry as well as academicians in Ghana should therefore know that the cement produce in Ghana have good resistance the water absorption.

![Figure 5: Comparison of Water Absorption Results](image)

**Compressive Strength**

The compressive strength test results comparison is presented in Figure 6. The results show that the Ghana Grey cement had less than 1% and 5% increase in compressive strength for mortar and cement paste respectively than UK Grey cement specimen. The UK White cement on the other hand, recorded higher compressive strength than both Ghana Grey and UK Grey cement specimen. It can be concluded that while UK White cement performed better in compression than Ghana Grey and UK Grey
cements, the Ghana Grey was better than the UK Grey cement. Building contractors and other practitioners in the construction industry as well as academicians in Ghana should therefore know that the cement produce in Ghana have good resistance under the influence of a compression stress.

![Figure 6: Comparison of Compressive Strength Results](image)

**CONCLUSION**

This paper adopted the approach of determining the quality of Ghana Type I Portland cement by comparing its strength properties with that of UK cement. The assessment found that the dry density of Ghana Grey cement was higher than both the UK Grey and UK White cements. Furthermore, the Ghana Grey cement performed better in resistance to water absorption than UK Grey cement, while the UK White was better than both Ghana Grey and UK Grey cements. In addition, while UK White cement performed better in compression than Ghana Grey and UK Grey cements, the Ghana Grey was better than the UK Grey cement. Building contractors and other practitioners in the construction industry as well as academicians in Ghana should therefore know that the cement produce in Ghana have good strength properties. It can therefore be concluded that the quality of Ghana cement is comparable to that of UK, and therefore may not be a contributing factor of building collapses in Ghana. It is therefore recommended that further studies should be conducted on the quality of sand, standard of cement to sand mix ratio in Ghana and the quality of other building materials such as reinforcement bars, timber, aggregate and water in order to establish which material is of sub-standard and contribute to the collapse of buildings in Ghana.

**REFERENCE**


KEY COMPETENCIES OF VALUE MANAGERS IN LAGOS STATE, NIGERIA

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Competency is the ability of a professional to function as expected in discharging professional duties as a result of training, skills, knowledge, experience and innovative thinking ability. It is a set of behaviours that encompass skills, knowledge, abilities and personal attributes that are critical to work accomplishment. This research work examined the competencies and personal skill attributes of value managers with a view to ascertaining the key and important ones. Primary data were collected via questionnaire administered on construction professionals that were eligible to be a member of value management team. Percentile, mean internal score, Cronbach's alpha and Kruskal-Wallis test were employed in the analysis and testing of the hypotheses generated. The research showed that innovation and mental alertness are the most significant of the identified areas of competencies of value managers while conflict management is the least. Smart thinking is the most significant personal skill attributes of value managers, however, the result also depict that all the identified personal skill attributes of value managers are significant except “no preconceived ideas” that was ranked below average. The study finally recommended a need for construction professionals to keep themselves abreast with various forms of innovation and new ideas in the international construction market - especially in the area of value management - in their quest to function and participate effectively in value management workshop.

Keywords: Competencies; Personal skill attributes; Value manager; Value management; Nigeria

INTRODUCTION

The concept of value management, which was first applied to construction projects in the United States in 1970s (The College of Estate Management, 1995), is receiving an increasing amount of attention within the international project management community (Stuart, 1994). In South Africa, Sigle, Klopper, and Visser (2000) observed that clients are insisting that value management should be applied to construction projects and such could probably be attributed to the effectiveness of value management as a tool for ensuring value for money.

There are so many views and opinion on the discipline of value management. The Institute of Value Management (2008) defined the term value management as “a style of management particularly dedicated to motivating people, developing skills and promoting synergies and innovation, with the aim of maximizing the overall performance of an organization”. The concept of value management according to Society of American Value Engineers (2008) is defined as “a systematic, multi-disciplinary effort directed towards analysing the functions of projects for the purpose

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of achieving the best value at the lowest overall life cycle cost. This definition is not complete as observed by De Leeuw (2006) where it was stated that return on investment, which is a vital issue to the private sector, is supposed to be included.

Value management according to Office of Government Commerce (2007) is “a well established methodology for defining and maximising value for money”. As incomplete this definition may be, it suggests that the discipline of value management can be applied to any type of project regardless of size or timeframe and at all stages. This may be contrary to the general belief that value management must and can only be applied at the design stage of construction project. This also connotes that value management is becoming dynamic and various forms of its application in the construction industry are springing up. In differentiating between value management and value engineering, Kelly and Male (2006) suggested that value engineering is a sub-set of value management in that the former deals mainly with the design processes while the latter deals with the overall management of value throughout the contract.

Odeyinka (2006) defined value management as “a service, which maximises the functional value of a project by managing its development from concept to completion and commissioning through the audit (examination) of all decisions against a value system determined by the client”. In summary, value management can therefore be seen as “a systematic and multi-disciplinary process directed towards analysing the functions of projects from its inception to completion and commissioning for the purpose of achieving best value and return on investment at lowest possible overall life cycle cost and a value manager is the professional that is trained in the field of value management.

Academics, professional groups and government agencies do not appear to be working from the same frame of reference in relation to the term “competencies” (Gonczi, 2001). In Battersby (2004) opinion, this may have occurred due to growing number of professions moving towards the development of competency standard in that each profession will define the term competency in relation to their professional ethics, value and obligation. There appears to be no accepted definition of competencies (Wells, 2002). Hogg (2008) in differentiating between competencies and competency observed that although in the 1980s and 1990s, human resources professionals drew a distinction between ‘competencies’ and competency’, it was observed that ‘competency’ is more precisely defined as the behaviours that employees must have, or must acquire, to input into a situation in order to achieve high levels of performance, while ‘competence’ relates to a system of minimum standards or is demonstrated by performance and output.

Value managers in this research are construction professionals that are eligible to be members of value management team. In Nigeria, these are Architects; Quantity surveyors; Builders; Engineers; and Estate Surveyors and Valuers.

This research examined the competencies and personal skill attributes of value managers in order to determine the important and vital ones for construction professionals. This will help the professionals their quest to function effectively and efficiently as members of value management team.

**LITERATURE REVIEW**

This aspect of the paper discuss the identified areas of competencies and personal skill attributes expected of professionals in order to function as members value management team.
Areas of Competencies for value managers

Meyer and Semark (1996) described competence as the demonstration of an integration of knowledge, skill, personal attributes and value orientation. Wisher (1994) insists that competencies provide a common cultural thread, a language for success, a framework for thinking about excellence and a way of communicating the future.

Sigle et al (2000) identified ten key skills required of a value manager by Potential Index Battery (PIB) based on series of diagnostic instruments developed by Erasmus and Minnas (1996) over a period of twenty years. These ten basic skills that form the competencies areas of a value manager in rank order (Nkado, 1999) are:

**Creativity**

Creativity has to do with the ability to develop new ideas, create new concepts and find solutions to problems of any type. It is the ability to generate innovative ideas and manifest them from thought into reality. The process involves original thinking and then producing.

**Mental alertness**

This is the ability to react quickly, strongly and favourably to situations, suggestions, ideas and innovations. This is an essential competency of any manager bearing in mind the nature of the work, the people involved and the expected result that is solely resting on his shoulder.

**Leadership-transformational**

Leadership is the ability to guide, direct or influence people. (Microsoft Encarta, 2009). This can either be transformational or transactional in nature. The former has to do with changing something completely especially by improving appearance or usefulness while the latter is a kind of leadership where any activity affects and influence both the leader and the follower. Transformational leadership skill is expected of a value manager.

**Listening skills**

This is the ability to concentrate on ones hearing by paying necessary attention. (Microsoft Encarta, 2009). This is mostly influenced by the environment in which one finds himself and available facility for effective listening ability. This includes ability to hear, understand and comprehend.

**Conflict management-collaborate**

There are five recognised ways of resolving conflicts according to Sigle et al (2000) and they are competition; compromise; negotiation/co-operation, avoidance and accommodation. It was further stressed that negotiation/co-operation is the preferred management style due to the following guidelines:

When the differences are very important to both parties and no one is willing to give in;

When a close, continuous and interdependent relationship with the other party exists;

When there is sufficient time available to deal with the problem (This approach can require a great deal of time);
When both parties know precisely what they want to achieve and are also willing to spend time and energy on its achievement and

When both parties are articulate, willing to listen to one another and skilled in the solution of problems.

**Social style-expressive**

A value manager is expected to be expressive and interactive. Social styles according to Sigle *et al* (2000) are expressed in four categories, namely being an extrovert, a supporter, a driver or an analyser. An extrovert is an outgoing person while Microsoft Encarta (2009) defined such person as sociable and self-confident. This constitutes a very good skill of any value manager.

A supporter can be seen as one who gives needed help or encouragement. A driver can be seen as one who provides the necessary impetus or motivation for a team or individual. An analyser can be seen as one that examine something in detail in order to understand it better or draw conclusions from it. It can be concluded that the four categories of social style are useful and necessary skill areas of value managers.

**Innovation**

Innovation entails such things as receptive to others’ ideas; initiating change; improvising or changing existing ideas; introducing new way of doing things; and being willing to experiment for continued improvement.

**Adaptability**

This is the ability to suit, fit and adjust to different conditions or purpose at different times.

**Self-motivation**

This is the ability to be energetic and ambitious, and so able to make plans and get things done without being directed by others. (Microsoft Encarta, 2009)

**Abstract reasoning**

This is the ability to anticipate, understand, reason and initiate practicable and appropriate concepts and conclusions by applying imaginative ideas through logical thinking.

**Personal skill attributes of value managers**

Similar to the areas of competencies are the expected personal skill attributes of value managers. Daddow and Skitmore (2005) identified 20 personal skill attributes of a value manager through the results of an interview survey involving 17 professionals working in the property and construction industry. These attributes are: Lateral thinking ability and intuition; An inquiring mind; Industry expertise; Life experiences; A positive, constructive approach; Knowledge of the client/owner requirements; Motivated and enthusiastic; Proactive; Attentive; Smart thinking; Having an open mind and an objective approach to communication; Having personal skills; No preconceived ideas; Able to bring expertise to the value management workshop; Ability to communicate ideas confidently and professionally; Confidence; Understanding that what people may say, may not be quite what they mean, so they need to be able to interpret and ‘read between the lines’; Recognise reactions whether
verbal or physical; Able to listen to other ideas and relate to others; and Be adaptable and flexible.

**RESEARCH METHODOLOGY**

Primary source of data collection through a well-structured questionnaire was administered to relevant professionals in the construction industry. The population were the Nigerian construction professionals that are eligible to be members of construction projects value management team and they are: Architects; Quantity surveyors; Builders; Engineers; and Estate Surveyors and Valuers.

Due to a large population as identified above, the sampling frame was delimited to Lagos state of Nigeria where research questionnaires were distributed. The choice is on the premise that Lagos is the commercial capital city of Nigeria and most of the construction professionals in this state handle projects in other states of the federation. Fagbemi (2008) observed that 75% of quantity surveying firms in Nigeria are either based in Lagos state or have their branches located there. The result of the study is expected to represent the whole population. More so, the list of professionals were obtained from relevant professional bodies and the sample size in respect of the various categories of respondents was determined from the following formulae as used by Kish (1965) in Shash and Abdul-hadi (1992)

\[
n = \frac{n'}{1 + \frac{n'}{N}}
\]

Where \( n \) = sample size; \( n' = \frac{S^2}{V^2} \)

\( N \) = Total population, \( V \) = Standard error of sampling distribution = 0.05,
\( S \) = the maximum standard deviation in the population elements

Using the formulae, the sample sizes for each of the respondents were calculated and the result is as shown in Table 1. Out of the 265 questionnaires administered, 94 were completed and returned, this represent 35.5% response rate.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Respondent</th>
<th>Population</th>
<th>Sample size</th>
<th>Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Architect</td>
<td>233</td>
<td>66</td>
<td>22</td>
</tr>
<tr>
<td>B</td>
<td>Quantity Surveyors</td>
<td>148</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>E</td>
<td>Estate Valuers</td>
<td>194</td>
<td>52</td>
<td>13</td>
</tr>
<tr>
<td>C</td>
<td>Professional Builders</td>
<td>107</td>
<td>43</td>
<td>17</td>
</tr>
<tr>
<td>D</td>
<td>Structural Engineers</td>
<td>214</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>896</td>
<td>265</td>
<td>94</td>
</tr>
</tbody>
</table>

Tables were employed in this research for the presentation of analysed data using descriptive and inferential statistical methods: frequencies; percentiles; cronbach’s alpha test; mean internal score (MIS); and Kruskal-Wallis test of variance.

Cronbach’s alpha test was used in testing the reliability and viability of the research instrument and the result is as presented in Table 2.
Table 2: Reliability Coefficients for the Measuring Scales

<table>
<thead>
<tr>
<th>Scale of Measure</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significance of areas of competencies of value managers</td>
<td>0.697</td>
</tr>
<tr>
<td>Significance of personal skill attributes of value managers</td>
<td>0.756</td>
</tr>
</tbody>
</table>

Table 2 shows that the Cronbach’s α value for scale of measures of the research instruments ranged from 0.501 to 0.811. Since the degree of reliability of the instrument is more perfect as the value tends towards 1.0 (Moser and Kalton, 1999), it can then be concluded that the instruments used for this research are significantly reliable.

FINDINGS AND DISCUSSION

Characteristics of the respondents

The general characteristics of respondents revealed that about 23%, 18% and 14% of the respondents were quantity surveyors, builders and estate valuer respectively while engineers and architects that responded to the questions were about 22%. On the average, the year of working experience of these respondents was calculated to be 9.83 which could be considered appropriate for the study.

As expected, all the professionals were members of their professionals’ bodies as the frequencies for each body corresponds with that of the professionals. However, majority of these professionals are corporate members (about 46%) followed by graduate members with about 37% while probationers and fellows were about 14% and 3% respectively. On the geographical zones that the respondents have executed one or more projects, the study revealed that all the respondents have been involved in project located in the South-West, South-South and South-East region of Nigeria. It could be concluded that about 41% of construction professionals in Lagos state i.e. the respondents have participated or involved in other projects located in other geographical zones of the country.

Key Competencies of value managers

Respondents were asked to rank the significance of identified competencies of value managers. Table 3 on the significance of areas of competencies of value managers reveals that based on the quantity surveyors’ opinion, leadership is the most important followed by listening skills, while conflict management was ranked least. In architects’ perspective, innovation is the most important followed by mental alertness while creativity and leadership were ranked lowest. The estate valuers perceive that innovation and creativity were the most significant factors while conflict management was ranked least. In builders’ opinion, mental alertness and creativity were ranked 1st and 2nd while adaptability was ranked least. In the opinion of the engineer, leadership and listening skill were tied on the 1st position while social style was ranked lowest. In general opinion of all the respondents, innovation is closely followed by mental alertness while conflict management is at the lower ebb.

Kruskal-Wallis test was carried out in order to determine if there is any variance in the opinions of various groups of respondents based on this hypothesis:
**Null Hypothesis (H₀):** There is no difference between the sample means of quantity surveyors, architects, estate valuers, builders and engineers in ranking the significance of areas of competencies of value managers.

**Alternate Hypothesis (H₁):** There is difference between the sample means of quantity surveyors, architects, estate valuers, builders and engineers in ranking the significance of areas of competencies of value managers.

Kruskal-Wallis test was carried out

Degree of freedom (DF) = 10: \( H_{calculated} = 5.82 \); \( \chi^2 = 14.684 \) at 10% level of significance;

Based on the result of analysis, it could be observed that there is no difference between the sample means of quantity surveyors, architects, estate valuers, builders and engineers in ranking the significance of value managers’ areas of competencies.

**Key personal skill attributes of value managers**

Respondents were asked to rank the significance of identified personal skill attributes of value managers. Table 4 on the significance of personal skill attributes of value managers, the quantity surveyors believed that smart thinking and, having an open mind, were the most significant while architects believed that a positive, constructive approach and life experiences were the most important. Estate valuers ranked smart thinking as the most significant while builders ranked proactive and having personal skill 1st and 2nd respectively. The engineers believed that confidence and smart thinking are the most significant while the general respondents ranked smart thinking as the most significant of all the identified factors.

Kruskal-Wallis test was carried out in order to determine if there is any variance in the opinions of various groups of respondents based on this hypothesis:

**Null Hypothesis (H₀):** There is no difference between the sample means of quantity surveyors, architect, estate valuer, builder and engineers in ranking the significance of personal skill attributes of value managers.

**Alternate Hypothesis (H₁):** There is difference between the sample means of quantity surveyors, architect, estate valuer, builder and engineers in ranking the significance of personal skill attributes of value managers.

Kruskal-Wallis test was carried out
The result of the analysis revealed that there is no significant difference between the sample means of quantity surveyors, architects, estate valuers, builders and engineers in ranking the personal skill attributes of value managers.

**DISCUSSION OF FINDINGS**

**Competencies of value managers**

In ranking areas of competencies of value managers, innovation was ranked 1st followed closely by mental alertness while conflict management, social style and adaptability were ranked at the lower ebb. All the identified areas are found to be above average in term of their significant. Contrariwise, Sigle et al (2000) believe that creativity is the most important factor followed by mental alertness and leadership while adaptability, self-motivation and abstract reasoning are at the lower end.

The study also revealed that there is no difference between the sample means of quantity surveyors, architects, estate valuers, builders and engineers. This is expected as the study hade earlier revealed that all the professionals for the study have an average knowledge of value management.

**4.4.2 Personal skill attributes of value managers**

The study shows that there is no difference between the sample means of Nigerian construction professionals in ranking personal skill attributes of value managers. Smart thinking, knowledge of client requirement and confidence were the three most important personal skill attributes of value managers. Leung (2001) agrees with this finding while stating that ability of value management team members to understand client requirement is very important if the team will be successful. More so, Daddow and Skitmore (2005) in a finding revealed that people involved in successful value...
management generally have a positive attitude and a desire to contribute to a successful project.

CONCLUSION AND RECOMMENDATIONS

For a professionals to function effectively in any value management workshop, there is a need to posses basic competencies and personal skill attributes. The study revealed that innovation, mental alertness and listening skills are the three most important areas of competencies required of professionals to participate in value management workshop while conflict management, social style and adaptability are the least. It could further be observed that all the identified areas of competencies of value managers are significant.

For the personal skill attributes required of value managers, it could be observed from the study that smart thinking is the most significant. This is followed by knowledge of the client/owner requirements, confidence and life experiences. All the personal skill attributes of value managers were found to be above average in term of their significance. However, having no preconceived idea is the least significant attribute.

There is a need for personal development on the part of construction professionals in their bid to participate in the discipline of value management especially in the areas of social style, adaptability and self motivation as these factors were rated as highly significant by respondents and this can be achieved by attending international conferences, seminars, workshops, symposium, etc.

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KNOWLEDGE MANAGEMENT PERCEPTIONS: THE CASE OF CONSTRUCTION PROFESSIONALS IN NIGERIA

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Knowledge management (KM) has been studied extensively in recent years. Contemporary perspectives even consider knowledge and its management to be strategically important resources within organisations. However, the fragmented project-based and task-oriented nature of most construction activities have often times made knowledge management implementation challenging within the construction industry. Utilising semi-structured interviews, this paper examined the perceptions of knowledge management among professionals within the Nigerian construction industry. The major findings indicated that even as professionals in the Nigerian construction industry may be aware of knowledge management and its benefits, its systematic application still remains largely uncommon during practice. The paper also highlighted the need for shifts in organisational culture as a means of facilitating a more knowledge management conscious construction industry in Nigeria.

Key words: construction industry, knowledge management, Nigeria, organisational culture.

INTRODUCTION

Knowledge can be considered as one of the most vital resources within any organisation and the survival or success of organisations depends largely on how effectively knowledge is managed. Nonaka and Takeuchi (1995) suggested that many large organisations are actively embracing the concept KM and there are also indications that most globally acclaimed leading organisations are those which have rapidly become experts in managing their organisations knowledge. However, even as knowledge can be identified as contemporary subject that provides leverage in organisations and the global economy, Kluge et al. (2001) identified that a comprehensive approach to managing knowledge in order to maximize returns remains nebulous. Similarly, Udeaja et al. (2008) opined that the success from KM still depends on the effective and efficient deployment of various KM strategies and tools within the context of the specific organisations.

Although the global construction industry has been severally described as a strong, knowledge-based industry which relies heavily on knowledge input by the different participants in project teams, its nature is not exactly beneficial for effective KM. The Egan Report highlighted certain characteristics with the construction industry to support this notion. For instance, the complex and heterogeneous and notorious level
of rivalry between companies and employee migration; the constantly dynamic and changing construction environment as well as increased clients sophistication and demands can all be said to impede effective knowledge management (Egan 1998).

At the moment, the construction sector in Nigeria is also faced with most of these characteristics which have tendencies to affect its future viability and that of the entire national economy. Even though KM strategies have been severally identified as being important in the performance and the competitiveness of organisations, most studies on KM implementation in the construction sector have been mainly carried out in leading countries such as the Canada, the United Kingdom and the United States (Al-Ghassani et al. (2002); Mertins et al. (2001); Carrillo and Chinowsky (2006) and Forcada et al. (2013). Given the importance of the construction sector to the Nigerian economy, Knowledge Management in the Nigerian construction readily became an interesting area for research. This is because the study of knowledge management in construction projects is still in its infancy, particularly in Nigeria (Kasimu et al. 2013). Limited studies have investigated how construction companies use knowledge management to leverage various aspects of their operations like organizational performance or project team performance. Therefore, what is lacking in the Nigerian construction industry can be identified as a comprehensive understanding of important knowledge management issues. Thus, this paper aimed to better understand the perceptions of knowledge management among professionals within the Nigerian construction industry. Generally, managing knowledge more effectively offers construction professionals and organizations a possible mechanism for improving their performance in times of greater competition and reduced profit margins (Egbu and Robinson 2005). The results from the paper serve as preparatory steps geared towards improvements in KM systems among construction professionals and organisations in Nigeria. It will also facilitate a mechanism that enables construction industry stakeholders to develop additional standards to promote KM strategies. The paper commenced with an overview of pertinent literature and examined the current issues in the Nigerian construction industry. It then went on to describe the research methodology utilised, highlighted and discussed the key findings from the data collected before concluding.

The concept of knowledge management

Literature is replete with examples of various definitions of Knowledge Management which provide a reflection of their author’s perspectives. For example, the definitions by Egbu et al. (2001) and Harman and Brelade (2000), tend to depict a Human Resource (HR) perspective which largely depends on the people aspect to provide KM solutions while definitions by O’Leary (2001); Tsui (2002) seemed more inclined to concentrating on selected IT tools for the delivery of KM solutions. In addition to the IT or HR perspective, KPMG (1998) and Tiwana (2000) also showcased a more integrated perspective on KM which acknowledges that both the IT and HR perspectives complement each other. Of the numerous definitions of KM, Webb (1998) definition of knowledge management tends to depict a more holistic perspective. According to Webb (1998), Knowledge Management can be defined as the identification, optimization and active management of intellectual assets to create value, increase productivity and gain and sustain competitive advantage. When implemented, Robinson et al. (2005) explained that KM enables organisations to learn from their corporate memory, share knowledge, and identify competencies in order to become more forward thinking and learning.
Knowledge management in the construction industry

Generally, the construction industry is characterised by product uniqueness, rapid on-site production, and temporary project teams that have abilities to generate huge profits. Among several reasons, Dave and Koskela (2009) argued that the construction industry should be considered as unique because there is always a sharing process between a number of stakeholders who collaborate with each other at various stages during the construction phase but may or may not continue to work together at other phases or even once projects are completed (Kamara et al. 2002). In view of all these above, the nature of the construction industry makes the adoption of KM a major consideration.

Consequently, the combination between information management and KM becomes crucial but has still remained a very daunting task for the construction industry and this may be responsible for the poor efficiency encountered in certain construction activities (Tserng et al. 2009). As a result of the fragmented nature of the construction industry, Tserng et al (2009); Dave and Koskela (2009) posited that the anticipated benefits from KM may have not been readily feasible. Nevertheless, Udeaja et al. (2008) still indicated that KM has been embraced widely in the Architecture, Engineering and Construction (AEC) industry. Also, in a survey carried out in UK project-based organisations, Egbu (2002) also revealed that about 50 per cent of the respondents noted that KM plays a significant role in deploying new technologies and new processes that benefit their organisations.

Even with the progress made towards adopting KM, there are still challenges in the management of knowledge in the construction industry. For instance, Udeaja et al. (2008) identified certain practical difficulties preventing the effective use of KM. These difficulties include: fragmentation of the knowledge required to deliver projects due to such knowledge being held by different personnel in different organisations and the fact that the knowledge acquired depends on different resources or on the previous experiences of personnel. As a result, it can be inferred that there may still be no holistic system that organises the process of KM within the construction industry.

The Nigerian construction industry

The construction industry in Nigeria maybe classified as a major stimulant to the nation’s economic growth. Oluwakiyesi (2011) explained that the Nigerian construction sector accounted for approximately 1.4 percent of its GDP in 2010. Despite the seeming growth recorded in the construction sector output, it can still be argued that its contribution to total GDP has still remained at abysmally low levels over the years. For instance, in 1981 the construction sector accounted for about 5.8 percent of Nigeria’s GDP and over the last three decades, Nigeria’s total GDP rose in the region of 495 times its size. However, the construction sector GDP has only grown to 125 times its size in 1981 (Oluwakiyesi 2011). These figures are indicative of the inability of the Nigerian construction sector to realise its full potentials. However, it is anticipated that Nigeria’s huge infrastructure gap should provide a strong platform for the growth of the construction industry in the near future.

It must be emphasised that the current state and performance of the Nigerian construction sector may not be laudable however, it is not an isolated case. This is because Ofori (1993) indicated that the structural problems of the construction industry in other developing countries are more fundamental, serious, complex and overall much more pressing than those confronting their counterparts elsewhere. Ofori
(1993) also identified, common problems affecting the construction industry in most developing countries to include the lack of management skills, shortage of skilled labour, low productivity, shortage of supplies, bad quality of supplies and lack of equipment. Besides the problems enumerated above, Kasimu et al. (2013) suggested that KM activities are still at the developing stages in the Nigerian construction industry. However, KM is crucial for improved construction project delivery, as lessons learned from one project can be carried on to future projects resulting in continuous improvement (Carrillo 2004). Additionally, KM provides an enhanced knowledge base in organisations thereby resulting in fewer uncertainties and risk minimisation and it also improves the agility of construction organisations to respond to organisational changes (Anumba et al. 2005). In the light of the above disclosures, having a focus on Knowledge management perceptions of construction professionals in Nigeria in this paper was justifiable.

**Research Methodology**

The limited number of empirical studies on knowledge management in the Nigerian construction industry dictated the selection of semi-structured interviews as a robust means of data collection for this paper. The interviews were conducted among seventeen professionals within the Nigerian construction industry who were purposefully selected based on the research requirements and the need to gather in-depth information. Bryman and Bell (2011) explained that semi-structured interviews provided an excellent means of gathering relevant information from experts. As such the semi-structured interviews enabled the researcher to gather detailed information on the perceptions of knowledge management from the selected construction industry personnel. The personnel who were mainly site engineers, project engineers and managers as well as construction managers were located in four major cities in Nigeria (Port Harcourt, Lagos, Kaduna and Abuja) where major construction activities are regularly undertaken. Although the process of carrying out the semi-structured interviewing was cumbersome, it still allowed for flexibility in terms of main subject coverage and catered for emergent themes as and when they were raised by either the researcher or participants. Four of the participants disclosed that they have been involved in relatively large scale construction activities while the rest of the participants were involved in medium and small scale construction activities.

The participant’s experience within the construction industry which was gained from several years of practice provided rich information for the paper. On the average, each of the interviews lasted for fifty minutes during which participants responded to several questions. The questions provided general information on participants background for statistical purposes and probed specific issues related to knowledge management practice in construction projects. Before the commencement of each interview session, participants were assured of their confidentiality and the voluntary nature of their involvement. Subsequently, the data obtained was analysed by adopting the following steps: organising the data; categorizing the data, building and understanding of themes; afterwards, findings and conclusions were made for the paper.

**Findings**

The interview results were divided into three sections: perceptions on the concept of knowledge management, awareness of KM benefits and factors affecting knowledge management deployment in the Nigerian construction industry.
Perceptions on the concept of knowledge management

All the professionals interviewed indicated several degrees of awareness on the concept of knowledge management. However, their accounts highlighted differences in their perception of the concept of knowledge management. From their various definitions and illustrations, there was quite a mixed awareness on what exactly constitutes knowledge management. What also clearly emerged was that certain professionals had difficulties in separating the concept of knowledge management from information management. With different expressions, interviewees explained that the concept of well organised knowledge management is relatively new within the Nigerian construction industry. A participant even disclosed that, many construction organisations in Nigeria are now actually engaged in knowledge and systematic learning initiatives but they do not specifically label such activities as KM.

Awareness of KM benefits

Generally, most findings indicated that participants had an awareness of the benefits of KM. Certain participants provided robust details of their awareness of the benefits of KM; some identified improved project delivery, performance and innovation while others included risk minimisation and financial gains and savings during construction activities to be among key benefits. Other notable benefits identified from KM deployment were their organisations increased capacities to win new projects and seamless transfer of knowledge across project/ organisation boundaries as well as client satisfaction. Consequently, an extensive list of examples of the benefits of KM emerged from the participants.

Even as participants still argued that the entire KM concept remains novel in most construction activities in Nigeria, it was concluded that it is rapidly gaining prominence. One participant explained that, ‘although knowledge may have been disseminated within in previous times, there are now more structured strategies to support its effective dissemination based on the obvious benefits knowledge management brings to their activities’ while another submitted that project management and knowledge management actually complement each other in the construction industry.

Factors affecting knowledge management deployment in the Nigerian construction industry

The participants identified several factors affecting knowledge management deployment in the Nigerian construction industry. Some of the factors enumerated included poor communication, limited personnel incentives, obsolete technology, organisational culture, skills shortage, the nature of the construction industry, limited resources, limited management support, personnel behaviour/ lack of synergy, limited formal channels for capturing and reusing knowledge and inadequate human resource support.

Discussion

The findings provided an overview of the status of selected construction personnel’s perception of knowledge management within the Nigerian construction industry. The results demonstrated that the participants had an awareness of knowledge management concept and its benefits. Thus, the remaining part of this section discussed the findings based on different themes.
Theme 1: Knowledge management perceptions and its benefits in the Nigerian construction industry

The participants highlighted differences in their perception of the concept of knowledge management. As observed from their various accounts, certain professionals had difficulties in separating the concept of knowledge management from information management. This difficulty in distinguishing these two concepts was not peculiar to just construction professionals in Nigeria. The reasons for the lack of clarity might not be farfetched as certain attempts have been made to classify the two as being substitutable (Hicks et al. 2006). Other common misconceptions on knowledge management identified by Carrillo and Chinowsky (2006) included the tendencies to consider lessons learned, project extranets and internets as being knowledge management systems.

In a basic form, Leseure and Brookes (2004) explained that knowledge management entails encouraging people to share knowledge and ideas that create value added products and services. On the other hand, Hicks et al. (2006) defined information management to include those activities that support the information lifecycle from its creation, representation, maintenance as well as its communication and reuse. According to Bishop et al. (2008), even as knowledge can be codified, shared, and exchanged but its scope is still broader than information management, because not all knowledge can or requires codification. Thus, while information management and knowledge management may adopt similar processes and practices, it can be opined that information management can at best be considered to be an enabler and significant component of the knowledge management process.

The findings also established that there is a growing awareness of the potential benefits of KM in the Nigerian construction industry. With different expressions, the interviewees had identified improved project delivery, improved performance and innovation, risk minimisation and financial gains, organisations increased capacities to win new projects and seamless transfer of knowledge across project/ organisation boundaries to be among the benefits of KM deployment. Most of these views on the benefits of KM were in consonance with the findings from Zin and Egbu (2010); Anumba et al. (2005); Egbu (2004) and Robinson et al. (2001). Similarly, the KPMG (1998) survey concluded that KM leads to: better decision making; faster response time to key issues; improved productivity; creation of new/additional business opportunities; reduced costs; better sharing of best practice; increased market share and share price; and improved staff attraction and retention.

In addition to all these benefits, Clark and Soliman (1999) explained that there were so many other benefits from KM that are not tangible and cannot be readily classified. Irrespective of the nature of the benefits of knowledge management, the findings demonstrated that professional in the Nigerian construction industry were aware of knowledge management benefits and this to an extent justified the need for its logical deployment in their current and future activities.

Theme 2: Factors affecting knowledge management deployment in the Nigerian construction industry.

A plethora of issues were identified as factors affecting knowledge management deployment in the Nigeria construction industry. The factors identified included poor communication, limited personnel incentives, obsolete technology, organisational
culture, skills shortage, the nature of the construction industry, limited resources, personnel behaviour/ lack of synergy absence of human resource support. Most of these factors were to a certain degree identical to what Carrillo et al. (2004); Egbu et al. (2001); Al-Ghassani et al. (2002) identified as challenges facing the implementation of knowledge management in construction companies. The summary of Carrillo et al (2004) study on knowledge management in UK construction also ranked not enough time, organizational culture, lack of standard work process and insufficient funding as main challenges for knowledge management within the industry. In addition, Robinson et al. (2005) recognized initiative overload, bureaucracy associated with KM, lack of top management support, conflicting priorities between KM and other business functions and the difficulties associated with communicating as barriers the benefits of KM. On the other hand, Davenport et al. (1998) identified having a knowledge-friendly culture, creating an organisational infrastructure that systematically supports knowledge management, shared knowledge and motivating workers who develop, share and use knowledge to be knowledge management success factors.

When combine the literature and the disclosures from the Nigerian construction personnel have provided a wide range of factors that can influence knowledge management deployment in the Nigerian construction industry. Of all the several factors identified, the participants illustration indicate that what seemed to be the most crucial of these factors were those closely related to their organisations leadership and personnel. For instance a participant suggested that, ‘even as our management may acknowledge the need for improved KM, they still do not understand what it actually is and how to implement it’. Another participant retorted that ‘the type of philosophy in any organisation will determine how knowledge is managed. If people are not giving to sharing knowledge how can the one they even have be ever documentation not to even mention being shared’. When put together, the factors affecting knowledge management deployment appeared numerous but for the purpose of this paper, they were classified under three major categories; the individual/ personnel, the organisation and technology/ information categories. The choice of the individual/ personnel, the organisation and technology/ information categories was a result of the convergence of the identified factors to these three categories in terms of their characteristics.

Theme 3: The way forward for KM practice in the Nigerian construction industry

Major construction industry reviews around the world have highlighted the need for continuous performance improvement (Latham 1994; Egan 1998). It is now recognizable that learning, knowledge sharing and its management have become essential drivers necessary to achieve and sustain the construction industry’s performance. The previous sections of this paper presented evidence on the state of knowledge management in construction organisations in Nigeria from the perspectives of construction industry professionals. It established that knowledge remains a strategic asset with construction organisations which requires constant nurturing for long-term corporate leverage. It also recognized that effective knowledge management can result in the transformation of knowledge for construction organisations use and continuous project improvement. Nonetheless, irrespective of relevance, it was acknowledged that the practice of knowledge management in the Nigerian construction industry has remained at its embryonic stage.
The factors affecting knowledge management deployment appeared numerous but were still classified under three major categories; the individual/personnel, the organisation and technology/information categories. For the individual/personnel category, even as it was admitted that most personnel are competitive by nature and would be less inclined to share the knowledge they possess, the need for knowledge sharing among personnel within organisations could never be overemphasised. Additionally, construction organisations in Nigeria need to introduce systems that appreciate and recognise personnel’s contribution towards the knowledge management process within their organisations. Additionally, training support needs to be provided to keep personnel abreast with relevant knowledge of recent trends in the industry.

On the part of the organisation, it must be acknowledged that the prevalent culture within organisations affects the manner wherein knowledge is managed. Therefore, organisations need to have cultures that promote and facilitate knowledge management. Irrespective of size, construction organisations in Nigeria can also prioritise their knowledge management activities to suit their organisation size and resource capacities based on their individual peculiarities. For the senior management, there will be an urgent need to of having a reorientation on organisational culture especially as it bothers on the personnel fears, attitudes or resistance to knowledge sharing among personnel. By so doing, knowledge management activities in construction organisations can be enshrined more deeply.

Regarding the technology and information category, organisations should attempt to incorporate both simplistic and sophisticated tools and techniques for knowledge capture and reuse. In today’s world, most IT infrastructure now provide an edge in gathering knowledge (especially tacit knowledge) from data repositories. Therefore knowledge can be shared among the employees and would be easily accessible. This facilitates greater efficiency and improvement of project and overall organisational performance.

Conclusion

Overall, the aim of this paper was to examine the perceptions of knowledge management among professionals within the Nigerian construction industry. The research investigated this problem by conducting semi-structured interviews among construction professional in various Nigerian cities. The interview results indicated the growing recognition of knowledge management and its benefits within the Nigerian construction industry however, its systematic application still remains largely uncommon during practice. Therefore to facilitate improvements in practice a way forward for KM practice in the Nigerian construction industry was suggested based on the findings. One crucial means towards achieving this was identified to be a shift in organisational culture. The findings documented in the paper should provide construction stakeholders in Nigeria with additional insights into knowledge management activities in the construction industry and a suggested strategy for it improvement.

References


MANAGING END-USERS’ SATISFACTION DURING CAPITAL DEVELOPMENTS BY ADOPTING VALUE ENGINEERING AS PROJECT MANAGEMENT TOOL

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The burden of translating the end-users’ project briefs into the development of functional support facilities that enhance the performance of the core functions of the organisation require the use of dynamic modern project management methods. In the course of developing capital assets, it is inevitable that original designs are modified, some sections redesigned while some facilities or components are out-rightly removed due to budgetary, time or other constraints. It is imperative, therefore, to incorporate the end-users into the development process, so that managing changes, trade-offs, commissioning and project close-outs will be smooth and enhance the achievement of customers’ satisfaction. Customers’ satisfaction, in the context of this paper, is viewed in the light of how effective and functional the completed facilities enhance the performance of the core functions of the organisation. The case study method of qualitative research was used in this research. The research data were collected through semi-structured questionnaire complemented with interviews. The thematic method was used to analyse the interview data. The client and end-users provided information on the level of their satisfaction with the performance of the capital development unit as well as identified some areas of concern that require improvement. Recommendations made include the use of Value Engineering as a project management tool; considered suitable for the management of design or scope changes and ‘trade-offs’, in order to improve on the level of customers’ satisfaction.

Keywords: End-users, Managing changes, Trade-offs, Customers’ satisfaction, Value Engineering.

INTRODUCTION

Translating end-users’ project briefs into the development of functional support facilities that enhances the performance of the core functions of the organisation requires the dynamic use of modern project management methods as well as applying the hard and soft skills of project management. Critical areas in this exercise include developing functional but flexible execution documents, adopting progressive procurement method, incorporating the end-users into the development process, managing changes, trade-offs, project commissioning and close-outs in order to achieve customers’ satisfaction. Customers’ satisfaction, in this context, is viewed in the light of how effective and functional the developed facilities enhance the performance of the core functions of the organization. The efforts of the Capital Project Development Unit (CPDU), notwithstanding, will not yield the desired results

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if their output does not serve as a vehicle that will enable the operators of the core functions of the organization to carry out their mandates smoothly in order to achieve the goals of the organisation.

In the course of developing capital assets, it is eminent that the original designs are modified, some sections redesigned while some facilities or components are outrightly removed due to budgetary, time or other constraints. In order to improve on customers’ satisfaction, it is important that the customer (end-user) be adequately informed, educated and incorporated into the process of managing the proposed changes. The principle of consensus building embedded in Value Engineering (VE) method (Male et al., 2007) has made the tool most suitable for integrating all stakeholders while resolving problem at any point in the project execution process, so that the end-users can easily accept and use the completed facility (Pemsel et al., 2010).

This paper is part of a wider case study on the Facilities Management (FM) operation in a higher educational institution in Sub-Saharan Africa and advocates the adoption of the principles of Value Engineering (VE) as a project management tool for managing changes during project execution that will facilitate improved customers’ satisfaction. Due to ethical considerations, generic names will be used to describe the institution, operational units and officials involved in this research.

THEORETICAL BACKGROUND

The literature reviewed in this section centred on end-users’ involvements, performance assessment and value engineering in relation to end-users’ satisfaction with the completed physical asset developed for the performance of the core function of the organization.

End-users’ involvement

The development of infrastructure for teaching and research requires long term planning. The resulting edifice should be robust, solid and yet flexible so that they can be adaptable for future changes; this infrastructure should be able to serve many generations of end-users. It is important therefore, to involve the current end-users in all stages of the development (for new, rehabilitation or modification projects). Pemsel et al (2010) observes that end-users’ satisfaction is the product of the outcome of the project and the way the result is achieved. Thus the, active not passive, involvement of the end-users is the ideal, otherwise the end-users can become hostage, where their opinions do not really matter (Mumford and Sackman, 1975). Two broad areas of concern in infrastructure development that can affect customer satisfaction are management of design or scope changes and orientation or induction of the end-users into the developed edifice (Yeo, 2008). The problems arising from design or scope change, modification of specification and decision on appropriate trade-offs can be managed through the effective and contextual use of the principle of Value Engineering (VE). Through the process of consensus building, the most functional and cost effective alternatives are agreed upon and executed; thus allowing all stakeholders to move progressively from existing situation to the “negotiated representation of the desired situation” (Thiry, 2001, p. 75). Other salient approaches include conducting study tours and workshops, where end-users are exposed to different scenarios of good and not so good projects that are similar to their context (Pemsel et al, 2009). Though, project commissioning and close-outs are scheduled into capital development, when the project is running behind schedule, these laudable
stages are either omitted or hurriedly executed. Nevertheless, the most effective way of enabling the end-users to settle into the new edifice comfortably is to progressively induct or orient them into the fixtures, features and facilities in the new edifice in specific or general orientation exercise (Dvir, 2005; Lowry, 2002). Primarily, the specific orientation or capacity building exercise can be achieved by incorporating the end-users into the installation, testing and commissioning stages; beside familiarising the end-users with the features, they are equally being empowered to operate and manage the features and only resort to the experts in case of major repairs (Berg, 1993; Tay and Ooi, 2001; Lowry, 2002; Potter and Brough, 2004; Lai, 2010). The general orientation should be conducted when the project is complete with all the fittings, fixtures and features in place. This exercise is aimed at educating the end-users on how to use the facilities to execute the core functions of the organisation as well as know what to do during emergency period (Wong and Fong, 2005). This concluding phase, like the ‘icing on cake’, encapsulates how well the project briefing has been translated into the developed edifice for the performance of the core functions that will facilitate the achievement of the set goals of the institution.

Effective end-users’ involvement during project execution enables them to ‘own’ the project and be proud of the resulting edifice including the imperfections (Pemsel et al, 2010).

Assessment of performance

The term, ‘Performance measurement’, conveys different meanings to different people, agency or units of the same organization. Several management tools have been developed to measure the contribution of the organ providing the support facilities to the effective performance of the core function of the organization and the improvements in the level of customers’ satisfaction (Amaratunga and Baldry, 2002; Amaratunga and Baldry, 2003; Pitt and Tucker, 2008).

A common performance measurement tool known as ‘balance scorecard’, has been described as “the dials in an airplane cockpit: it gives managers complex information at a glance” (Kaplan and Norton 1992, p. 71). It can be used to measure the performance of an organization or unit from four interrelated perspectives by addressing four relevant questions. Adapting the balance scorecard concept of Kaplan and Norton (1992), the four perspectives and related questions can be rearranged as follows:

Financial Perspective: How do we look to shareholders?

Customer Perspective: How do customers see us?

Internal Business Perspective: What must we excel at?

Innovation and Learning Perspective: Can we continue to improve and create value?

The first two perspectives of the balance scorecard could serve as ‘balance sheet’ for the operators responsible for the development of capital assets to measure the level of satisfaction of their client and end-users, while the last two perspectives and associated questions should serve as ‘internal audit’ check to know where and how to improve. Furthermore, the Financial Perspective can measure the client’s satisfaction on the quality of asset developed weighed against the money invested. On the other hand, the “Customer Perspective” and its accompanying question: “How do customer see us?” can be used to measure the end-users’ satisfaction on how functional the facilities, fixture and fittings in the new asset are facilitating their ability to perform the core functions of the organization; especially in terms of “time, quality,
performance, service, and cost” (Kaplan and Norton, 1992, p.73). These contribute to creating value and satisfaction for the end-users.

The operational concerns of the end-user in the completed capital asset include the functional flow of the workplace interface (Carder, 1995, 1997), the quality of the fittings and fixtures and the ease of operation as well as functional escape roots in case of emergencies (Wong and Fong, 2005). The end-users’ satisfaction can be measured through realistic evaluation of the quality, functionality and how the completed asset enhances the ability of the end-users in the performance of the core functions of the organization.

**Value Engineering (VE)**

Some practical description and application of VE include but is not limited to the following:

VE is an innovative thinking methodology that enables creative decision making through **good group** interaction skills (Thiry, 2001; Abidin and Pasquire, 2007). The process enables the group to systematically define common objectives, functionally prioritise what needs to be done, then creatively identify how best to achieve the desired result (McGeorge and Palmer, 2005; Male *et al.*, 2007).

The principle can be used to resolve problems in any aspect of the built environment industry, manufacturing, health, hospitality and other engineering sectors. It can be used in the construction method, process, product, service system, human resources and management style, (Cheah and Ting, 2005, Bowen *et al.*, 2011; Male *et al.*, 2007). The result exceeds the benefits of the ‘iron triangle’ of cost, time and quality to include, effective teamwork and improved communication among stakeholders (Fong, 1998; Atkinson, 1999; Cheah and Ting, 2005; Toor and Ogulana, 2010).

The practice of VE in the construction industry is well established in the United State of America, UK and VE application was introduced into Japan, Italy, Australia and Canada in the 1970s (Cheah and Ting, 2005). It is “not widely understood and practiced by engineers in the SA (South African) construction industry” (Bowen *et al.*, 2010, p. 293) and in the Engineering and Built Environment industry in many other African countries (Bowen *et al.*, 2009). A VE session may take the form of ‘seminar or workshop that should embrace critical stakeholders of the whole project or those directly connected with the section, equipment, component, fittings, fixture or feature to be reviewed. As a rule, it is recommended that someone not connected or knowledgeable in the profession should be included as participant in the workshop because, the contribution of such neutral person has added value in reshaping the thinking of other participants. Typical VE seminar or workshops follow a ‘five-step’ principle with each step building on the information and conclusions reached in the previous step. The steps include:

*Information phase:* This is concerned with the identification and collection of relevant information about the project or problem to be solved;

*Functional phase:* Through functional analysis of the information, set in order of priority, the cause and effect relationship is determined that enables the project team members to know where to concentrate energy and project resources to meet the customers’ requirements or address the problem that was the subject of the seminar or workshop;
End users’ satisfaction

Creative phase: This allows participants the opportunity to ‘think outside the box’ for alternative solutions to the current problem by building on the achievements of the previous step;

Evaluation phase: This requires systematic synthesis of each alternative weighed against the overall (cost, functionality, maintainability, flexibility and other factors) benefit throughout the life-cycle of the project;

Presentation phase: Here the chosen alternative or alternatives that most appropriately addresses the problem is or are developed as a proposal with responsibility matrix and time frame. The presentation should include audit time line to evaluate the success or failure of the proposal (Zhang et al, 2008; Formentini and Romano, 2011).

When the information gathered in the ‘information phase’ are adequately processed through the instruments of functional analysis, creative thinking and evaluation, the decisions presented in the proposal phase will not be seen as ‘imposed’ but as having been achieved through collective decision (Cheah and Ting, 2005; Male et al, 2007; Pemsel et al, 2010).

The majority of the literature reviewed has described VE; the procedure, its use in managing the construction project as well as a demonstration of its limited use in the built environment industry in different parts of the world. However, there is yet no evidence of the use of VE in managing design or scope changes or project trade-offs with the active participation of the end-users. This paper, therefore, seek to advocate the use of VE to manage end-users participation in critical decision making during construction processes.

RESEARCH METHODOLOGY

The case study method of qualitative research was chosen as the most appropriate methodology suitable for addressing the research questions and achieves the research objectives. The case study method allows the sourcing of in-depth and accurate information (Lateef, et al, 2010) about a particular situation or phenomenon within its context (Green and Thorogood, 2009); this method allows the researcher to relate with the operatives directly involved in the subject matter being investigated. The research data were obtained through the administration of ‘semi-structured’ questionnaire complemented with interviews. The participants were drawn from the university administration (client), academics (end-users) and the management staff of the Capital Projects Development Unit (CPD), known as the ‘operators’. The information obtained from the operators was corroborated with responses obtained from the client and end-users in order to clarify issues and validate the information obtained.

Though there are no strict rules in literature specifying the sample size in a qualitative research, other than the sample must be truly representative (Green and Thorogood, 2009). However, by including experts in the research area can reduce the number of participants needed in a study (Jette, et al, 2003). The majority of the academics representatives were from the Faculty of Engineering and Built Environment; “This ensures …optimal quality data and minimum dross” (Morse, et al, 2002, p. 18). The principles of member check (Amaratunga et al, 2002), where research information and analysis are recycled back to key informants for confirmation of reported speech and thick description which involves detailed description of the context in which the enquiry took place (Gilchrist, 1992) were applied, to guarantee the validity and reliability of the research information. Further, information from different sources
were compared and sieved to harness the most useful information that answered the research questions and objectives.

THE CASE STUDY, FINDINGS AND RESULTS

The Capital Project Development Unit (CPD), of the university under reference, is charged with the responsibilities of translating project briefs of the respective end-users into fully developed asset suitable for the execution of the core functions of teaching and research. The unit is managed by two full-time professional staff, while others are engaged on project basis. According to a senior officer of the institution, the unit (CPD) adopts the principle of “Top-down middle-up” while considering projects to be executed within each faculty or unit; this system allows for contribution from staff members at the middle level of leadership in the university.

The Director of CPD disclosed, during the interview, that there are two levels of communication structure for consideration and execution of capital projects. They are, the ‘University Planning and Development Committee’ (UPDC) and the ‘Technical Execution Team’ (TET). The CPD motivates all capital development proposals to the UPDC for detailed consideration. Projects that meet the requirements are given temporary approval and the funding prospectus forwarded to the university’s advancement unit for fund raising. According to the Director, “when the fund is secured substantially and the university is willing to write off the shortfall”, UPDC communicates approval to the requesting faculty or unit through CPD. Relevant consultants are commissioned to produce the detailed design and contract documents.

The ‘Technical Execution Team’ (TET) is made up of CPD, project manager, consultants, contractor, the client, end-users and other project personnel as the occasion demands. An interesting feature at this level is that the number of representatives from the immediate beneficiaries (end-users) of the project is increased to allow for more objective contribution and familiarization with the project. To underscore the importance of the active participation of the end-users, according to the Director, “the client and end-users attends the site meetings, visits the project site and makes objective contributions through the TET”. The Dean and one of the Head of Schools occupying the new faculty building confirmed that they usually attend the periodic site meetings. However, they noted that when dealing with design changes, they are not adequately consulted or educated; thus some of the changes undermine the effective performance of their core functions.

Project closeout

In an effort aimed at developing better relationships with the end-users, helping them to settle into their property with relative ease and facilitating its operation and maintenance, the Director opined that strong emphasis is being laid on proper project closeout sessions. He said “at the end of each project, a complete set of the ‘As-Built Documents’ (ABD) is handed over to the representatives of the end-users and the maintenance unit respectively”. To buttress the importance on producing authentic ABD, the Director emphasised that a clause in the letter engaging all consultants read thus: “The final 10% (ten percent) of the full fee payable will only become processed for payment on submission of a project completion report and “as built” drawings, acceptable to University authorized representative”. (Ogbeifun, 2011, p. 85). These documents are produced in both hard and electronic copies.
However, some of the end-users of the new faculty building complained that the close-out or commissioning processes need improvements. Some of their complaints include the fact that:

“…they have difficulties relating with some of the features in the drawings and what they are meant to serve; thus hindering the effective performance of their core functions of teaching and research. The Heating, Ventilation and Air-conditioning (HVAC) system in some of the lecture halls are not functioning, within a short period after handing over the project to the faculty. The maintenance unit and the nominated contractors have had difficulties resolving the problem and the capital development unit is yet to find suitable solution.”

Further, the Dean observed that, though volumes of drawings are delivered at the handing over stage, they have difficulties relating some of the drawings with the relevant sections of the project. These observations are reflected in the assessment of the performance of CDP by the academics connected with the capital project in this research.

**Assessment of performance**

The performance of CPD was measured in a 5 point linker scale; where 1= not satisfied and 5= very satisfied. The client and the end-users expressed their levels of satisfaction and this was compared with the self-assessment of CPD. Each respondent provided additional explanations to substantiate their assessments, where necessary. Table 4.1 shows the composition of the respondent, while Table 4.2 show the average score in the assessments for CPD and Fig. 4.1 shows the graphical representation of the assessment.

<table>
<thead>
<tr>
<th>Class</th>
<th>Sample size</th>
<th>No of response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPD</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Administration</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>End-users (academics)</td>
<td>8</td>
<td>7</td>
<td>87.5</td>
</tr>
</tbody>
</table>

(Source: Ogbeifun, 2011)

<table>
<thead>
<tr>
<th>Respondent</th>
<th>KPI</th>
<th>Level of consultation</th>
<th>Quality of internal management &amp; reporting</th>
<th>Quality of project delivery</th>
<th>Delivering project within budget</th>
<th>Delivering project on time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPD</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3.5</td>
<td>3</td>
</tr>
<tr>
<td>Admin.</td>
<td>-</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>End-users</td>
<td>-</td>
<td>2.13</td>
<td>1.75</td>
<td>2.38</td>
<td>4.5</td>
<td>2</td>
</tr>
</tbody>
</table>

(Source: Ogbeifun, 2011)

The administration and the academics expressed their satisfaction with the performance of CPD in terms of delivering projects within cost limits and they rated the performance of the unit higher than CPD rated its own performance. The administration, on the one hand, was quite satisfied with the performance of CPD and rated them high in every item. However, the academics (end-users), on the other hand, expressed reservations on the level of consultation with clients during the period of
project execution, especially as this affects the management of changes and trade-offs. Other areas where the division needs improvements include: quality of internal project management and reporting; quality of project delivery; and delivering projects within time schedule. The Director of CPD accepted these observations “as fair representation” of their performance in the present circumstances (Ogbeifun, 2011). Noting that each capital development project is dynamic, the lessons learnt in one project form a vital component in the learning curve that will assist in improving performance in the execution of subsequent projects.

![Fig. 4.1 Graphical Representation of Assessment of the Performance of CPD](Source, Ogbeifun, 2011)

**DISCUSSION**

Though CPD may have suitable project execution structure and adopts dynamic modern project procurement instruments, they have limited number of (two) full-time professional project personnel. Further, the objective of integrating the end-users in the project development processes is to ensure that the developed infrastructure is suitable for the performance of the core functions that will facilitate the achievement of the goals of the university. The performance assessment results identified the key areas that demonstrate how the CDP’s efforts are yet to effectively satisfy the end-users. The active involvement of stakeholders in capital developments follows best practice, where “line function” departments work closely with project personnel from the earliest part of the project to completion phases (Heywood and Smith, 2006). Representatives of the stakeholders that participated at the planning stage should translate into the execution governance for effective implementation (Pemsel *et al.*, 2010). The Dean and some of the Head of School of the faculty building actively participated through the construction processes.

The implications of executing project within budget and the project is also associated with negative observations (table 4.2) suggests that some basic project management systems (such as managing change, trade-offs) were not properly followed (Anbari, 2003). In this regard, adapting the VE method, project managers and the relevant stakeholders resort to roundtable talks to agree on essential ‘trade-offs’ that will not compromise the strategic importance of the project (Cheah and Ting, 2005; Thiry,
End users' satisfaction

2001; Pemsel et al, 2010). Through the process of consensus building, the most suitable alternatives are mutually agreed on (Thiry, 2001; Male et al, 2007). The low assessment rates of the performance of CPD evidently show the dissatisfaction of the end-users irrespective of the fact that the unit may be working with modern project procurement instrument that is designed to improve on end-users satisfaction.

CONCLUSIONS

Though CPD has made appreciable progress in translating project briefs into the development of functional capital asset, especially integrating the end-users in all the stages, nevertheless, the end-users’ assessment of their level of satisfaction of the completed asset is below average (less than 3) (Thiry, 2001; Pemsel et al, 2009). These may be precipitated by the lean full time professional project personnel while others are engaged on project basis; this creates discontinuity in the transfer of knowledge between capital projects. The management of multiple capital projects simultaneously can overstretch the capabilities of two full-time professional staff. Though the end-users have been incorporated into the project development processes, their complaints and assessment of the performance of CDP shows that the end-users have been hostages, where their opinions do not really matter (Mumford and Sackman, 1975). The positive effects of the active involvement of end-users include their ability to ‘own’ the project and identify with the resulting edifice including the imperfections (Pemsel et al, 2010). Here, the CDP requires the mastery in the use of hard and soft project management skills in order to avoid the negative comments of the end-users as shown in the project close-out section and assessment of performance.

Since it is not feasible to develop the physical asset that was envisioned during the project briefing without changes, it is important that CDP should effectively manage the change processes in order to improve on end-users’ satisfaction. As shown in this research, the major areas of dissatisfaction to the end-user had to do with effective communication, management of change and transferring the final project to the end-users. The inherent problems in these processes can be managed through the effective and contextual use of the principle of VE (Cheah and Ting, 2005; McGeorge and Palmer, 2005; Formentini and Romano, 2011). Through the process, dynamic consensus is built to resolve emerging problems before they escalate, thus the most functional and cost effective alternatives are agreed upon and executed; allowing all stakeholders to move progressively from existing situation to the “negotiated representation of the desired situation” (Thiry, 2001, p. 75). Thereafter, the level of disaffections associated with completed projects will be reduced.

FURTHER RESEARCH

In order to improve on the level of consultation and communication with end-users during project execution, as well as improve on the quality of project management and reporting that will facilitate the delivery of project on schedule, the researchers posit that further research be conducted to determine: The effects of 'lean' in-house (full-time) professional staff on the quality of capital project delivery and the level of satisfaction of the end-users. This is to test if increase in the quantity of in-house professional staff will have positive impact on the quality of project delivery.

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METAMORPHING BARRIERS: BOWLDERIZING THE NIGERIAN WALL

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As long as most can remember, the wall has been one of the most significant elements of Nigerian architecture and in turn, building. However, the wall has reached a stage where clear manifestations are beginning to directly infer the fact that it has out-lived its capacity for redefining space and human activity at certain levels of design. Here, the surreptitious but implicative inadequacies of the wall in Nigerian architecture are discovered, delineated, and dogmatically deliberated on with an aim to mutate it in response to the radically imposing environmental problems facing Nigerian architecture and building today. Concepts of biomimetics, computational and algorithmic design are carefully and contextually employed to aid the proven imperative motive of rethinking the wall as a skin and a membrane. An attempt is also made to blur and recalibrate to an extent the idea of ‘inside’ and ‘outside’ in relation to the functional integrity of the wall. It is discovered that the classical wall and the motive through which it exists is actually inadequate in engaging and solving new design problems currently arising in Nigeria. This is majorly as a result of the recalcitrance of Nigerian architecture to continually ordinate classical design systems to solve contemporary problems. The need is therefore sensed for walls to exist in allotropes based on environmental and design requirements in order for the Nigerian wall to be repositioned as an active elemental generator of sustainable design and autopoietic development.

Keywords: Bowdlerize, Skin, Membrane, Biomimetics, Autopoiesis.

INTRODUCTION

The idea of walls bore deep into the history of a seizable number of civilizations, the history of Nigeria cannot be left out. Over the past few centuries, walls have demonstrated the enviro-cultural capacity to project an image that engages amongst others, issues of security, politics, and dominion. When the term 'room' is under sapcial-analytic attention, the identity of the wall fades behind the dominating integrity of the defined space. Often in formal discourse, the word room only signifies a space to be put under consideration and usually tells less of the walls that actually define the space and bring into existene the very epitome of the room. Probably the scenario in which the wall gains center stage is when the scale of the room is pushed to that of a bigger territory like a compound, or a fort or a city. Long have walls been the principal indicators of terriory and as a result, teritorial politics, culture and economics. The notion of walls as definers of land and space, culture and in the long run ideas, have given a more complex definition to the idea of encroachment and social resistance. This notion of social resistance has in turn led to wars, where boundaires are forcefully overstepped and territories invaded partly with a motive to increase the area and scope of teritory. Over the years the existence and identity of the

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wall as a major social and philosophical catalyst of war cannot but be noticed. From the ancient march on the walls of Jericho, the war tales of the great wall of China, the breaking down of the Berlin wall, to the walls of Queen Amina of Zaria which are significant milestones in the history of the wall (Fletcher, 1999), walls have been active in the hallmark of territorial social friction. The wall as a tool of identity and warfare spans across the globe. After the last two world wars the idea of the wall stayed behind. It was still ordinated by the post war architecture and urbanism and man wanting to cling to every object that could bring about a sense of security, no matter how modicum. Man deliberately ignored the horrific truth; that the wall as it has always been conceived can no longer live up to its once heralded famous and infamous identity of socio-cultural definition and security. The invention of the aircraft meant that walls need not be an obstacle of trespass and invasion. If walls where the ultimate recipe of territorial security, the technology of automated projectile missiles and atomic bombs would'nt have been so feared. Slowly and furtively, the wall began to lose its global use as a security tool and only clung to the importuning powers of history for identity, integrity and survival. The wall seemed to have two forms, one was its existence at the scale of a compound or a settlement, the other was at the scale of a room. Even as the nature of the wall began to change at the macro level, little happened to the wall at the scale of the room. The wall continued to be a vertical plane with punctuations for the interaction of animal, light and air. As time went on, the heralded awareness of so-called new parameters of design (most of these parameters have been present all along but have not captured the attention of architects, environmentalists and designers) began to take their toll on the nature of the wall. The ideas of climate change, lunar activity, and new patterns of civil unrest gave rise to new imperatives for the reconstitution of the re-othering of human activity. Now the wall has undergone a series of mutations and shifts that have engaged the new arising environmental problems at a more sophisticated level. Unfortunately, this motive is yet to firmly find place in Nigeria. In a situation like this, Nigeria and the general African design community find it easier to solve many problems and engage a wider range of sustainability possibilities if the primary idea of the wall is re-thought and re-applied. This study focuses on the nature of the wall from a Nigerian context and juxtaposes it with the current and impending problems that threaten the Nigerian environment. The wall is also explained in terms of its new possibilities and propensities for high performative design and sustainability. This is done with the aim of creating a strategic motive that favours a recalibration of the generative process of the wall for an optimised effort for programmatic layering and urbanistic frameworks especially in a sustinatable way.

THE 'NIGERIAN' WALL

The wall as seen through the Nigerian lens still retains its rigid predictive low performance form. Very little has changed in juxtaposition with the traditional huts made of mud and plastered with various materials ranging from chalk to cattle dung. The most notable changes of the twenty-first century Nigerian wall include the introduction of a limited array of building bricks (also with a capability to customize the form, which still remains strictly under the stern influence of the traditional primitive shapes), a more sophisticated wall finish system, and a slightly more mechanized upgrade in the methodology of construction and installation. Walls were previously made by crude methods that involve the slap and shape method, and the first or early attempts of forming brick to orchestrate patterns along the wall’s plane. Despite these improvements, very little variety and in turn capacitive tendencies have
been achieved. The texture of the traditional mud wall for instance has moved from its rough, craggy form to a smooth rectilinear form. The existence of walls in twenty-first century Nigerian architecture has been majorly influenced by some of the dogmas that surreptitiously govern it.

**The Dogma of Rectilinearity:**

In 'Nigerian design', care is consistently taken so as not to bulge or explore the limitless three dimensional space. Buildings are designed with conformity to old rules of primitives; walls must always be straight or definitely curved, no matter the nature of their propagation along the programmatic distributions of the plan or the prospect of their consequential impact (Ajadi, 2012).

**The Concept of 'Membrane':**

In Nigeria, the reigning notion of the membrane of a building remains the wall. As a matter of fact, the wall is rarely seen as a membrane (Ajadi, 2012). This is a deep contrast to new and effective architectural principles at the tip of cutting edge technology, which tackle design and environmental problems from a more effective and efficient angle. It can be argued that approximately all Nigerian buildings still traditionally engage the wall (irrespective of the material used). In new architecture, the notion of the wall has since evolved into 'skin' and skin has now evolved into 'hide'; an advanced hybrid of the skin (Payne and Hirsuta, 2011), these notions of membrane are more flexible in delineating the equally advancing methods of spatial form creation.

Chiefly, the Nigerian wall seems oblivious of the following, amongst many others:

That the new and advanced environmental problems have pushed design into frontiers that require the wall to undergo a major paradigmatic shift in terms of performance capabilities.

To assume a positional credo that is extremely dynamic and autopoietic in nature, so as to take on new developments in design.

It is ultimately necessary to leave the tardy iconic position of a flat or curved surface design of a wall primarily driven only by the motive of tradition, immediate necessity and norm.

The wall can actually engage itself as a sustainability tool to be an aid for the environment in terms of power generation, temperature reduction and multiple access control amongst many other performances.

The need to be adaptable and regeneratively susceptible to new advances in technology as well as hybrid efforts of design and science, especially in areas like robotics, and biomimetics.

**THE NEW WALL**

Architecture seems to grow newer as it grows older, with more genres of scientific and artistic enquiry blurring boundaries with the profession. Old notions are being challenged so radically that once mutated, the old notions seem derelict and forbidden. The introduction of the computer to aid design and fabrication has created almost a plethora of methodologies to solve design problems. The mutation of design problems on the other hand has even increased the complexity of the variety of design solutions. As a result, the identity of major building elements are being re-thought and even sometimes challenged. Eric Owen Moss (2012) said that ‘when a column is stuck in
the middle of a bed it raises some questions: what is a column? What is a bed? One can further ask...what is a window? What is a wall? These questions are more important that asking why? The use of a wall has now transcended, civil defence and privacy, motives of its design have shifted from aesthetics and function to the performative and responsive. The early 30's were a period that most likely first witnessed the early mutation of the traditional wall (Rosa, 2003). From Frederick J. Kiesler' space house in 1933, to Wallace Heff's bubble house in 1941 similar to the beehive houses in Syria near Aleppo (Fletcher, 1999), this motive went on for a few decades and was further characterised when John Lautner morphed the idea of the concrete wall with his Arango house in Acapulco, Mexico in 1973, where the wall undulates in ways that where at that time unorthodox (Rosa, 2003). Concrete indications show that the undulations of the walls of the Arango house were based on parameters that include visibility, topography, and thermal comfort amongst others. This period set a vague platform for what advanced wall design will eventually turn out to be. Probably one of the most significant early projects that pushed the boundaries of the wall can be said to be the Aegis Hyposurface (see figure 1) designed by the architecture firm, dECOI. Aegis was a competition design for the cantilevered space in the Birmingham Hippodrome in England. It is a dynamically reconfigurable surface, capable of real-time responsiveness taking place in the theatre (Rosa, 2003). The surface of the 'wall' is a reconfigurable screen that changes its topography according to the sound in its environment, making it truly responsive to external stimulus. This is made possible by computer algorithms relaying data to matrixes of a wide array of actuators that in turn translate the data to mechanical movements. Aegis cannot be called a typical wall, in fact it might not be called a wall since it drastically veers off almost entirely what the traditional wall is known to represent. Design cases like these and many others like that of OylerWu (Fung, 2012), Jason Payne (Payne and Hirsuta, 2011) give indications that the wall has metamorphosed into a few 'isotopes', a few of which are the skin, the membrane, the layer are typical ones.

**Figure1**: The responsive hyposurface by dECOI (Source: www.hyposurface.org)

**The Skin, Membrane and Layer**

'Skin' is a term that came into place as a result of the wall blending totally into the roof; when designs and eventually projects that seemed to erase the boundaries of

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2 dECOI is an architectural firm of which architect Mark Goulthorpe is a principal. See www.decoi-architects.org
the jurisdiction of the wall came to being, the wall looked like a skin covering the entire body of a building or a set of programs. This was at first a way to break away from the usual design outlook. Later the prospects of the divergence began to be deeply investigated and more sophisticated design solutions began to emerge.

The term 'membrane' came as result of the skin being more performative, some use the term 'skin' to represent a more performative membrane. Other researchers (especially theorists) just interchange the terms at will. The membrane sets the wall in a vantage point that reveals possibilities and propensities for it to mimic actual biological and chemical membranes.

The term 'layer' is used when the skin or the membrane assumes a more complex assemblage of more than one skin or membrane. Some instances require the membrane (wall) to be more elaborate in order for it to solve the problems it is expected to solve. A typical example is the helium project by Michael Pawlyn where layers of ETFE are used to generate a very light shell-like membrane that spans a long distance on a site that is constantly shifting in different directions. The water cube by ARUP (the Olympic Aquatic centre at Beijing) is also an example that shows the use of a membrane in layers. Biomimetic methodologies have tried to re-enact certain biological processes like meiosis, mitosis, diffusion and osmosis in the functionality and performative framework of the wall, this and many more research taking place all over the world continues to open up new solutions to old and emerging design problems.

THE INTERSECTION OF WALL AND MATERIALS

As implied above, the improvement of research in materials have lent the freedom of new capabilities to the improvement of the architectural wall, the wall now assumes its sophistication partly to the availability of new materials. Fortunately the search of new materials have extended formally into architecture as architects now independently investigate the possibilities of materials to fit their design strategies (see figure 2). It is no longer only the material that defines the design now; rather it is the design that places unique responsibilities on the research for new materials. Due to the programmatic requirements and responsibilities of the wall to bring about more green and sustainable design, the design process of the wall has employed a vast array of materials to achieve various design motives, some of which are new and ground breaking (Rambert, 2005). Apart from ETFE (Ethylene tetra-fluor ethylene), materials such as titanium also offer opportunities for complex forms of the wall.

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3 See Wallace Heff's bubble house which ironically resembles early traditional Nigerian northern huts, as the huts are shaped like a hemisphere of mud.

4 See works or Greg Lynn, Thom Mayne, Zaha Hadid, amongst many others.

5 ETFE is fully called Ethylene tetrafluoroethylene, a fluorine based plastic, designed to have high corrosion resistance and strength over a wide temperature range. It is 1% the weight of glass.

6 Research currently being carried out by the author.
METHODOLOGY
The study follows a process of scientific and historical enquiry that borders on a juxtaposition technique in which the typical Nigerian wall is mutated with respect to a number of functional, performative and environmental conditions and scenarios. Computer Aided Design as well as algorithmic and computational methods are employed in mutating the wall. Computational methods are employed to set out an enquiry into some strategies for developing scenarios that challenge the proliferation of the wall in design and planning. Algorithmic methods are employed as a deformative/mutative tool to change the wall in alignment to considered conditions and contexts of design.

THE WALL AS A SUSTAINABILITY TOOL
Sustainability is primarily tied to the environment, and the most usual link between a building and its environment is through the skin (wall) of the building. The wall is what actually first comes in contact with the external environment. Therefore it can be said that part of the steps to making a building sustainable is to create and or allow an eco-friendly interaction between the design element and the environment. Since the environment is protean and dynamic, it is only expected that the wall behaves in such a way that will make the characters of the environment in which it will be put an ally of the building instead of an enemy.

A Sustainable Wall in Nigeria
Nigeria is located in the tropical parts of the world, off the western coast of Africa; it therefore poses a set of environmental requirements on a prospective sustainable wall than what is usually expected in temperate and partly temperate areas. This means a variation in the application, materials and the motive of designs. Unlike the temperate regions of the world, heat is usually kept out of the building than in it (except for fairly temperate regions like Jos). This section will evaluate two attempts to use the wall in a contemporary context as a sustainable tool for building, thereby showing the feasibility of the attempt to make a more sustainable Nigerian environment.
Mud as a Design Driver

One of the methodologies employs computational and algorithmic processes to generate a circular enclosed structure with a 'wall' that reconstitutes in a near obscure way of visibility but allows air and light. It takes a more complex process than that employed in the construction of a traditional wall (see figures 3 and 4). The sustainable character about this is the fact that mud is used as the material which is capable of poor electrical and heat conduction and therefore does not let go of heat easily. Mud has been the major material for building in Nigeria for a long time, sources show that as early as the 15th century, houses, and boundary walls across the country were built with mud (Ogunsote, 2006). The culture of mud architecture also extends to various parts of the continent; Uganda for instance is a very typical example where about 71% of the buildings are made of mud (Sanya, 2007). This character is taken advantage of and it is used to create a pavilion suitable for tropical regions. Choosing a hypothetical location in tropical Nigeria (assuming the topography is plain and the temperature ranges from 280°C to 320°C) a spacial solution to solve the aforementioned design problems is arrived at.

Another approach is that employed in a proposed design for the student affairs building of the University of Lagos (see figure 5). The design process starts with computationally generating a 3D graph based on spacial and environmental parameters like temperature, wind direction and light (properties which are not the same across Nigeria). The design strives to make the best use of these properties, taking account of their variation across the site in order to bring about an optimum thermal comfort situation. The two bulges, as well as the materiology and texture in the proposed student affairs building are computationally and algorithmically generated.
Complex Layering as a Design Methodology:

The diagrams below are a result of an on-going research into the dynamics of reiterative planer generation. The aim is to try to create a tectonic paradigm that bends and twists upon itself whilst maintaining the character of a plane. (I.e. planes within planes). This can be used in areas that are extremely hot or extremely cold as it allows the flow of water or latent heat to move in a rather longer and more proliferative way that the temperature is kept within the topographical fabric for as long as it is needed. The work is generated by some analogue calculations reiterated along an inflected curve. The work is computationally modelled with some plug-ins in sketchup and with rhino\textsuperscript{7} scripting. The base calculations are manual (see Figures 6 and 7).

\textsuperscript{7} Sketchup and rhino are 3D modeling software
Figure 6: Resulting generated wall structure showing a complex layering system (source: Author, 2012)

The logic is to create a complex layering system capable of sustaining temperature or water flow throughout its fabric, the planes twist and bend simultaneously in such a way that they intersect at 'nodes' that form in successive arrays along the membrane. If it were to be used to hold rain water for instance, it can be adapted to the programatic need. Depending on the choice of design and the permutation of material types along the 'fabrics' the membrane can be configured to hold water within its pocket-like nodes and then control the proliferation of the water throughout the whole internal network of the wall (see figure 8). The materials at certain strategic intervals can be semi permeable, thus filtering the water as well as redirecting it to various parts of the space related to the wall that will need the water. This planer arrangement will be very useful in scenarios that require irrigation, storage of pure water and temperature control; by using water as a coolant. These design responsibilities can be performed by extremely little or even no external energy at all as the main force needed to make the whole system work is gravity.

Figure 7: close-up view showing overlapping planes of the layering system (source: Author, 2012)

The planer morphology posees a character that allows it to be sustainably adaptable to a wide array of design scenarios. The fact that little energy is needed to operate the system makes it eco-friendly and sustainable in terms of management, performance
Application as a Flood Resilient Landscape:

Here, the methodology is tested as a membraneous landscape that uses its resulting tectonic geometry to redirect harmonic and turbulent waves heading away from a costal settlement (see figure 9) in Lagos Nigeria (Oworonshoki), currently the effect of this method is being heuristically tested. Scenarios involving various stages of flood impact are evaluated with respect to the resiliency of the membrane and its probable effect on the ecological niche of the coastal area. In this context, the ‘wall’ is a membrane between housing and flood (see figure 10-11). The ‘pockets’ in between the overlapping layers will eventually accumulate algae which can be sucked out and converted to biofuel.

The conceptual motive is to try to create a tectonic paradigm that redirects flood water in a strategic path instead of trying to repel or resist it. Plants as well as light structural elements are planned to be used collectively to mitigate the impact of flood making the landscape recuperation relatively easy.
CONCLUSION AND FURTHER RESEARCH

It is clear that a lot more needs to be done in order to bring the performative capacities of the wall in nigerian architecture and planning to a more sustainable design approach that will yield autopoietic solutions. The western world has for long gone deep into finding new ways to rethink the whole idea of architecture and planning. Radical and ground breaking advances have already been made in various aspects of the field. The period of the avant garde has come and gone (though some may disagree) in western architecture in the sense that the new and radical have now become the norm, and almost every research initiative is with a genuine motive to solve the new environmental problems that we have with new methodologies and tools. The motive of bowlderizing the nigerian wall is not to show the inadequacies of the Nigerian wall but to reaveal the novel and qualitative solutions that can be achieved when the whole notion of the wall and in turn, its architecture and planning, is re-thought. Further scientific enquiry will include seeking new ways in which new methodologies can be channelled to make the wall even more performative for
tropical regions like Nigeria. The wall can also lead to new changes in the way other aspects of planning and architecture is approached. Further tests will be carried out on emerging solutions (including the two cases mentioned), they will include small to full scale fabrication and real time testing to juxtapose the theoretical behaviour of the cases. It is absolutely imperative that the country should work on new methodologies and tools of design in the educational curriculum to increase the research force of enquiry towards a more sustainable environment. There are new and unexpected environmental problems arising in various parts of the world. It is only logical for newer solutions to be thought up as they are needed.

REFERENCES

OPERATION GREEN LAGOS PROGRAMME AND ITS IMPLICATION FOR SUSTAINABLE DEVELOPMENT

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The focus of the environmental management strategy of Lagos State government in Nigeria is “to foster a clean, healthy and sustainable environment for the wellbeing of the citizens through the application of best practices in environmental management”. In pursuance of the above objective, the operation green Lagos programme was initiated as an environmental regeneration programme. It targeted degraded and misused urban open spaces which were subsequently converted to green spaces. This paper examines the operation green Lagos programme with a view to identifying its various dimensions and underscoring its importance to sustainable development. The research adopted focus group discussion as a method of data collection alongside secondary data from literature as well as direct observation method. It was found that apart from the initial veiled resistance to the programme, it has been accepted as a positive intervention to the environmental challenges of Lagos. Similarly, it has contributed positively to environmental sustainability by making the environment cleaner and more beautiful as well as through its climate change mitigation potential. In addition, its ability to generate direct and indirect employment especially of people involved in the horticulture and landscape architecture business has contributed to economic sustainability. It has also contributed to social sustainability by reducing crime rate especially among the street urchins or “area boys” that previously held sway in the degraded areas. Challenges facing the programme were identified and strategies for deepening its penetration and for widening the active stake-holders base were adduced.

Keywords: Climate change, Green infrastructure, Lagos, Sustainable development

INTRODUCTION

The interplay of economic development and the environment has characterized the development conundrum for a long time necessitating the adoption of the concept of sustainable development as a preferred development paradigm (WCED, 1987). Sustainable development represents a paradigm shift in the understanding of development in the sense that, it is predicated on the integration of human, social, economic, environmental and physical development dimensions of development (Oduwaye, 2009). Even though the concept of sustainable development was first articulated at the international level, it is very well understood that it can only be meaningfully operationalised at the country and local levels; hence the important role of cities, city administrations, city institutions and good governance in the actualization of sustainable development goals (Osuocha and Njoku, 2012; Ilesanmi, 2010; Oyefara, 2013).

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In the context of sustainable development the city is affected by external factors such as the general issues that affect the sustainability of the earth as well as by internal city-specific factors such as urbanization, industrialization, pollution, waste management and their associated consequence (Oduwaye, 2009). The ability of the city to deal with the internal factors of sustainability goes a long way in determining its progress towards sustainable development. Regrettably, cities in the developing world have exhibited low capacity in dealing with the internal dynamics of urbanization, industrialization, population explosion, pollution and waste management despite the fact that such cities are growing at a faster rate than their counterparts in the developed world (Ilesanmi, 2010). This has resulted in a myriad of environmental challenges which include poor and inadequate housing; inadequate and overstretched infrastructure; evolution of informal settlements, rapid depletion of natural resources as well as poor waste management (Daramola and Ibem, 2010; Ilesanmi, 2010; Labisi, 2012; Oyefara, 2013).

The above environmental challenges characterize Lagos, Africa’s fastest growing megacity. The conditions are further compounded by the coastal location of the city which not only makes it a major development hub but equally makes it highly susceptible and vulnerable to the effects of climate change (Adelekan, 2010). It has also been established that resources needed to address environmental challenges in developing countries are scarce and in short supply given that industrialization lags behind urbanization instead of being driven by it (Ilesanmi, 2010). Resource limitations in developing countries as well as best practices dictate that pro-active measures in environmental management are more efficient and cost-effective than reactive measures. Unfortunately, environmental management in many megacities of the developing world are largely confined to responses when the relevant events have occurred (Ibem, 2011).

In 2007, a new political administration came on board in Lagos, Nigeria and embarked upon massive infrastructural and environmental regeneration programmes. The overall aim is to foster a clean, healthy sustainable environment for the well being of citizens through application of best practices in environmental management (Bello, 2012). Operation Green Lagos (OGL), an important aspect of the environmental regeneration programme is essentially a green infrastructural programme encompassing tree planting and replanting; development and redevelopment of open spaces, parks and gardens supported by a strong environmental advocacy campaign and improved waste management. The specific objective of this paper is to examine the greening programme in order to identify its dimensions and its implications for sustainable development in the megacity of Lagos. The paper also explores ways of deepening the penetration of the green Lagos programme by widening both its scope of operation and the stakeholder base.

**CLIMATE CHANGE, GREEN INFRASTRUCTURE AND SUSTAINABLE DEVELOPMENT**

The United Nations Framework Convention on Climate Change (United Nations, 1992) defines climate change as “change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. Climate change is regarded as one of the greatest challenges confronting the international community in the 21st century (IPCC, 2007; Nigerian Institute of Advanced Legal Studies, 2010; Northwest Climate Change
Partnership, 2011) and it has a lot of implications for the natural and built environment (Wong et al., 2012). Evidence which link climate change with increasing greenhouse gases emissions occasioned by anthropogenic factors such as urbanization, industrialization and burning of fossil fuels have been established (Odjugo, 2011; Aboyade et al., 2012). Even though developed countries have been largely responsible for climate change its effects are potentially catastrophic for both developed and developing countries; hence there is need for adequate planning to combat it. The emphasis in planning for climate change is mainly directed at reducing emissions such as carbon dioxide (CO₂) especially when it is understood that due to the long shelf life of carbon, present day emissions will impact on climate change in the future (Gill et al., 2007).

Adequate mitigation and adaptation measures are necessary in order to reduce the effect of climate change and thereby ameliorate its impact on physical and human resources. While mitigation refers to activities that reduce greenhouse gases in the atmosphere or enhance their storage in ecosystems, adaptation refers to measures that reduce or prepare for impacts of climate change (Adebamowo et al., 2012). Adaptations complement mitigation. Adaptive responses to climate change in most cases take the form of engineering approach through the construction of sea walls, drainage channels and other “hard” infrastructure. However, it has been shown that not only can the engineering approach fail; it also poses serious challenges to developing countries in terms of technical capacity and financial resources (Kithiia and Lyth, 2011). In this respect, the use of less expensive, multi-beneficial green infrastructure approach to climate change mitigation becomes necessary (Gill et al., 2007; Kithiia and Lyth, 2011). Green infrastructure refers to a network of natural environmental components, green spaces, blue spaces within or between cities that provide multiple social, economic and environmental benefits (Northwest Green Infrastructure Think Tank, 2008). Specifically, green infrastructure includes street trees, parks, gardens, green roofs as well as natural urban waterways. Green infrastructure advocates natural intervention to climate change mitigation.

Significant air temperature increase is a fall-out of climate change. Urban green spaces have been shown to play a moderating role on rising air temperature associated with climate change (Gill et al., 2007). The importance of trees as shading devices against direct impact of the sun is well known in architectural and urban design. The use of green roofs especially in areas where building cover is high such as city centres and densely populated residential neighbourhoods helps to keep air temperatures within acceptable threshold (Gill et al., 2007). Similarly, the usefulness of green roofs in mitigating urban heat islands as well as in reducing rainwater runoffs in dense urban areas are well documented in literature (Tam et al., 2011; Hui and Chu, 2009; Hui, 2006; Gill et al., 2007). Green infrastructure improves air quality, encourages biodiversity and helps in the management of storm water. Socially, green spaces especially those within residential areas encourage interaction and engender a sense of responsibility for natural resources (Ayeni, 2012). Green spaces also make economic sense as they add to property value. Importantly, green infrastructure act as carbon sink by absorbing carbon dioxide in the atmosphere thereby helping to keep atmospheric carbon dioxide low thus limiting the quantity of greenhouse gases in the atmosphere (Backstrand and Lovbrand, 2006).

Notwithstanding the above multi-faceted benefits of green infrastructure, their quantity and value are being diminished in many parts of the developing world as a result of rapid urbanization and associated population increase which puts a lot of
pressure on limited land resources (Ayeni, 2012). The foregoing is typical of a megacity like Lagos where the ingredients of rapid urbanization and shrinking green infrastructure are present.

Green infrastructure plays a significant role in environmental sustainability as succinctly outlined in Goal Seven of the Millennium Development Goals (MDGs). Green infrastructure planning and implementation encourage the reduction in the depletion rate of forest cover. Loss of bio-diversity is also an index of an environment that is not sustainable; green infrastructure encourages increase in bio-diversity. Green infrastructure, through its climate change mitigation efforts, helps to reduce the incidence of human-induced environmental disasters through preserving and conserving the natural environment.

LAGOS AND CLIMATE CHANGE

Lagos is Nigeria’s most populous city. It also has the unique feature of being a city and at the same time, a state in Nigeria’s 36 states federal structure. With an estimated population of about 18 million people, Lagos is Africa’s fastest growing megacity (Bello, 2012; Mehrotra et al, 2009). It has been projected that Lagos population would grow to 27 million inhabitants by the year 2020, a development that would put further pressure on existing infrastructure and impair the city’s capacity for good environmental management (Barredo and Demicheli, 2003). Lagos is within latitudes 6°23’N and 6°41’N and longitudes 2°42’E and 3°42’E (Ilesanmi, 2010). The Lagos metropolitan area measures approximately 1000 square kilometers and it is a group of islands surrounded by creeks and lagoons with a southern border to the Atlantic Ocean (Mehrotra et al, 2009). With an estimated coastline of about 180 kilometers, (Bello, 2012), its climate is affected by ocean and atmospheric interactions both within and outside its environment (Mehrotra et al, 2009). Lagos and indeed the entire Nigerian coastline have low elevation hence prone to storm surge. Incidentally, Lagos plays an important role in the economic life of Nigeria. Having hosted Nigeria’s seat of government up until 1991, Lagos still remains the commercial, financial, industrial and transportation hub of Nigeria and the West African sub-region.

Already, recent environmental challenges in Lagos indicate that the effects of climate change are already prevalent. Incidence of flooding and inundation has been on the increase (Salami, 2010; Aderogba 2012a; Aderogba 2012b; Odjugo, 2011; Ofuani, 2011). Increased levels of carbon emission have been established in the oil and gas sector through gas flaring as well as in the transportation and energy sectors (Ladan, 2009). Nigeria’s triple vulnerability as outlined by Salami (2010) which includes land-based vulnerability, economic vulnerability and human-based vulnerability are applicable to Lagos. Adaptation and mitigation measures are applicable to Lagos and they are carried out simultaneously with the city’s development planning and implementation. In realization of the challenge posed by climate change to an ever-expanding megacity like Lagos, the current Lagos State administration has responded by incorporating climate change mitigation measures into its development planning and implementation. Even though Mehrotra et al (2009) argue that the mitigation and adaptation measures adopted by Lagos State government rather than being climate-change driven are fallouts of the administration’s renewed commitment to development especially infrastructure provisions. However, recent evidence as outlined by Bello (2012) and Oyefara (2013) indicate that the Lagos green programme is largely positioned as a climate change mitigation initiative.
OPERATION GREEN LAGOS

Operation Green Lagos was introduced in 2008 as a multi-faceted approach to the development of green infrastructure in Lagos. Lagos is the most urbanized state in Nigeria, a feature which it combines with limited land resources. Rapid urbanization has brought along with it depletion of forests and green areas resulting in substantial modification of the ecosystem. Similarly, pressure on land had necessitated high percentage of built up areas. The green programme is an attempt to arrest the negative trend and put Lagos back on the path to sustainable development. According to Afun (2011) the objectives of the operation green Lagos programme include the following:

(i)To restore order, improve quality of life in neighbourhoods, mitigate the effect of climate change and ensure environmentally sustainable, healthier and more visually pleasing society;

(ii) To reclaim open spaces from all agents of environmental degradation and subsequent preservation of the biodiversity and ecosystems of the environment.

Specifically, the green programme encompasses tree planting and replanting programme; provision of parks, gardens and green areas; improved solid waste management as well as environment advocacy campaigns.

Tree Planting and Replanting Programme

The tree planting programme was modeled after the billion trees campaign of the United Nations Environment Programme (UNEP, 2006). Its aim is to replace a substantial number of trees lost in the process of urbanization and development. The target of the tree planting campaign is one million trees annually. The tree planting campaign include ceremonial tree planting; continuous tree planting; private sector participation; me and my tree programme (Bello,2012). In ceremonial tree planting, designated locations host the tree planting exercise which usually takes place on the tree planting day (July 14). Ceremonial tree planting is therefore commemorative and the locations are selected in line with the diversity of the Lagos ecosystems .Continuous tree planting is the flagship of the tree planting campaign and it is embarked upon along major roads and streets, road intersections, traffic islands and other spaces where evidence of degradation were observed (Fakare and Oduwayne 2009). “ Me and my tree” component of the programme targets the young generation with the aim of inculcating the tree planting culture among students of the state public schools. The tree planting campaign encourages the participation of the private sector in collaboration with the state government. A number of corporate organizations partner with the state government in the promotion of the ceremonial tree planting. Similarly, non-governmental organizations have joined in the tree planting programme. The Eko Green Dream Initiative plans to plant six thousand trees in some parts of Lagos in addition to pioneering a reward system (Eko Green Card) in conjunction with the manufacturing sector for individuals and groups who engage in tree planting (Adegboye, 2013)

An important aspect of the tree planting initiative is the tree replanting programme. Rapid and large scale infrastructure upgrade and expansion in Lagos as well as increased housing provision necessitated the removal of certain trees. In line with the objective of conservation, the government of Lagos embarked upon relocation of certain trees using state-of-the-art equipment procured for that purpose. In addition, felling of trees has been prohibited (Bello 2012). So far, as at April 2013 over 5million trees of different species have been planted (Bello 2013).
Provision of Parks, Gardens and Green Spaces

A quiet but profound parks, gardens and green spaces development is ongoing in Lagos. The aim is to convert all free spaces, traffic islands, road setbacks, illegal waste dumps and unapproved roadside markets to green areas (Fakare and Odwuye, 2009; Ogunsote et al., 2011; Okunlola, 2013). In order to facilitate the progress towards sustainable environment and further enhance the aesthetics of Lagos, the Parks and Gardens Agency (LASPARK) was established through the instrument of Lagos State Parks and Gardens Law (2011) as the overall coordinating agency for parks, gardens and green spaces in Lagos (Lagos State Government, 2011). The agency has the mandate to take the green initiative to every property in Lagos. In this respect one hundred landscaped and beautified sites have been handed over by the Lagos State Ministry of the Environment to the Lagos State Parks and Gardens Agency (Bello, 2013).

Improved Solid Waste Management

The greening programme is being complemented by an improved solid waste management system. Cleaning of major roads and streets keep the streets neat and additionally reduce the quantity of solid wastes that fall into drainage channels. Also waste collection from households is facilitated by Private Sector Participation (PSP) which has reduced the incidence of indiscriminate dumping of waste and incineration (Adewusi, 2012; Idowu et al., 2011). In addition waste landfill sites are being converted to waste-to-wealth locations. Recycling of non-biodegradable materials such as plastic materials is in operation. Similarly, biogas capturing at Olushosun landfill site is in operation. It has been found that solid waste disposal sites are responsible for up to 20% of global emissions of methane gas, the second most important greenhouse gas (Aboyade et al., 2012). Importantly, Oshodi Waste Transfer Station which also incorporates a Medical Waste Treatment plant is in operation (Bello, 2012).

Environmental Advocacy Campaign

The Lagos green programme is supported by a strong advocacy campaign which encompasses sanitation advocacy, waste management advocacy, green infrastructure advocacy and climate change advocacy. The advocacy campaign is a collaborative effort with various environment sensitive groups (Nigerian Conservation Foundation 2011) and it is carried out through environment advocacy groups; climate change clubs in schools; appointment of environment ambassadors and public enlightenment through symposia. In this regard, the annual Lagos Climate Change Summit has succeeded in putting climate change issues on the front burner. Five summits have been held with varying themes but all directed at climate change and the place of Lagos in the climate change scenario.

RESEARCH METHODOLOGY

A combination of research methods was adopted for this study. Given the relative young age of the operation green Lagos programme and paucity of literature on its operations and considering the fact that the project is still ongoing, a facilitated focus group was considered a useful tool in gaining understanding of its operation and implication to sustainable development. Prior to the focus group, an initial desktop study on scoped literature was undertaken to gain insight of the green programme and to identify the spatial distribution of projects associated with the green programme. Thereafter a pilot survey to identify the specific locations of the green Lagos projects...
was undertaken which was subsequently followed by detailed observation of the specific features of the greening programme including types of plants and current state of the green areas.

Focus groups are useful in programme development and evaluation where it can be used to gain insight into whether a particular programme is achieving its goals (Barnett, 2002). Even though focus groups are more widely used in social research it has been found to be useful in environment-related research. Labadie (2010) employed focus group of professionals in environmental management to identify barriers to the use of low impact development and green infrastructure in the Albuquerque area of Mexico.

The focus group used in this study comprise of eight (8) participants drawn from built environment practitioners with Lagos as base. The participants are currently in a consortium arrangement developing blueprints for a green university campus in Southwest Nigeria. The focus group interview was planned to coincide with regular consultative meetings of the group which comprised of architects(2), landscape architect(1), energy consultant(1), civil engineer(1), electrical engineer(1), urban planner(1) and horticulturist(1). Researchers field notes as well as transcripts from focus group discussions were the basis of analysing qualitative data obtained.

FINDINGS AND DISCUSSIONS

The tree planting so far has been concentrated along major roads especially those that have recently been constructed, renovated or upgraded, thus indicating that the green programme is integrated with general infrastructure development. The tree planting has not penetrated the local areas and neighbourhoods largely because road infrastructure upgrade is yet to reach those areas. The tree varieties identified include yellow fuchs, dwarf cocoanut, queen palm, Melina and masquerade tree which is generally referred to as Asoka tree. No fruit trees were observed which is explained by the potential risk to children and motor vehicles such would pose. It was found that there was a preponderance of the Asoka tree (polyalthia longifolia) in the tree planting campaign which can be explained by the evergreen characteristic of the plant and its high survival rate. However, its shading ability is limited because of its morphology. The trees are in good condition as owners of adjoining properties are usually advised to monitor the trees and report any challenge to the appropriate agency. The major roads that have witnessed tree planting include: Ikorodu Road, Marina, Third Mainland-Ibadan Expressway, Iyana Ipaja-Ikotun Road, Agege Motor Road, Lasu-Isher Road, Apapa-Oworonsoki Road, Abeokuta Expressway, Airport Road, Mobolaji Bank Anthony Road, Lekki-Epe Road, among others. However, property developments that encroach into road setbacks hamper the tree planting effort; hence the need to encourage tree planting within property boundaries. Also tree planting was observed along overhead electricity supply lines, which is potentially dangerous.

The major parks and gardens are located at traffic islands, major road interchanges and cloverleaves, unused open spaces and previously misused spaces. Examples include MOE Park Alausa, Millennium Park Oshodi, Muri Okunlola Park (Ozumba Mbadiwe –Akin Adesola-Kingsway road interchange), Adeniji Adele Park (Third Mainland Bridge-Adeniji Adele interchange), Oworonsoki interchange garden, Airport interchange garden, Costain Park (Western avenue- Moshood Abiola Road-Apapa Road- Eko Bridge interchange), Ijora Park (Eko Bridge- Ijora Causeway interchange), Gani Fawehinmi Park, Ojota and MKO Abiola Garden Alausa. Greening of road medians were found along Agege Motor Road, Mobolaji Bank Anthony Way,
Amuwo Odofin industrial estate road and Lagos-Ibadan Express by the old tollgate. Features identified in the parks and gardens include well tended grass lawns, walkways made of interlocking paving stones which were properly lined with kerbs, ornamental trees, water borehole and sprinkling equipment. The parks were also well lit to avoid possible wrong usage at night. However, due to location of the parks and gardens at traffic nodes, only minimal car parking is provided thus limiting large public usage of the facilities with the exception of the MOE Park Alausa and the Millennium Park Oshodi which attract substantial public usage.

It was also found from observation which was corroborated by the focus group that the major roads and streets are clean which is attributable to increased street cleaning efforts. However the solid wastes especially empty water sachets and drink cans still find their way into drainage channels an indication that solid waste management needs a lot of improvement with particular reference to the attitude of the population towards solid waste disposal. The existing waste landfill sites are not operated with sustainability as a target. Their location within built up areas and very close to major roads and the fact that the landfills are not lined are indicative that the solid waste management aspect of the green programme falls below acceptable international best practice (Olorunfemi, 2011). This is supported by research findings which show that leachate contamination of ground water around landfill sites is a real threat (Afolayan et al, 2012; Salami and Susu, 2013).

The green Lagos programme was strongly supported by an environmental advocacy campaign the flagship of which is the annual climate change summit which commenced in 2009 and has covered the following themes: Reclaiming the Environment : Challenges and Consequences of Climate Change (2009); Trans-border effects of Climate Change: Sharing Best Practices in Mitigation and Adaptation Measures (2010); Charting a Roadmap for Combating Climate Change in Nigeria (2011); Vulnerability and Adaptation to Climate Change in Nigeria: Lagos State Agriculture, Industry and Health Sectors in Focus (2012); Vulnerability and Adaptation to Climate Change in Nigeria: Lagos State Transportation, Housing and Infrastructure Sectors in Focus (2013).

There was a consensus among the focus group members that the green programme is a positive contribution to the environmental challenges facing Lagos. Initial public response to the initiative was not encouraging due largely to the fact that many small businesses especially along the roadssides were displaced. The government commitment to the programme which has translated to cleaner, healthier and more beautiful environment has led to increased support for the programme and has elicited positive attitudinal change on the part of the public.

The focus group discussion also identified some positive attributes of the green programme as:

- Increased awareness of environmental challenges;
- Improved quantity and quality of urban green spaces;
- Generation of direct and indirect employment;
- Reduction in crime rate among youths who gained employment through the programme.
Increased Awareness of Environmental Challenges

The green advocacy aspect of the green Lagos programme has created an increased level of awareness of environmental issues in Lagos especially the challenges associated with climate change effects and vulnerability. The school outreach aspect of the advocacy campaign has grown to encompass over 600 public and private schools with a total enrolment of about fifteen thousand students (Bello, 2012). Other advocacy programmes include environmental sanitation advocacy teams, quarterly public enlightenment forum with community development associations (CDAs) and market advocacy teams that focus on sanitation of markets. Lagos membership of C40 Cities Climate Leadership Group, a network of the world’s mega cities committed to addressing climate change has impacted positively on the advocacy campaign.

Increased Urban Green Spaces

Urbanization especially in rapidly growing cities put pressure on landuse and limits the amount of space available for beautification (Ayeni and Olalusi, 2012). With the advent of the green programme, urban green spaces in Lagos have increased both in quantity and quality. In a recent ceremony the Lagos State Ministry of the Environment handed over 100 beautified sites to the Lagos State Parks and Gardens Agency for maintenance and management (Bello 2013). The green initiative has contributed positively to sustainable environmental development. However, given the ever-expanding character of Lagos, emphasis should be placed on the hinterlands to prevent further depletion of natural green infrastructure.

Employment Generation

Lagos, because of its economic attraction has been at the receiving end of migration especially of unemployed youths seeking gainful employment (Emeh et al, 2013). The green programme has created direct employment to horticulturist, landscape architects, electrical engineers, sculptors, water borehole experts, welders, bricklayers, electricians, painters and unskilled labour. Indirect employment has also been created for suppliers of granite, sharp sand, cement, concrete kerbs and concrete paving stones; hence the green programme has contributed to the economic dimension of sustainable development as indicated by the increasing number of people engaged in commercial horticulture and prospects for economic gain derivable from it (Abegunde et al, 2009; Abegunde, 2012).

Crime Reduction Potential

The green programme has reduced crime rate in Lagos state. Prior to the green programme, most of the open spaces were dark spots where street urchins also known as “area boys” and various armed gangs held sway. In developing the open spaces into green spaces, many criminal gangs lost their bases. The green programme integrated the streets urchins i.e. “area boys” into the greening programme and many of them were rehabilitated in the process thus contributing to social sustainability. It is estimated that more than seven thousand street urchins and young street gang members have been employed by the green programme (Afun, 2011).

CHALLENGES OF GREEN LAGOS PROGRAMME

In spite of the positive contributions made by the green Lagos programme, a lot still needs to be done in order to make Lagos truly green. The challenges facing the green programme can be summarized under three headings namely:

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Perception;
Penetration; and
Scope of Operation.

**Perception**

Notwithstanding the level of public enlightenment embarked upon by government and non-governmental organizations on the rationale for the green Lagos programme, the focus group observed that the programme is still largely seen as a city beautification initiative which obscures the wider perspective of the programme as a climate change mitigation strategy. It is therefore plausible that earlier resistance to the green programme especially by displaced users of the degraded open spaces may have been informed by the perception of the programme as a beautification project which adds no value to their immediate economic life. In contrast to their perception, a degraded environment will ultimately impair the capacity of the environment to provide economic value. It is therefore apposite that continuous public enlightenment programmes should be embarked upon.

**Penetration**

Even though Lagos state Ministry of the Environment claims 60% penetration of the green Lagos programme, the programme has been largely restricted to the highly urbanized areas and along major development corridors. Programme penetration to the hinterland is limited owing largely to the fact that the programme is tied to other infrastructure developments such as roads and drainage which have not fully penetrated to the hinterland, characterized by unco-ordinated physical development. The Lagos hinterland with moderate level of urbanization holds a lot of prospects for green infrastructure development because it is not fully built up yet and proactive planning can reverse the prevailing tendency towards unsustainable physical development. Similarly, the green programme should be repositioned so that property owners would be at the vanguard of providing green infrastructure especially within their properties. Limiting tree planting to road corridors without corresponding support from adjoining property owners would not achieve the level of green infrastructure needed to mitigate the effects of climate change. Property owners should be encouraged to plant fruit trees within their properties.

**Scope of Operation**

In order to ensure provision of effective green infrastructure, all resources available within the state should be taken into consideration. In this respect the undeveloped areas such as wetlands and wildscapes with their valuable ecosystems should be integrated into the green programme. According to Ojekunle (2012) as well as Olaniyi and Akinluyi (2013), wetlands are useful to sustainable environmental development. A proper wetland development policy will enhance the Lagos green programme. On the other hand, wildscapes are urban spaces where natural processes such as spontaneous growth of vegetation appear to be shaping the natural environment (Kithiia and Lyth, 2012). In Lagos, natural green belts like the ones found along canals and watercourses qualify as wildscapes and their inclusion in the green programme will add value to it.
RECOMMENDATIONS

The reality of climate change especially in a coastal megacity such as Lagos has been established. It has also been shown that coastal cities of the developing countries are more developed than cities in the hinterland in terms of housing, transportation, commerce and infrastructure (Adelekan, 2010). Given that the impact of climate change on coastal cities are likely to be devastating, the protection of coastal cities like Lagos from the impacts of climate change becomes a task for all stakeholders. The green programme adopted by Lagos is a positive development and the following recommendations would help reposition the programme for greater impact.

Continuous Enlightenment

Continuous education of all stakeholders through well directed public enlightenment programmes should be encouraged. Target groups such as artisans, market groups, informal sectors, formal business groups, professional groups, property owners, community development associations, non-governmental organizations, etc. should benefit from specially packaged enlightenment programmes that would enable them key into the green initiative efforts. In this respect, government should play coordinating role rather than engage in direct provision of the green infrastructure. The future of the green programme lies in its being private sector driven with government providing the enabling environment and necessary directions.

Widening the Stakeholder Base

The green programme is still largely dominated by government. Sponsorship of aspects of the green programme by the organized private sector in the form of corporate social responsibility (CSR) is limited. Efforts should be made to attract increased level of involvement of the private sector through a number of incentives. In addition, major government infrastructure contractors should be persuaded to sponsor aspects of the green programme as a way of improving their ecological footprints. Similarly private property owners should be encouraged to contribute to the greening programme by utilizing a percentage of their plot areas for private gardens and tree planting. A recent planning regulation stipulates that 30% of developable land should be for greening (Jeje, 2013). In this respect, enforcement of developing planning regulations with respect to set backs and densities should be maintained so as to make the undeveloped part of the plot available for trees and gardens. The Parks and Gardens Law is intended to make greening compulsory at plot-specific level. However, community based approach to the enforcement of the law by using Community Development Associations (CDAs) is recommended as evidence shows that CDAs are more effective in this respect (Akinsorotan and Olujide, 2006 ; Abegunde, 2009).

Enlarging the Scope of the Green Programme

The green Lagos programme should be extended to cover the wetlands and urban wildscapes as their unique ecosystems would add value to the greening programme. Wetlands are currently accommodating a number of unapproved settlements and pressure on land resources implies that more settlements will spring up within the wetlands. A comprehensive development programme for the Lagos wetlands in the light of climate change induced challenges as well as the green infrastructure programme should be embarked upon by the government of Lagos state. In pushing the green agenda further, urban wildscapes should be allowed to develop in line with sustainable principles. Wildscapes exist especially along canals and water courses and
their sustainable conservation and controlled development can result in an urban green corridor.

**CONCLUSION**

This paper has discussed the operation Green Lagos programme within the context of green infrastructure as a multi beneficial environmental management strategy in the light of climate change. It was observed that the Operation Green Lagos Programme is a viable intervention in the hitherto unco-ordinated environmental management of a megacity like Lagos. The available data from government sources as well as from researcher – observation and focus group discussion indicate that the green programme while fulfilling its climate change mitigation objective had impacted positively on the Lagos megacity in the areas of increased environmental awareness, increased number of green spaces, employment generation and in crime reduction. The green programme has so far been dominated by the government but there is needed to widen the active stakeholders’ base in order to guarantee deeper penetration of the programme. It was observed that the green programme is closely linked with infrastructural development; hence peculiar ecosystems such as wetlands and wildscapes are not yet part of the green programme.

The paper finally recommended the active development of Lagos wetlands as well as the wildscapes along canals, green belts and buffers as well as disused burrow pits and related areas. Continued public enlightenment is the key to better understanding and increased uptake of the green programme. By so doing the green programme would be positioned to contribute more profoundly and effectively to sustainable environmental development. In all, pro-active measures especially for developing areas as well as wetlands and wildscapes would be paramount.

**References**


Adelekan, K.A. (2010), “Vulnerability of Poor Urban Coastal Communities to Flooding in Lagos, Nigeria”, *Environment and Urbanization, Volume.22 No.2*, page.443-


Plate 1: Road Median, Mobulaji Bank Anthony Way, Ikeja
Source: Author’s Field Survey, May 2013

Plate 2: Trees along Iba – Isheri Road
Source: Author’s Field Survey, May 2013

Plate 3: Trees growing towards electricity lines, Iyana-Ipaja – Ikotun Road
Source: Author’s Field Survey, May 2013

Plate 4: Private Horticulture Garden complimenting tree planting, Agege Motor Road
Source: Author’s Field Survey, May 2013

Plate 5: Tree planting integrated with public infrastructure, Iba – Isheri Road
Source: Author’s Field Survey, May 2013

Plate 6: Trees planted next to walkway, Lasu – Isheri Road
Source: Author’s Field Survey, May 2013

Plate 7: Mini park, Isheri Round about
Source: Author’s Field Survey, May 2013

Plate 8: Road Median and trees, Isheri – Iba Road
Source: Author’s Field Survey, May 2013
APPENDIX
Ensuring availability of resources (including human) is among the requirements of quality management system. This paper is aimed at investigating the relationship between Organisational Quality Policy of Nigerian Building Design Firms and their number of employees. Organisational Quality Policy is among 20 quality management sections contained in various design standards. Questionnaire survey was used to generate data for the study. Average Prevalence, Regression and Correlation Analyses were adopted for data analysis. The overall average quality practice prevalence values recorded by the firms indicated that only firms under the group of ‘Over 20 Employees’ attained the status of ‘Require Slight Improvement’ with overall average quality practice prevalence value of 76.17%. All the remaining groups require serious improvement as indicated by their respective overall average quality practice prevalence values that generally fall below 75%. Improvement in practice was noted to increase with increase in number of employees. A correlation coefficient of 0.74 indicated that there is a strong correlation between the quality practice performance of the Nigerian Building Design Firms and their number of employees. It is recommended that the Nigerian Building Design Firms need to improve in all aspects of Organisational Quality Policy practices, particularly in the areas of staff improvement.

Keywords: quality management, quality policy, design firms, quality practices, employees.

INTRODUCTION

Quality Management is observed to include “all the activities that managers perform in an effort to implement their quality policy’, (Harris and McCaffer 2005). Quality policy is described in ISO 9000 (2005) as the overall intention and direction of an organisation related to quality as formally expressed by top management”. It provides the framework for establishing and reviewing organisational quality objectives. The success of an organisation largely depends on how sound its quality policy and objectives are established and pursued. The achievement of quality objectives can have a positive impact on product quality, operational effectiveness and financial performance and thus on the satisfaction and confidence of interested parties, (ISO 9000 (2005).

Design activity is essentially a service work and it is an important aspect of construction activities; its success contributes immensely to the overall project quality (Kado, 2011). Sanvindo et al, (1992) in Soentanto et al, (2001) mentioned that “quality in construction projects, as well as project success, can be regarded as the

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fulfilment of expectations of those participants involved”. The participants include client/user, design team and their workforce and contractors. The most important among them is the satisfaction of the client as testified by Barret (2000) that “client’s satisfaction is the ultimate measure of construction quality…”

Kolawole (1998) categorised the factors militating against achievement of quality in construction into “cheapest first cost attitudes, design and construction,” also recognising that “cheapest first cost” attitude is perhaps “the most prevalent reason for absence of quality in the end product of the Nigerian Building Industry.” The same attitude also affects the extent to which professionals are employed in the design, construction and quality control of building.

Some of the steps involved in meeting the customers’ needs according to ISO 9000 (2005) include:

Determine who the customers are.
Determine their needs.
Develop product features which respond to customers’ needs.
Develop processes which are able to produce those products.
Transfer the resulting plans to the operating forces.

The last step highlights the relevance of organisation quality plans in achieving quality. This is clarified by Wilkinson and Scofield (2003) that “the purpose of such plans is to put in place a quality control system for the project.” Such system sets out inspection, testing, control and verification requirements for all aspects of the project. The step also points out the relevance of human resource in achieving the success of the quality plans. In this respect, Wilkinson and Scofield (2003) pointed out that the quality plan not only sets out a mechanism for showing how quality will be achieved, but also contains information about key personnel involved in the project and how they will be used. In essence, it is the employees of organisation that are responsible for implementing quality plans. Responsibilities of employees, their requirements and contributions in quality management system have been discussed by Stebbing (1987), Hendrickson and Au (1989), Stebbing (1990), Kume (1992), Aggarwal and Rezaee (1996), Harris and McCaffer (2005), Osofisan (2007), and ISO 9001 (2008).

Furthermore, ISO 9001 (2008) noted that “the adoption of a quality management system should be a strategic decision by the top management of an organisation”. In this respect, the standard outlined the following factors that influence the design and implementation of an organisation’s quality management system. These are;

Its organisational environment, changes in that environment and the risks associated with that environment.

It’s varying needs.
Its particular objectives.
The product it provides.
The processes it employs.
Its size and structure.

It is imperative to note that organisational quality performance is enhanced when there are sound management and control disciplines and effective and efficient working methods implemented through trained and committed management and workforce.
RESEARCH AIM

Studies conducted on the performance of the Nigerian Building Design Firms in relation to quality management practices revealed that their performances vary according to certain grouping criteria. For instance, by Kado et al., (2010) conducted a similar study on the quality management practice of the North-Western Consultancy Firms of Nigeria using consultancy activity as a grouping factor. The study established that only Mechanical and Electrical group of consultancy firms had a percentage prevalence of between 75-80% which indicated need for slight improvement. Using similar grouping criterion with sample of Building design Firms across Nigeria, Kado (2011) determined that the Structural and Multi-disciplinary groups of design firms had overall average prevalence values of 77.4% and 75.63%, respectively; this indicated that both attained the status of ‘Require Slight Improvement.’ Moreover, Kado and Abubakar (2012) studied the quality policy of the Nigerian Building Design using organisational age as a grouping factor. Findings showed that firms falling between 6 – under 10 years, 16 – under 20 years and firms over 20 years require slight improvement as indicated by their average prevalence values falling between 75-80%. However, firms falling between 1 – under 5 years and 11 – under 15 years require serious improvement. Thus, the result suggested that their performance did not vary (proportionally) with increase in their ages.

Another approach to the similar studies highlighted above is by grouping the Nigerian Building Design firms based on their number employees. Based on this criterion, this paper is aimed at investigating the relationship between Organisational Quality Policy of Nigerian Building Design Firms and their number of employees.

RESEARCH METHOD

Questionnaire survey was used to generate primary data of the study based on identified 20 design quality sections with a total of 100 practices. Some of the standards and source of these quality sections and practices include International Standard Organisation (ISO 9000 family series), Malcolm Baldridge Standards, BS 5750, Stebbing (1987), Ducan et al., (1990), Bubshait et al., (1999), Sebastian et al., (2003), Bamisile, (2004) and Kado, (2011). Organisational Quality Policy is among these quality sections with six practices as outlined below.

‘The organisation has a defined quality philosophy and is understood by all’.
‘The organisation has an established quality programme.’
‘Organisational objectives and individual responsibilities for quality are clearly defined.’
‘Quality manual is available and is updated to reflect current quality policies and procedures.’
‘Quality plan is prepared for individual projects.’
‘The organisation has a specified design methodology.’

The work of Bubshait et al., (1999) was adopted for the research. Respondents were asked to rate their quality practices as; ‘Always – 100%’; ‘Mostly – 75%’; ‘Sometimes – 50%’; ‘Rarely – 25%’ and ‘Never – 0%’. Responses obtained were used for conducting analysis based on which inferences were drawn.
SAMPLING FRAME AND QUESTIONNAIRE ADMINISTRATION

From the list of registered consultancy firms obtained from the Headquarters of the Corporate Affairs Commission (CAC, 2010), table 1 was constructed to show the distribution of the Building Design Firms according to the Nigerian six geopolitical zones.

Table 1: Distribution of the Nigerian Building Design Firms

<table>
<thead>
<tr>
<th>S/No</th>
<th>Geographical Zone</th>
<th>Number of Consultancy Firms</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North-East</td>
<td>140</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>North-West</td>
<td>489</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>North-Central</td>
<td>1,747</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>South-East</td>
<td>350</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>South-West</td>
<td>2,796</td>
<td>40</td>
</tr>
<tr>
<td>6</td>
<td>South-South</td>
<td>1,468</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6,990</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: (CAC, 2010).


DATA ANALYSIS TECHNIQUES

Data analysis was also adopted from the work of Bubshait et al (1999). Average quality practice prevalence values for each quality practice under the quality section were calculated using equation 1.

\[
\text{Average Prevalence} = \frac{\sum (a_i x_i)}{\sum x_i} \tag{1}
\]

Where \(a_i\) takes the value 100, 75, 50, 25 and 0; and \(x_i (x_1, x_2, x_3, x_4 \text{ and } x_5)\) are the numbers of the corresponding respondents answering always, mostly, sometimes, rarely and never. Average values were also calculated across the rows and down the columns. The quality practices were then ranked according to a particular group of firms.

Four category of performance were observed from the work of Bubshait et al, (1999). They are – ‘Commendable (90-100%)’, ‘Satisfactory (81-89%)’, ‘Require slight improvement (75-80%)’ and ‘Require increased improvement (less than 75%)’. Inferences were drawn using the four categories.

Regression and correlation analysis were also conducted to investigate the relationship between the number of employees (Independent Variable) and average quality practices prevalence values (Dependent Variable). Regression line equation and correlation coefficient \((r)\) were obtained according to (Keller and Warrack, 2003).
RESULTS AND DISCUSSION

Analysis of Administered Questionnaires

A response of rate 44.7% was obtained. Moser and Kalton (1971) asserted that the result of a survey could be considered as unbiased and significant if the return rate is not lower than 30-40%. Based on the total response (the number of returned questionnaires), 90.6% were observed to be usable and adequate for analysis.

The numbers of employees employed by respective groups of the design firms were presented in figure 1 below.

![Graph showing distribution of number of employees of Nigerian Building Design Firms.](image)

From the figure the fifth group of firms with over 20 employees happened to be the largest in terms of number of employees. The group represented 30.2% of the whole responding design firms. Generally, it can be depicted that about an average of the firms employ not more than 10 employees (about 47.9%). The least group (group 3 – 5%) employ over 11-15 staff, while, 6.3% of the firms did not indicate their number of employees.

Quality Practices

The overall details of the assessment of the various quality practices under the ‘Organisational Quality Policy’ in relation to number of employees of design firms are presented in figure 2. It should be noted that the code ‘QP’ in the figure represents ‘Quality Practice.’

From figure 2 it can be deduced that the best quality practice by the groups of firms was generally in area that relates to establishing organisational quality programme (QP2) while the least practice was in the area of provision and update of quality manual (QP4).

Figure 3 shows the overall average quality practice prevalence values of the groups. Note that the steady increase in performance according to increase in the number of employs suggests some positive relationship between the number of employees and their performance. Note also that the highest performance of 76.17% prevalence value is recorded by the last group having over 20 employees. This indicated that it is the only group that require slight improvement. All the other groups require serious improvement. However, overall average prevalence of 72.3% for the whole groups
revealed that much is desired from the Nigerian Building Design Firms with respect to Organisational Quality Policy.

![Figure 2: Average quality prevalence for Nigerian design firms according number of employees](image)

Results of the regression and correlation analysis yielded the following results. Regression equation obtained is presented in equation 2.

\[
y = 0.27x + 68.93
\]

Figure 3: Overall average quality prevalence for the Nigerian design firms according number of employees

Where y stands for Overall Average Quality Prevalence and x stands for Number of Employees. The slope of the equation (0.27) suggests a positive relationship between the two variables.
Correlation coefficient (r) of 0.74 indicated a strong relationship between the two variables. However it should be noted that correlation does not means causality, (Afonja, 1985).

**CONCLUSION**

The result of the study revealed that the best quality practice by the Nigerian Building Design Firms under Organisational Quality Policy was in establishing quality programme. The best performing group of firms was the group that were employing over 20 employees as suggested by the group’s prevalence value of 76.17%. The results also indicated that there was a strong relationship between the performance of the Nigerian Building Design Firms and their Number of Employees. The poorest practice recorded by the firms was in the availability and update of quality manual.

**RECOMMENDATIONS**

The fact that the study established a strong relationship between the performance of the Nigerian Building Design Firms and their Number of Employees, however it is imperative point out that increasing number of employee in the Nigerian design firms may not necessarily improve their performance towards attaining the requirements of Organisational Quality Policy and that of Quality Management System in general. It is therefore recommended that requirements of employees in the design firms should be adequately planned using relevant procedures and techniques. Similarly, employees’ needs and requirement in the provision of adequate training/retraining, motivation tools and other resources must be met in order to ensure attainment of quality in the Nigerian construction industry.

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PERCEPTIONS OF FINAL-YEAR FEMALE UNDERGRADUATES ON THEIR PROPENSITY TO PARTICIPATE IN CONSTRUCTION PRACTICE

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Education is one of the means for promoting development and improving the capacity of individuals to address environmental and development issues. This paper aims to examine the perceptions of final-year female undergraduate students in construction disciplines on their propensity to participate in construction practice. A questionnaire survey was undertaken of fifty-seven (57) female respondents in three higher institutions in the Northern part of Nigeria and a semi-structured interview of fifty of the respondents was conducted. The quantitative data were analysed by obtaining the measures of central tendency (means) and frequencies while the data from the interview were treated using content analysis. The barriers common to the respondents are poor image of the industry, sexual harassment and the difficulty in gaining acceptance. The results of the interview revealed further that social and cultural factors such as traditional women’s role will likely influence their decision to practice. It was concluded that though the female undergraduates face barriers, they have confidence that they can develop the requisite skills to exercise their professional abilities. Marriage, societal culture and religious affiliations influence the choice of whether or not to continue in the construction profession. It is recommended that modalities need to be worked out whereby women are encouraged to explore their potentials in the industry such as a forum where the female members of professional construction bodies can provide role models to the younger women in tertiary institutions.

Keywords: women, gender, construction undergraduates, education, barriers

INTRODUCTION

Education is one of the means for promoting development and improving the capacity of individuals to address environment and development issues. The education of women in construction disciplines has been a subject of research. For example, the recruitment of women into higher institutions of learning was investigated by Dainty and Edwards (2003). They found that the number of women applying for construction disciplines in the UK has remained steady over time though their numbers, compared to men are far less. Dainty and Lingard (2006) noted that despite more female graduates completing construction related degree courses, they still remain underrepresented in the UK and Australian construction industries. Bennett et al. (1999) observed that course enrolments in construction disciplines in the UK were highly gendered and Dainty et al. (2000) noted that only 18% of undergraduates on construction-related courses within the UK are women.

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Kehinde and Okoli (2003) examined historical data on the enrolments of women in construction related disciplines as well as women’s participation in professional bodies in Nigeria. They found that there is an increase in the average enrolment of female entrants into Engineering and Environmental faculties but the figures are below the over-all average enrolments in the University. Kolawole and Boison (1999) found that the intake of women into construction-related courses in tertiary institutions in Nigeria has increased over the years but that enrolments are more concentrated on courses which require office-work than field-work. The participation of women in professional bodies was shown to be very low and this could be due to the fact that many of the graduates from these courses do not eventually end up practicing the professions they were trained for. Several authors have recommended different approaches to dealing with the problem of women’s underrepresentation like: widening access to construction higher education; identifying specific barriers, image, and culture of the industry and introducing equal opportunities guidelines for best practice (Adeyemi et al. 2006; Kehinde and Okoli, 2003, 2004; Ling and Poh, 2004; Dainty et al. 2000; Kolawole and Boison, 1999). This paper aimed to examine the perceptions of Final-Year Undergraduates on their propensity to participate in construction practice with a view to identifying barriers faced particularly by female undergraduates and identifying ways to mitigate these. This will provide a framework for the empowerment of women in the Nigerian construction industry.

RESEARCH APPROACH

Quantitative research investigates facts and tries to establish relationships between these facts. While a qualitative research is a subjective assessment of a situation or problem, and takes the form of an opinion, view, perception or attitude towards objects. Triangulation (a combination of quantitative and qualitative approach) is advocated because it takes advantage of the strengths in the two approaches while limiting the weaknesses. Quantitative study of human phenomena can only give frequencies of occurrences of certain observable manifestations of the phenomena without explaining why they occur. Therefore it is important to also adopt a qualitative research paradigm to compensate for the limitations of using quantitative approach to study human behaviour.

Sample selection

A matrix of Universities which offer the construction disciplines of Architecture, Building, Civil Engineering and Quantity Surveying and the ones which had the four courses was prepared. The study design led to a choice of only final year students who had undergone six months of Industrial Training in the construction industry and selection of three Universities thereby giving a research population of all the final year students of the Departments of Architecture, Building, Civil Engineering and Quantity Surveying from:

Abubakar Tafawa Balewa University, Bauchi (North East zone)
Ahmadu Bello University, Zaria (North Central zone)
Federal University of Technology, Minna (North West zone)

These three Universities are the ones in the North which were selected as a convenience sample and the respondents being from both northern and southern Nigeria were considered a good representation of the population.
In the second phase of data collection, semi-structured interviews were conducted with 50 out of the 57 (87.7%) who had earlier responded to the questionnaires. The interviews adopted an attitudinal approach which is used to subjectively evaluate the opinion of a person or a group of people towards a particular attribute, variable, factor or a question.

**DATA ANALYSIS**

The quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) Software and results obtained include frequency distributions and measures of central tendency (means). The interview data were analysed using conceptual content analysis which takes into account the appearance of a concept or the numbers of times (frequency) a particular concept appears in a text. Bordens and Abbott (2008) note that content analysis is a useful technique to help in understanding behaviour adopting a purely descriptive approach. Also the validity of the results will depend on the textual material to be analysed and so a thorough interview is necessary to ensure that all issues are adequately captured.

**CONCEPTUAL FRAMEWORK**

The conceptual framework for this study is illustrated in Figure 1 and it gives a picture of the major themes of this study. At the first instance is the education of women in construction discipline. They are attracted into the construction industry and need to make a career decision which could be deterred by barriers. The decision could be to depart from pursuing a career in the construction industry which would lead to further underrepresentation of women in the construction industry and consequently lead to a need to educate more women in construction. On the other hand, a decision to enter and remain in the construction industry does not guarantee an automatic progress. Women could face further barriers (glass ceiling) which would lead to underachievement and likely dissatisfaction in the women or they could adopt success strategies to deal with these barriers and experience career progress and promotions. This latter option is what will lead to increased benefits of the participation of more women in construction professional practice. This study focuses on the influences of the women’s career decisions.

![Fig. 1 Conceptual positioning of major themes in the study](image-url)
Career Decision Factors

Sullivan (2002) found that women who grew with brothers and competed in their activities (described as ‘tomboys’) had socialisations within their families which were influential in their choice of careers in non-traditional fields. ‘Tomboy’ refers to a young girl who enjoys activities and games that are traditionally considered to be for boys. Kehinde and Okoli (2004) found that women in construction disciplines began a career by choice others found themselves in it by chance and some others were introduced into it by colleagues and peer groups. The study by Sullivan (2002) revealed that women’s decision for non-traditional college degrees was influenced by both internal and external factors. The internal factors include personal interest (pursuit of jobs that offered financial stability and intrinsic rewards); background (early non-traditional socialisation process); and a simple case of ‘settling for’ the degree. There were several external factors which influenced their decisions but key among them is the role of an ‘influential other’ person, parents by far being the strongest influence.

Women do face unique, even daunting challenges at work and these have their foundations in the socialisation they have received in childhood and in educational institutions. Gale (1994) put it succinctly by referring to the higher institutions as the ‘gatekeeper’ to the industry where the student is socialised. This early socialisation predisposes a person to choose a career path in construction or to abandon years of training in favour of other less ‘threatening’ career. Girls are taught, directly or indirectly, to steer clear of studies and jobs typically pursued by boys and men. They are also taught to be cooperative and passive while boys are taught to be competitive and aggressive. Comments received from childhood inspire behaviours which underscore and strengthen the stereotypes already at work behind the scenes. These stereotypes inadvertently lead to barriers which are classified as either ‘External’ or ‘Internal’ barriers.

Results of the Questionnaire Survey

The female final year students of construction disciplines of Architecture, Building, Civil Engineering (CE) and Quantity Surveying (QS) were the target population of this survey. Table 2 shows the numbers of the students who were enrolled in the various Departments at the time of the study. Ten questionnaires were distributed in each of the four departments in the three institutions yielding total of 120, 59 were returned and fifty-seven (57) used in the analysis. The distribution of respondents showed Architecture (14), Building (7), CE (11) and QS (25) students.

<table>
<thead>
<tr>
<th></th>
<th>ABU. Zaria</th>
<th>ATBU, Bauchi</th>
<th>FUT, Minna</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>22</td>
<td>16</td>
<td>5</td>
<td>43</td>
</tr>
<tr>
<td>Building</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Quantity Surveying</td>
<td>15</td>
<td>14</td>
<td>17</td>
<td>46</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>133</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The result showed thirty-five (70%) of the fifty respondents are from the northern part of the country. The institutions sampled are all located in the northern region of the
country and this may explain why most of the students are from that region. Students are more likely to attend school where they are domiciled or their states of origin.

**Respondents’ Age and Marital Status**

The respondents who were between 18 to 23 years of age made up the majority (61%) and 31.6% were between 24 to 29 years. Thus on average students could be expected to graduate between their early to mid twenties and so will potentially have at least 40 years for active service in some form of employment based on the Federal Government retirement age of 65 years. The marital status of the respondents showed that thirteen out of the total fifty-seven (i.e. 22.8%) were married. Of these, nine had a child each while only one respondent had four children.

**Reasons for course of choice**

The admission process into Universities is influenced by availability of slots as well as the choices of individual candidates. The result of the survey showed that of the 57 students surveyed, 33.3% indicated that they did not choose the course they studied at the first instance but they ‘found’ themselves there. The students had the choice of rejecting the offers but they chose to study the course anyway. The reasons for the choices of respondents of courses in construction disciplines were investigated and Table 4 shows the numbers of respondents (out of the 57 total respondents) who acknowledged the following reasons for their choice of course:

The study queried a possible relationship between the reasons why the students chose to study a construction discipline and their decision to practice- specifically those who were influenced by parents or older relatives may go ahead to practice to live up to family expectations. It was noted in literature that apart from issues which an individual may have control over, there are external circumstance which may influence choice. Some of these influences identified from literature and studied showed that the students’ were greatly influenced to study the construction courses primarily due to their personal interest, the perceived marketability of the course and influence from parents or other relatives.

<table>
<thead>
<tr>
<th>s/n</th>
<th>Reasons for choice</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I love the construction profession</td>
<td>23</td>
<td>40.4</td>
</tr>
<tr>
<td>2</td>
<td>It is an interesting industry to work in</td>
<td>19</td>
<td>33.3</td>
</tr>
<tr>
<td>3</td>
<td>I was influenced by my parent, teacher, older relative (or other persons)</td>
<td>19</td>
<td>33.3</td>
</tr>
<tr>
<td>4</td>
<td>It is a marketable profession with high expected income</td>
<td>13</td>
<td>22.8</td>
</tr>
<tr>
<td>5</td>
<td>I had some prior knowledge of the profession from personal experience</td>
<td>10</td>
<td>17.5</td>
</tr>
<tr>
<td>6</td>
<td>No particular reason</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

Respondents were asked the extent to which career counselling positively influenced them toward a career in construction and out of 42 responses, 25 indicated that it had no influence at all. Others opined that career counselling had varying degrees of influence on their decisions with only 5 opining that it had a high influence on them.
Religious Affiliation

The religious affiliations of respondents were investigated and those who practiced Islam constituted 43.9% (25) of the total while 56.1% (32) practiced Christianity. A cross-tabulation of religion and decision to practice showed there is no difference in terms of the percentages of the Muslim or Christian’s decision to practice which indicates that religion is not a barrier as queried by the researcher.

Respondents’ perceptions on construction issues

The perceptions of the respondents were studied in three categories:

a. Likelihood to study the same programme
b. Employability in the Construction industry
c. Willingness to practice

Respondents’ likelihood to study the same programme

The respondents were asked whether they would study the same programme if given a choice. Results show that 50 would do so, 5 said no and 2 were not sure.

For the respondents who would study the same programme if given another chance, the reasons they gave were that they loved the profession and it is marketable. The profession gives a wide knowledge in life and it is a marketable profession even though it can be stressful when in school. The love for the profession, the interesting nature of the programmes and the passion the respondents have are the reasons why they would study the same programme again and this also is their reason for believing they would succeed. One respondent wrote that “Construction is interesting, it’s challenging and you have the opportunity to tap into the reservoir of knowledge of various professionals”. Another opined “the construction industry is a very progressive industry and it is a prestige to study a programme where out of countless number of women only few are found”. The respondents find their uniqueness in the construction industry to be a motivation and they felt a sense of fulfilment in doing work that people think are men’s work.

For those who will not study the same course again the reason was due to family responsibilities “I have found it very difficult to cope mixing up together family affair, child care and studies”.

Respondents’ perception on their employability in the CI

The respondents were asked about their perceptions on their employability in the construction industry and results show 54 considered themselves to be employable while 3 were not sure. The respondents who opined that they were employable gave the reason that they feel competent to do any kind of construction work. They have acquired skills and gained a lot of knowledge during the course of their study; they are hard working and feel confident about their capabilities. Some respondents who were not sure felt the profession is too stressful and would rather go into academics and impact the knowledge on the younger generations and do more research to help the Government and the people. The perception they have is that working as an academic or in a state/federal agency is not ‘real construction’ work and it is not demanding.
Respondents’ willingness to practice

The respondents were asked to state if they were willing to practice. The result showed that 49 intended to practice their professions, one had no intention and 7 were uncertain at this time. The reasons proffered by those who will practice are that the profession is lucrative and it allows one to apply the skill that has been acquired. The low level of income was the reason given by the female respondent who decided not to practice in the construction industry and also that construction work can be time consuming and they would like to have time for their family.

The Barriers investigated

Respondents were asked to rate on a likert scale 1 (no influence) to 5 (great influence) the extent to which the factors identified in Ling and Poh (2004) became a barrier to their participation in the construction industry. Therefore the factors with the higher means are barriers which will have the higher impacts on their propensity to practice and those with the lower means will have little or no influence on their likelihood to practice their profession. The mean is appropriate in this case for giving the measure that accurately defines the perception of the sample and by implication, the population as well.

Discussion of Results of Questionnaire Survey

The findings of this study affirm the position of literature on the wide disparity between the numbers of male and female students registered in educational institutions (Dainty & Edwards, 2003; Dauda, 2007; Imhanlahimi & Eloebhose, 2006; Kehinde & Okoli 2004, Kolawole & Boison, 1999) and construction courses in particular. There are fewer women than men enrolled in all the Departments surveyed and this was identified in Kehinde and Okoli (2003) as one of the factors influencing the low trend in women participation in construction. This trend consequently continues into practice and of the few who do graduate, a smaller number are attracted to pursuing careers in construction and even fewer remain long enough in the industry; thus confirming Adeyemi et al (2006) and Kolawole & Boison (1999) findings that women are underrepresented in the Nigerian construction industry. Irrespective of the type of secondary school attended, whether public or private, candidates stand a good chance of gaining admissions into construction disciplines. However, the key component is that careers in construction disciplines studied can only be pursued by students who have a background in science based subjects and the fewer number of female students is an indication that there are fewer girls in science based subjects than men and statistics in Dauda (2007) and Kehinde & Okoli (2003) illustrate this trend. Thus in the crucial early stage of career development, women are outnumbered by men in highly relevant subjects like Mathematics, Science and Technology.

Career decisions are arrived at based on influences from the individual’s personal interests and other external factors. It is important to know why women in particular, would choose to study a construction course. The undergraduates’ personal interests and passion for construction disciplines was the major influence on their decision to study along those lines. Influences from parents and other relatives as well as the perceived marketability of the courses were key factors in their decision. The women are more likely to read construction courses if they know someone, particular a parent or other close person, who is in that profession as observed in Bennett et al (1999). Ahmed et al. (2007) found that of the factors which influenced the decision of
construction students to join the industry, family encouragement was the strongest influence.

Other factors include web searches, teachers in schools and lecturers in higher institutions. To attract more women in construction practice, early exposure to the opportunities which exist is a requirement to build interest and family members can be a good source of encouragement for those who show interest in this field. The respondents rated ‘Career counselling’ poorly as a contributory factor to their decision to practice and this was posited by English (2008) and Madikizela & Haupt (2010) as being crucial to attracting more women into the sector. It is an area that more attention needs to be paid and efforts made by relevant authorities to address. Studies done in Nigeria (Adeyemi et al, 2006; Kehinde & Okoli, 2004; Kolawole & Boison, 1999) and other countries (Amaratunga et al., 2006; English, 2008; Fielden et al, 2000, 2001; Lingard & Lin, 2004), have established that family responsibilities is one of the major barriers to women entering and being retained in the construction industry. For any of these women, married or intending to marry, they will be faced with challenges at work with respect to family responsibilities and they need to be able to overcome these challenges to successfully develop their careers.

### Table 8 Ranking of External Barriers by Respondents

<table>
<thead>
<tr>
<th>The External Barriers</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction jobs are stressful and demanding</td>
<td>4.02</td>
<td>1</td>
</tr>
<tr>
<td>Construction jobs are very competitive in nature</td>
<td>3.96</td>
<td>2</td>
</tr>
<tr>
<td>Male culture exists at the workplace</td>
<td>3.76</td>
<td>3</td>
</tr>
<tr>
<td>Construction jobs involve long working hours</td>
<td>3.70</td>
<td>4</td>
</tr>
<tr>
<td>The higher numbers of male professionals in construction intimidates women</td>
<td>3.66</td>
<td>5</td>
</tr>
<tr>
<td>Women on sites are not respected to the same extent as men</td>
<td>3.60</td>
<td>6</td>
</tr>
<tr>
<td>Female graduates face sexual harassment at work</td>
<td>3.49</td>
<td>7</td>
</tr>
<tr>
<td>Female graduates are given desk bound jobs</td>
<td>3.46</td>
<td>8</td>
</tr>
<tr>
<td>Construction jobs are masculine in nature</td>
<td>3.29</td>
<td>9</td>
</tr>
<tr>
<td>Female graduates are not given equal opportunities as male counterparts</td>
<td>3.27</td>
<td>10</td>
</tr>
<tr>
<td>Women are more suited to administrative than production function on sites</td>
<td>3.19</td>
<td>11</td>
</tr>
<tr>
<td>Female graduates are not easily accepted at the workplace</td>
<td>3.13</td>
<td>12</td>
</tr>
<tr>
<td>Construction jobs are undertaken under harsh working conditions</td>
<td>3.09</td>
<td>13</td>
</tr>
<tr>
<td>Construction jobs are career focused at the expense of family</td>
<td>3.05</td>
<td>14</td>
</tr>
<tr>
<td>Female graduates don’t have opportunity to attain higher positions</td>
<td>3.00</td>
<td>15</td>
</tr>
<tr>
<td>Construction jobs have poor image</td>
<td>1.64</td>
<td>16</td>
</tr>
</tbody>
</table>

The respondents’ willingness to study the same programme again indicates a love for their professions and this will likely result in their participation in the CI. Therefore, whether by choice or by design, they have found themselves in a unique discipline and they are willing to make the most of it. For the female respondents as one wrote “it is a prestige to study a programme where out of countless number of women only few are found”. For the female respondent who would not choose construction in retrospect, the main reason is possible challenge of handling ‘family responsibilities’ reiterating the point that marriage and family responsibilities are barriers to women’s propensity to practice.
Kehinde & Okoli, (2004) identified women’s perceptions of their employment potential as one of the problem of access to employment. The respondents’ have a positive perception of their potential of being employed but a few opined that they felt the construction professions to be stressful and so would prefer something less difficult to handle. This perception is faulty in itself because all career paths whether construction practice, office work or academic have challenges associated with them and demands that need to be met in order to progress therein.

PRESENTATION AND DISCUSSION OF RESULTS OF THE INTERVIEWS WITH RESPONDENTS

Characteristics of the Interviewees

The respondents from the three Universities were interviewed to further clarify and/or explain the issues raised in the questionnaire survey. Fifty (50) final year female students of Architecture (9nr), Building (3nr), Civil Engineering (13) and Quantity Surveying (25) were interviewed. Of these numbers, forty-one (41) did not have children at the time while eight (8) had one child each and one of the respondents had four (4) children. Twelve (12) of the respondents were married, thirty-five (35) were from the northern part of Nigeria while fifteen (15) were from the south.

Choice of course

Indeed a number of the respondents did not select the courses they were studying in the first instance. More often the trend is that those reading Building or Quantity Surveying applied for Architecture while those in Civil Engineering would have applied for either Chemical or Electrical Engineering. A few random cases appeared of students who applied for Pharmacy, Medicine and Biochemistry ending up with construction related courses. This agrees with Kehinde and Okoli (2004) who found that women began a career in construction by choice others found themselves in it by chance and some others were introduced into it by colleagues and peer groups.

Cultural and Religious barriers to propensity to practice

Traditional role of a home maker: traditionally most people think women should stay at home but this is a mindset that most are willing to refute claiming that times are changing and the work environment is now more receptive of women. The African culture permeates the fabrics of society such that the women are forced to either meet up with these expectations or face the disapproval of family and friends. Two things that are important to the women are the approval of their spouses and how to handle children, pregnancy and work.

For respondents who are from the south, their experience is that in the north people do not have confidence in women; they feel women are not supposed to do construction work unlike in the south where people have confidence in, and trust women.

Dressing: there is a need to dress appropriately for such functions as site visits. A respondent reported to work on her first day wearing a skirt and she was told to always come in jeans trousers. For adherents of Islam, there are some guidelines on dressing/type of clothing to wear to suit their faith and some find it a challenge especially in keeping with health and safety regulations. The issue of spouse approval of one’s attire was a challenge for a Muslim woman who was concerned that her husband will not approve of say, wearing of trousers.
Marital and Family commitments as barriers

Pregnancy and other family obligations are reasons why some respondents are unsure about their future in the construction industry.

Permission from spouse to work: Some of the students expressed their unique positions where their decision to practice or not will depend on the approval of their spouses as required in the tenets of the faith and also by the culture of the society in which they are domiciled. The extent of a woman’s involvement in her work will also depend on her spouse.

Role Model

The experience of the female undergraduates was that they often found themselves being the only female in their offices or on site. A lady reported that she did her training in a firm that had a lady as General Manager of the firm and this served as a great encouragement to her; another worked with a Senior Civil Engineer who is a woman and one worked with a senior female Quantity Surveyor who engaged in all aspects of work on sites and showed proficiency in her practice. These experiences gave them the confidence to seriously consider a career in the construction industry especially seeing the success of the women in practice. Some of the respondents noted that they enjoyed some favours on sites being the only female among the workers and this is an enabler toward a decision to practice.

SUMMARY OF FINDINGS

The aim of this research was to examine the perceptions of final-year female undergraduate students in construction disciplines on their propensity to participate in construction practice and this was undertaken through questionnaire survey and semi-structured interviews. Researches on the barriers which women face exist in literature and these have been identified from literature. Prevalent among these are family commitments which women have to live with as primary caregivers in the home; the image and culture of the construction industry which has a macho, aggressive, long-hours concept of employees; the nature work in the construction industry that often requires exposures to the harsh weather conditions of the sites; lack of role models to train and encourage younger professional women to practice and negative perceptions by women of their competencies in handling work that is considered the traditional reserve of men.

The construction industry is traditionally a male dominated industry in all aspects of works related to both professional and non-professional capacities. There are studies which have reported the barriers extracted from literature or those studied at particular times in women’s career development or in specific works in the construction industry. This study investigates the career expectations of the female undergraduates particularly perceptions that they have already developed at this stage of their development. Female graduates’ concern is of how to balance family obligations and site work, obtaining one’s spouse’s permission to undertake work which is geographically dispersed and may require travelling and also how to dress ‘appropriately’ as married women especially in a traditional society which exists in Nigeria. In terms of professional practice the respondents often equated construction work to site work not considering that there are other aspects of construction work which could be office based also. They do consider themselves employable in the construction industry and are willing to consider a career in construction.
CONCLUSIONS

The findings of this study led to the following conclusions:

Women who are at the threshold of graduating from construction related discipline have had some thought as to whether they would practice or not and they are at this stage willing to practice despite the perceived barriers that they may have to deal with in practice.

Early socialisations play a role in the likelihood of women being attracted into construction. Women who make a choice of a degree in a construction related discipline were influenced by parents or other relatives or friends. Some had a background in technical schools or offered technical subjects such as metalwork, woodwork, introductory technology or technical drawing. A female student will more likely read a construction degree if she knows someone who is practicing in the industry or if she has an interest in technical subjects.

The students perceived themselves to be employable in the construction industry and are willing to take up employment in the industry. The factors which may pose as barrier to their likelihood of practicing include: the stressful, competitive and demanding nature of construction jobs and the existence of male culture in the workplace. In addition, there exist cultural barriers to the undergraduates’ propensity to practice and these include the traditional roles that women are required to play as home makers, the need to have permission from spouses to undertake external paid jobs and the need for ‘appropriate’ dressing for married women especially.

The respondents’ have a positive perception of their potential of being employed but a few opined that they felt the construction professions to be stressful and so would prefer something less difficult to handle. This perception is faulty because all career paths whether construction practice, office work or academic have challenges associated with them and demands that need to be met in order to progress therein.

RECOMMENDATIONS FROM THIS RESEARCH

The following recommendations are proffered in light of the findings of this research:

In order to address the underrepresentation of women in the construction industry, more women need to enrol in construction courses and they can only do so if they have a background in science and so it is recommended that professional bodies organise career talks in secondary schools as a means of educating girls of the benefits of taking science subjects as a route to obtaining a degree in construction.

Women need to be encouraged to explore their potentials in the industry in forums which may be organised by female members of professional construction bodies. The practitioners can provide mentorship to the younger women in tertiary institutions

Higher educational institutions should ensure that they implement gender-sensitive policies as part of their admission guidelines to ensure that female students are adequately represented.

This research is important because it advances the subject of gender inclusivity in the construction industry with respect to translating qualifications into employment as a means of addressing the problem of the underrepresentation of women in the Nigerian construction industry. The key issue addressed in this study is: Attracting more graduate women to the Nigerian construction industry by focusing on young entrants.
REFERENCES


PERCEPTION OF THE FINANCIAL SECTOR TOWARDS REAL ESTATE INVESTMENT IN SUB SAHARAN AFRICA: A CASE STUDY GHANA

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Interest rates in the Real Estate sector compared to other investment assets are on the high side hence require large sums of money to invest in it. The primary aim of the study is to provide empirical insights into the perception of the financial sector towards real estate investments in Ghana. Through the use of quantitative methodology it was established that the Ghanaian financial sector has engaged in some form of Real Estate investment in recent past, but mainly in the housing sector. It views Real Estate as a highly risky form of investment asset as the market is riddled with problems in the macro economy and lacks professional regulation of the market. However, majority of contingents in Ghana’s financial sector envisage a long term investment plan in the Real Estate market although seen as dependent on the maintenance of the stabilised economy, regulation of professional bodies in the Real Estate market and education of its investors. The paper recommends that, legal policy measures that seek to govern the Real Estate market should be ensured by the government and calls for the establishment of a credit rating agency that would link the financial sector with the real estate market.

Keywords: finance, Ghana, investment, property, real estate

INTRODUCTION

The real estate market is an institution that reflects the social pattern of power influencing ongoing activities to develop, use or invest in property (D’Acry and Keogh, 1998). This shows the important role property plays in investment alongside others such as shares and bonds (Miles et al, 2000). Investors who wish to gain exposure to the real estate market has the option of either investing directly by acquiring real estate property assets or indirectly by acquiring interest in investment
vehicles whose underlying investment performance is linked to the real estate market or a combination of both (McAllister, 2000). However investment interests in property are highly priced and indivisible as compared with stocks and shares and instead of large number of buyers and sellers, a relatively small number have sufficient financial resources to invest in it. Large sums of money are therefore required in real estate investment (i.e. purchase and or develop and transaction cost). However, the establishment of a successful and functional real estate market requires the development as well as full support of the financial sector. Bagehot in the 19th century was first to propound that, a developed and functional financial sector remains crucial not just to the real estate market but to each country’s economic growth and development (Ebohon, et al, 2002).

Sub-Saharan African (SSA) financial sector however, have continuously had a limited capital market. However, given the role of real estate in economic development in SSA, (Field and Ofori, 1988), it is imperative that Sub-Saharan African real estate markets are fully developed, operational and properly supported by the financial sector as this will foster growth and ensure sustainability in the real estate market. The past inability of SSA financial sectors to deliver appropriate services to the real estate market has resulted in an acute shortage of investment funds. Ghana’s financial sector has gone through a deteriorating economic conditions in the 1980’s followed by economic restructuring with the support of the World Bank and IMF structural adjustment programmes and is currently classed as a liberalised developing economy (Bank of Ghana, 2007). One element of these initiatives was the recapitalisation of the financial institutions in the country. Asare and Whitehead (2006) report that, prior to this boost; there had remained a clear segregation between the housing sector and a matter of fact between the real estate and the financial sectors without the recognition that, sustainability in the real estate market in Ghana will only be achieved, if the two markets are pulled together. Miles et al (2000) for instance have positioned that, for real estate developers and investors, the financial sector is critical to its development process. Moreover, through the use of debt finance for real estate development, the money locked up with the financial institutions, which otherwise has become dead capital could be released. The importance of a vibrant capital market in ensuring access to long term finance cannot therefore be overemphasized. The primary aim of the research is to provide empirical insights into the perception of the financial sector towards real estate investments in Ghana.

The research commences by reviewing the nature of real estate financing and its development in Ghana. The research method applied is then presented followed by the research findings, discussion and conclusions.

THE NATURE OF THE FINANCIAL SECTOR

Most real estate investors operate a relatively high level of gearing especially when their level of annual income in relation to the amount of capital they employ is low. They will thus try to generate funds internally. However, where finance for investment cannot be generated internally, companies have to heavily rely on the financial sector for support, be it in the short or in the long term. In the financial sector, financiers compete for attracting investors’ demand and at most times these are towards a mix of short-term and long-term flexibilities, composing portfolios of investments that seeks the advantage of rational investors (Pugh, 1996). There are thus, three distinct operations that occur in providing real estate investment finance and therefore three main players in the financial sector as follows:
Short-term finance; it is required to pay the development costs over the development period i.e. site purchase, payments to a building contractor and fees etc.

Long-term finance; it is required to repay the short-term finance on completion of the project. Long-term finance is usually not needed at the development stage of the project and if the investor decides to sell or dispose of the development at the completion of the project, it becomes unnecessary, as the short-term debt can be repaid with the sales proceeds.

Securitised finance; it has a capability of providing short and long term finance through the money market and stock market.

**Short-term and long-term financing**

Traditionally, short-term finance is provided by clearing banks, merchant banks and some finance houses who usually lend on a short term or variable interest basis but never for long terms and are referred to as Investment Banks. Most of these banks are profit making or what is usually referred to as private enterprises, although some are owned by government. As such, if a company borrows a large amount of bank finance, it may be vulnerable to rising interest rates and short term recall of funds from the banks. Merchant bank and finance houses on the other hand, are more willing to lend at specific terms of several years, sometimes at a fixed interest rate. Clearing banks on the other hand, lend on a conservative, well structured basis at relatively low interest rates and frequently on a corporate rather than on project basis. Short-term finance provided at variable interest is usually the norm as it is linked to the bank’s base rate. There could also be agreed interest rates which can vary from 0.5% to 4% depending on the bank’s perception of the risk incurred (Bank of Ghana, 2007). However, exposure to changes in interest rates can be reduced by agreements for a cap (maximum interest rates), collar (provides upper and lower limits to the rate) or swap (allow conversion from a variable to a fixed interest rates or vice versa).

Financing in the long-term is usually provided by non-bank financial institutions. The activities of these financial intermediaries have both theoretical and practical implications. They may for instance make net additions to the supply of loanable funds available to deficit units (units whose planned expenditures are in excess of funds arising out of the current income inflow). In doing so, they mobilise the idle balances of the public through sales of securities out their existing portfolios, thus channelling private sector savings directly or indirectly to the investment field. And by their investment behaviour, financial institutions may augment the savings currently flowing in from their policyholders with proceeds from sales of assets, particularly government securities, out of their existing portfolios. These financial institutions are broken down into three main types; pension funds; Insurance companies; Investment and Unit trust. Pension funds are created when employers and employees of an organisation pay contributions into a separate fund operating as a legal trust with the present and future pensioners as beneficiaries. Insurance is some form of risk management which is used to hedge against the risk of contingent loss by transferring equitable risk of a loss from one entity to the other in exchange for a premium. On the other hand Investment Trusts are usually limited liability companies and are not trusts in the legal sense like Unit Trusts.
Factors influencing the Amount of Money Financiers are Prepared to Invest

Financial sectors are also investors and like all investors, their final decisions on a particular investment are influenced by conditions in the environment in which they operate (Rutherford, 1983). Such conditions include inflation and interest rates, rate of growth demand, and business confidence.

One important factor that financial investors consider prior to investment is the impact of inflation on the value of investment. Inflation risk affect the investor’s requirements, i.e. whether there is say, the need for the investor to keep up with inflation or merely to cover a nominal liability such as the repayment of a fixed loan. Most investors whether they are individuals or institutions need to maintain the value of their investments in real terms. As such, it is important to assess the type of investment in the light of how well the investment is hedged against inflation.

When consumer demand is rising, investment tends to be stronger giving businesses the extra incentive to invest to expand their capacity to meet this demand. Price mechanism thus allocates extra funds and factors inputs toward investment good into those markets where consumer demand is rising. This can only occur when higher expected sales also increases potential profits.

The entry of investment-like development of new industries is still dependent on the quality of the business environment, good policies, sound infrastructure (Collier, 2000) and incentives provided by competition in an appropriate institutional setting (Grossman and Helpman, 1990 and Olofin, 2002). Business environments do not have to be perfect, but they have to be good enough on a number of crucial dimensions to stimulate investment and competition sufficient to self reinforce the process of its launch. When business confidence is strong, then planned investment will rise, whereas investment falls when business confidence is low.

DEVELOPMENTS IN THE FINANCIAL SECTOR IN GHANA, 1957 TO 2008

The financial sector when functioning well connects firms to lenders and investors. This section will show that; too often however, government interventions have made matters worse by disconnecting the financial sector from the real estate market. From the colonial era to 2008, the financial sector has either been repressed, distorted by state ownership, monopolised, undirected or controlled by other policies that appeal to the short term interest of politicians and/or favoured groups (Mensah, 1997). These measures have been the main problems undermining the financial sector development and investment in the real estate in SSA and more importantly, Ghana.

During the colonial era, the financial sector in Ghana was characterised by minimalist conditions in that, the colonial government concentrated on providing a basic currency infrastructure and banking services for the foreign trading enterprises within the colonial system. As such, monetary stability and growth was only tied to export performance. 1912 to 1957 saw the operations of the West African Currency Board on Sterling Exchange Standard through a guaranteed convertibility of the West African pound to Sterling (Mensah, 1997). The primary function of the financial sector in the colonial era was only to provide currency infrastructure, as the system was only used to lead in the transformation of the colonial economy from a barter system to a modern currency system.
In the post-independence era the economy of Ghana was streamlined towards the adoption of a socialist development strategy. As such, the state was to be given predominance in all aspects of economic policy making and implementation. While there were quantitative restrictions on interest rates, banks were forced to lend to specific sectors of the economy which were considered priority sectors by the government, turning Ghana into a closed economy. This era like the colonial era was solely state banking and was also supported by an unstable macro economy. Real growth only occurred between 1959 and 1960 when the GNP expanded in nominal terms by 10.2%. 1955 to 1965 was a period of large increases in the money supply reflecting in the large amount of government borrowing to finance the budget deficit (Mensah, 1997).

1983 saw the government adopting an economic recovery programme which included the devaluation of the cedi, dismantling of most price and distribution controls, elimination of many subsidies, broadening of the tax base, improvement of tax collection and restoration of macroeconomic balance by developing the foreign exchange market, designing fiscal policies to increase public savings and reducing inflation through monetary policies (Bank of Ghana, 2005). Other corporate restructuring that was undertaken in that period in both the public and private sector was a result of this, leading to the development of non-banking financial institutions and the training of more professionals. A gradual liberalisation of the financial sector in Ghana was only to be realised in 1987 (Bank of Ghana, 2007).

Did the structural adjustment programme implemented by the government earlier in the 1980’s change the macroeconomic conditions in the country? (Bank of Ghana, 2005) Absolutely! Ghana’s macro economy has been restored to a pattern of positive economic growth and reflects a 5% average annual GDP growth rate and 1-2% average annual per capita income growth (Bank of Ghana, 2005).

**Real Estate Investment in Ghana**

The real estate market in Ghana is dominated by the housing sector. Academic literature has got very little information on the commercial property sector of the real estate market in Ghana. However, Antwi et al (2006) recorded that, ownership of retail property assets are dominated by customarily “family ownership” with its rental market developed from its own strategies to deal with the rampant inflation, like the payment of goodwill which is negotiated independently from rental payments. Recently, however, there has been a boom in Ghana’s real estate market which is said to be underpinned by increases in the construction industry and housing sector (BOG, 2007), although the past was riddled with problems associated with the economy as a whole.

The establishment of any real estate market is partly dependent on certain basic requirements of the economy’s financial sector. Following from our previous discussions, we have seen that, the lending environment, which stems from macroeconomic stability, the legal systems and government policies have had a negative impact on capital lending by Ghana’s financial sector to the real estate market. The economy has also not been fertile enough for progressive development of the real estate market (Karley, 2002). Character or the capacity to assess the likely behaviour of borrowers has also been continually difficult as many potential investors
have a limited association with the financial sector (Karley, 2002 and Mahama et al, 2006) coupled with the establishment of no credit referencing agency.

The land market in Ghana which is supplied by traditional land owners has had its allocations associated with problems of injustice and other corrupt practices, thus demoralising the financial sector investing in the real estate market. There has also been a history of losses by major financial institutions in the past amounting to increasing cost of external long-term funding; making short term domestic funding, though expensive; as the only available funding to real estate lending, all of this coupled with various irregularities in the legal framework (Antwi, 2002).

The BOG therefore classifies the real estate market in Ghana as one in its rudimentary state (Antwi, 2002). However, with a number of people operating as estate agents with no professional training and lack of established professional institutions to regulate the market, Ghana’s real estate market (Mahama et al, 2006) could also be categorised as an emerging property market.

**RESEARCH METHODOLOGY**

Quantitative method coupled with case study techniques using real experiences of project participants to examine important soft issues was used for this research. The study also adopted convenience sampling in selecting the sample population which has the advantage of minimising time and effort rather than the potential source of bias (White, 2006). A total of seventy-six (76) contingents were drawn from the population in the financial sector of Ghana for the case study.

A set of ten questions were prepared through the study of related literature on the past, current and prospective investment activities of the financial sector in Ghana. A pilot study was initially carried out on two interviewees to test the adequacy of the questions and ability of prospective respondents to give appropriate responses to the questions. The questions were administered through a series of structured interviews to industry professionals involved in the investment sectors of the financial sector in Ghana. Structured interview questionnaires were used because it was most suitable for case study research and studies that require respondents with homogenous characteristics (Naoum, 2008). Overall 76 respondents were contacted through electronic mail (e-mail) to be interviewed, eventually only 36 firms responded and agreed to the follow up interview comprising of one (1) pension company, thirteen (13) banks, two (2) finance houses and twenty (20) insurance companies. The subsequent section discusses the outcome of the interviews.

**MAIN FINDINGS AND DISCUSSIONS**

It was found that all respondents interviewed had carried out some form of investment in the past. Short-term financiers with special emphasis on the banks, finance investors engage in general and commodity trading and construction. The finance houses are short-term investors only, who trade on the money market and finance various investments for a period of ninety-one (91) days to one (1) year. Their main aim is to provide funds to augment working capital. The long-term investors, for example SSNIT and some insurance companies tend to invest in fixed deposits, listed or unlisted such as Treasury Bills and shares and call accounts i.e. investment which have short or no notice. However, all the respondents have recently began investment in real estate which in Ghana refers to residential, either by developing directly or indirectly and selling to clients or giving clients some form of security to get a
mortgage. One respondent however mentioned that there is huge demand for commercial property but acknowledged its limited supply.

Table 1: Institutional Investors Who Finance Real Estate or Property in Ghana

<table>
<thead>
<tr>
<th>Respondents</th>
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<tbody>
<tr>
<td>Yes</td>
<td>33</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

It was observed that 92% of the respondents have financed real estate in the last five years and are still doing so. The other 8% comprising mainly insurance companies and banks responded negatively. However, it should be noted again that in Ghana, real estate here refers to home ownership and not commercial property.

Amongst the short term financiers, the frequency of real estate investment ranged from 1-20 per annum with a number of the respondents saying it depended on how the individual firms rated the property in question’s viability as per the developer’s cash flow projections. Most of the finance houses have augmented the working capital of real estate developers in the past and still have a range of 1-5 active clients. However, there has always been the problem of clients being unable to repay the interests and the loans. A number of the respondents have therefore had to pull out of real estate investment and they have decided to lie low until the market becomes more viable. The insurance companies recorded the lowest real estate investment ranging from 1-5 per annum, these being life insurance companies who have invested in property in the past, but only did so because their clients hold a policy package with them which can serve as collateral. SSNIT is the only active investor in property since its establishment. All respondents agreed to the underlying fact that the long benefits from investing in property in Ghana was less than the risk involved as a result of the uncertainties in the market.

All the respondents agreed that real estate as an investment in Ghana is highly risky, although, 95% of them also added that there could be untold gains only if the risks could be mitigated properly especially in the current market where increasing demand exceeds supply. One respondent mentioned risk as a function of repayment source. As such, to get involved in pure project finance means that the financial investor is interested in its implementation through to final completion when the property will be able to generate enough inflows to repay the long-term finance. However, in Ghana there is great possibility that the income generated could be diverted due to the low levels individual incomes and as such the financial sector places a lot of emphasis on the credit process.

Table 2: Significance of Macroeconomic Conditions on Financing Real Estate Investment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Interest Rate</th>
<th>Inflation</th>
<th>Business Confidence</th>
<th>Rate of Growth Demand of Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Percentage</td>
<td>88%</td>
<td>88%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
When interviewing on the significant macroeconomic conditions, 88% of the respondents ranked inflation as the most significant condition militating against the finance of real estate investment in Ghana also citing it as a major factor that determines interest rates and how well the loan repayment of individual developers will go. The other 12% of respondents who ranked Interest Rates as the number one factor were debating which was more important, inflation or interest rate. However, both quarters agreed that if macroeconomic conditions could be improved to reduce inflation, interest rates would correspondingly fall which would encourage more financial investors to invest in real estate directly or indirectly. All the respondents ranked Business Confidence as the number 3 factor which they also believed was in a better state than it was a decade ago. Rate of growth of demand for property was seen as the least of the threats as all agreed that the demand for real estate in Ghana is very high with not enough supply to meet the demand.

Table 3: Long-term Plan of Real Estate Investment to the Financial Sector

<table>
<thead>
<tr>
<th>Respondents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>53</td>
</tr>
<tr>
<td>No</td>
<td>19</td>
</tr>
<tr>
<td>May be</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3 shows that 53% of the respondents were definite about investing in property and said that property as investment equity was in their respective firm’s short and long term plans. The 28% of the respondents who were not sure about their plans want the real estate market to gain a bit of strength before venturing into it. One of the respondents who were undecided noted that, with the booming real estate market in Ghana, he expected the government to intervene to stabilise the macroeconomy and regulate the market otherwise, the market is bound to crash. 19% of the respondents who were negative about the real estate market had problem of bad debt in the past or did not believe it was profitable to invest in property in Ghana. Generally, the respondents were of the view that, property as an investment is a global economic boost and if additional encouragement via education was given among the Ghanaian financiers, it would be bound to boost the economy.

CONCLUSIONS

The Ghanaian financial sector has engaged in some form of real estate investment in recent past and other institutions are beginning to engage in it. However it was noted that, real estate in Ghana basically refers to home ownership with very few engaging in commercial property investment. Others who do not invest in property were either restrained by law or viewed the macroeconomic environment as unstable for its investment. Real estate investment in Ghana by the financial sector is generally viewed as a highly risky form of investment asset, again due to the unstable business climate attributed to countries in SSA. Other problems such as the underdevelopment of the land, valuation and rent markets, political interference, low income levels of the Ghanaian working population, negative loan repayment levels and the ill-developed laws regulating the market were cited as factors militating against investment in real estate by the financial sector. The study recommends that the Government puts in place policy measures that may be considered under a legal framework by legislature and further calls for the establishment of a credit rating agency that would link the
financial sector with the real estate market. Given that data collected for the study were based on the perceptions of interviewees rather than factual records, the responses provided are therefore sensitive to their state of mind at the time of the interview, hence the difficulty in assessing their reliability. Also, the study is not oblivious of the fact of low response from respondents, hence, the small size of the population used for this research. While the small sample sizes means that none of the findings can be taken as absolute, it is nevertheless maintained that, much can be gleaned from the information provided which has a potential value for further studies on a similar subject.

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POST OCCUPANCY EVALUATION OF PUBLIC SECONDARY SCHOOLS FACILITIES

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This paper explores the state of public secondary Schools facilities in Ikorodu Local Government in Lagos State, Nigeria. The study examines the state of physical condition of the five selected public secondary schools facilities and identified the most affected facilities. In achieving the set objectives, the study adopted research survey technique. A total of 50 questionnaires were administered to the end-users of the facilities. Data collected were analysed using descriptive and inferential statistics in relation to Post Occupancy Evaluation technique. The findings of the study revealed that most of the facilities were in a state of disrepair and the users are not satisfied with the state. Damaged internal doors, ceiling fans, defects in roof covering, broken window and window railings, classroom ceiling, dampness on toilet walls were identify as most noticeable facilities defects and problems in the learning environment. The study also reveals that the five selected schools were prone to the same facilities defects and problems.

Keywords: disrepairs, end-users’, local government, maintenance, school facilities,

INTRODUCTION

Buildings are required to provide a conducive and safe environment for various human activities (Oladapo 2005). For a building to be able to provide a conducive and safe environment for its occupants, that building must be functional. A building comprises diverse components with different purposes but towards a collective intent-the comfort and health and safety of the end users. Most human activities is confined in a building envelop. Then it is paramount that buildings are kept in good condition by the users.

Building care commences immediately after commissioning of the building and deterioration begins. As deterioration continues the function of the components erode and the work of its users will be progressively hampered. Maintenance of the building facilities is the only way to reduce the rate of deterioration in building fabrics. In Nigeria, public buildings are in very poor and deplorable conditions of structural and decorative disrepairs (Adenuga and Iyagba 2005). Despite the huge monetary investment in constructing the infrastructure they are left to face continuous deterioration after it is commissioned. This is the state of public secondary school facilities in Nigeria today.

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STATE OF PHYSICAL CONDITION OF PUBLIC SECONDARY SCHOOL BUILDING FACILITIES IN NIGERIA

School facilities are the paramount components that increase teaching and learning productivities. Adeboyeje (2000) and Emetarom (2004) attest that school facilities are the physical and spatial enablers of teaching and learning which will increase the production of result as cited by Asiyai (2012). The facilities in school environments consists of outdoor areas, learning environment, physical features, outdoor areas, media access, transition spaces and circulation routes, visual appearance, safety and security.

Quality and standard education can only be achieved by the provision of functional and effective school facilities. In aiding the efficiency of teaching outcome, school facilities must be able to enhance the path of learning. Effectiveness and efficiency in teaching and learning can only be achieved in a conducive learning environment. Facilities in a learning environment include learning space, comfortable space, social space, equipment, potable water, sanitary facilities and so on. According to Akinsolu (2004), educational curriculum cannot be sound and well operated with poor and badly managed school’s facilities.

The inadequacy of secondary school facilities in Nigerian schools had been attested to by many academic researchers. The study carried out by (Ikoya and Onoyase 2008) shows that only 26% of secondary schools across the country have school infrastructures in adequate quality and quantity. Asiyai (2012) attest that the facilities in Delta State public secondary schools are generally in a poor state of disrepair. The state of disrepair of such facilities as classrooms, assembly hall, laboratory and workshops, library, furniture, water closet and pit latrine were identified. The study also reveals that the maintenance carried out on school buildings such as repairing cracks on broken walls, broken ceiling roofs, electric fixtures were inadequate. There were no immediate replacement of damage louvers, doors and windows, furniture’s were not repaired and building not regularly renovated (Asiyai 2012).

A post occupancy evaluation of selected secondary schools carried out in Minna, Niger State (Zubairu and Olagunju 2012) confirms that laboratories facilities, sporting facilities, landscaping and overcrowded classrooms were the most cases of inadequacy in the schools. They attest that the most critical issues of concern was the provision of sanitary facilities, which some of the schools lack and where it was provided it was grossly inadequate and in terrible condition of disrepair. The study also reveals that public schools were far less well maintained than private one. Public secondary schools in urban areas show that classroom were over crowded where between 50-150 students use a classroom space designed to accommodate 40 students according to the National Policy of Education (Nakpodia 2012). Nakpodia 2012 opined that most of the classrooms were not comfortable and secure in terms of locks, doors and windows. Maintenance of the facilities is inadequate since there was no maintenance policy and maintenance staffs were not employed on full time basis (Nakpodia 2012).

Secondary school student’s enrolment has continued to increase without future facilities planning and forecasting for educational space to accommodate the student’s intake. In the face of dwindling funding of education in Nigeria, the Lagos State government is trying to maintain the existing schools facilities, renovate some and construct additional facilities. This is to facilitate effective and efficient learning process in the schools environments. The State government had shown his commitment in improving education in Lagos state from the grass root. Researchers
have indicated that an interaction exists between student’s performance and the state and condition of learning facilities. (Adeogun 2008, Ikoya and Onoyase 2008) reveals that a significant relationship exist between school environment and the student’s attitude to schooling. Adeboyje (2000) cited that a better student’s performance was recorded in school with well coordinated maintenance practices. Students in newer and adequate school facilities performed better than students in older and inadequate school facilities (Burkett and Bowers 1987). If the facilities in the learning environment is not functional as supposed, then the performance of both the teachers and the students are hindered. That is why the paper seeks to examine the state of physical condition of learning facilities in public secondary schools in Ikorodu district in Lagos State Nigeria.

Models for the performance evaluation of educational buildings

Different researchers have suggested and developed models/methodologies on building performance evaluation; these studies include Preiser et al (1988), Kaplan and Norton (1992), Cashs (1993), Ornstein (1997), Lackney (2001), Sanoff (2001), Kathrine and Svein (2004), Zimring, Rashidi and Kampshroer (2005). These studies focused on the performance evaluation of educational facilities in relation to space related issues. The methodology involved data collection tools such as questionnaires, walkthroughs, focus group discussions, and observations. The performance of buildings in educational institutions is affected by different variables which had led to development of various models as outlined below:

The balance scorecard (BSC) (Kaplan and Norton, 1996)

The process model (Preiser, Rabinowitz and White, 1988)

The building condition and students achievement models (Mutlag, 2004)

The school building assessment model (Sanoff, 2001)

The Programme on Education Buildings (PEB) organizing framework for evaluating quality in education spaces/” facilities (OECD, 2006)

The balance scorecard (BSC) model focuses more on four perspectives namely customer, internal process, learning and growth and finance. The process model outlines three levels of effort at which a building performance evaluation can be undertaken namely indicative, investigative, and diagnostic levels. Preiser et al (1988) further identified three levels of performance at which the evaluation of buildings can be considered, namely;

The health/safety/security level

The functional/ efficiency level and

The social, psychological, cultural, and aesthetic level.

Furthermore, Cash (1993) states that leadership and finance influence maintenance and custodial staff (facility staff) which in turn have a corresponding effect on school building condition and performance. Mutlag (2002), from Cash’s (1993) model illustrates a direct and indirect relationship between building condition and student’s achievement when linked to various factors such as temperature control and ventilation, adequate lighting in relation to space, aesthetics and colour. Sanoff (2001) identifies five methods of assessing school buildings;

Six factors school building assessment method: A walking tour
School Building Rating Scale
Photo Questionnaires
School Building Observation form
Wish Poem.

The six-factor assessment method allows one to focus on six key elements of building assessment, namely context, massing, interface, way-finding, social space and comfort. The school building rating scale is qualitative assessment tools which are essential components for meeting the requirements of a learning environment. These include outdoor areas, learning environment, physical features, outdoor areas, media access, transition spaces and circulation routes, visual appearance, safety and security. Numerical ratings are used to score each factor or element being evaluated by users using very unsatisfactory (VU) to very satisfactory (VS) continuum. The OECD, 2006 framework for evaluating quality in educational spaces / facilities consists of two dimensions: the first dimension addresses how quality is defined within the context of policy issues and the second dimension presents important characteristics in the process of evaluating aspects of quality in educational facilities. The evaluation tools for these assessment include questionnaires, focus group discussion, walkthroughs, interviews, and observations while the quality of evaluators provided by the framework include researchers, space and asset managers, staff, students and educationists.

RESEARCH METHOD

A literature review was conducted on performance indicators for educational buildings. These indicators need to be adaptable within the context of Nigerian secondary schools. Although some common variables were extracted from literature, they were summarized and simplified for adaptability after vetting by the research team. An indicative and investigative approach to POE which provides an in-depth study of building performance and solution to problems was used to measure building users’ experience of their learning environment. Also, questionnaires were sent to gather individual-level data through the responses of building users. A team of trained field assistance were sent to the five schools with structured questionnaires for data collection and oral interview. Analysis of the study data was done with the SPSS statistical package. POE deals with analysis of individual buildings, which can then be benchmarked when reliable and thorough approaches are used to collect data. Case studies ensure that POEs provide a greater depth of qualitative and quantitative data and a contextual background to the environment of building users (see Yin, 1994; Amaratunga and Baldry, 1999; Turpin-Brooks and Viccars, 2006). Additional data was also collected using a scheduled interview to obtain data at the organisational level from the school staffs and students. The user satisfaction survey instruments is a simple 34-questions (see table 3) questionnaire completed by the users (students and staffs) of the schools, who were randomly selected. A total of 50 questionnaires were used for the analysis. In the questionnaires, which was based on a four-point Likert scale, the respondents were asked to rate the level of criticality of facilities defects and problems in the buildings and its environment. Descriptive and inferential statistics were used for the analysis. Relative Criticality Index was adopted for the ranking of the facilities defects and problems and Kendall Wallis coefficient of concordance was used to analysis the agreement between the five secondary schools.
THE CASE STUDY

Ikorodu is a city and local government area in Lagos state south-west Nigeria. Located along the Lagos lagoon, it shares a boundary with Ogun State. As of the 2006 census Ikorodu has a enumerated population of 535,619. Many secondary schools are located in ikorodu both public and private. Five public secondary schools were selected for this study which are:

Zumaratul Islamiyyah Senior Grammar School Igbobgo (ZL)
Yewa Senior Grammar School (Yewa)
Ikorodu Senior Grammar School (Iksnr)
Ayangburan Senior High School (Ayang)
Lagos State Civil Service Senior Model College Igbogbo (Isces)

The secondary schools selected are Lagos state government owned school. The school were built between the 70s-90s. The schools are run by Lagos State School Management Board. Zumaratul Islamiyah Grammar School was founded in 1960, located along Obafemi Awolowo way, Igboabo. Lagos State Civil Service Model College Igbogbo located along Oba Omolaja road was founded in the year 1993.

DATA ANALYSIS

Characteristic of respondents

From table 1, twenty (20) students and (20) teaching staffs responded to the questionnaires. Ten (10) support staffs also participated in the survey.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>20</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>20</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Support Staff</td>
<td>10</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Forty (40) participants were also engaged in an oral interview the sample comprises ten (10) students, twenty (20) teachers and ten (10) support staffs (see table 2).

<table>
<thead>
<tr>
<th>Participants</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>10</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>20</td>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>Non-teaching Staff</td>
<td>10</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The questions asked were open-ended and it allowed the participants to share as much or as little as they wished about their experiences in the learning environment.

From tables 3, Zumuratul Islamiyyah Senior Grammar School (ZL) indicates damaged ceiling in classroom as a very critical defects in the school. Damaged door/window frames, faded paint, damaged air condition, ceiling fans, internal doors, water taps,
AC duct pipes connection, pipe leakages, floor finishes, offices, classrooms, overgrown green areas, workshop, improper car parking, undrained water on road/car park, cob web in classrooms, dampness on toilet walls and door locks as critical facilities defects and problems in their learning environment.

<table>
<thead>
<tr>
<th>Facilities defects and problems</th>
<th>ZI mean</th>
<th>Yewa mean</th>
<th>Iksnr mean</th>
<th>Ayang mean</th>
<th>Isscs Mean</th>
<th>Overall Mean</th>
<th>RCI</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage ceiling fans</td>
<td>2.70</td>
<td>2.20</td>
<td>1.40</td>
<td>3.70</td>
<td>2.90</td>
<td>2.58</td>
<td>0.65</td>
<td>1</td>
</tr>
<tr>
<td>Damage ceiling in classroom</td>
<td>3.60</td>
<td>1.40</td>
<td>2.40</td>
<td>2.00</td>
<td>2.70</td>
<td>2.43</td>
<td>0.61</td>
<td>2</td>
</tr>
<tr>
<td>Damage doors and windows frame</td>
<td>3.20</td>
<td>2.00</td>
<td>1.50</td>
<td>2.25</td>
<td>2.80</td>
<td>2.35</td>
<td>0.59</td>
<td>3</td>
</tr>
<tr>
<td>Damage air condition</td>
<td>2.80</td>
<td>1.40</td>
<td>2.00</td>
<td>2.56</td>
<td>2.80</td>
<td>2.31</td>
<td>0.58</td>
<td>4</td>
</tr>
<tr>
<td>Burnt and damage fluorescents</td>
<td>2.60</td>
<td>2.20</td>
<td>1.30</td>
<td>2.40</td>
<td>2.90</td>
<td>2.28</td>
<td>0.57</td>
<td>5</td>
</tr>
<tr>
<td>Damage air condition duct pipes</td>
<td>2.70</td>
<td>1.70</td>
<td>1.56</td>
<td>2.50</td>
<td>2.50</td>
<td>2.42</td>
<td>0.56</td>
<td>6</td>
</tr>
<tr>
<td>Dampness on toilet wall</td>
<td>2.80</td>
<td>1.20</td>
<td>1.70</td>
<td>3.22</td>
<td>2.60</td>
<td>2.38</td>
<td>0.54</td>
<td>7</td>
</tr>
<tr>
<td>Broken window and damage window railing</td>
<td>2.40</td>
<td>1.60</td>
<td>1.30</td>
<td>2.50</td>
<td>2.70</td>
<td>2.13</td>
<td>0.54</td>
<td>8</td>
</tr>
<tr>
<td>Cob web in Classrooms</td>
<td>2.50</td>
<td>1.50</td>
<td>1.90</td>
<td>2.44</td>
<td>2.40</td>
<td>2.14</td>
<td>0.54</td>
<td>9</td>
</tr>
<tr>
<td>Rough connection of air condition duct pipes</td>
<td>2.80</td>
<td>1.10</td>
<td>1.70</td>
<td>2.78</td>
<td>2.33</td>
<td>2.13</td>
<td>0.53</td>
<td>10</td>
</tr>
<tr>
<td>Offices</td>
<td>2.80</td>
<td>1.20</td>
<td>2.00</td>
<td>2.00</td>
<td>2.60</td>
<td>2.12</td>
<td>0.53</td>
<td>10</td>
</tr>
<tr>
<td>Classroom</td>
<td>2.80</td>
<td>1.30</td>
<td>2.10</td>
<td>2.00</td>
<td>2.40</td>
<td>2.12</td>
<td>0.53</td>
<td>14</td>
</tr>
<tr>
<td>Damaged internal door</td>
<td>2.80</td>
<td>1.33</td>
<td>1.20</td>
<td>2.40</td>
<td>2.70</td>
<td>2.10</td>
<td>0.53</td>
<td>14</td>
</tr>
<tr>
<td>Floor finishes deterioration</td>
<td>2.60</td>
<td>1.44</td>
<td>2.00</td>
<td>2.11</td>
<td>2.30</td>
<td>2.08</td>
<td>0.52</td>
<td>18</td>
</tr>
<tr>
<td>Damaged tap</td>
<td>2.60</td>
<td>1.60</td>
<td>1.70</td>
<td>1.78</td>
<td>2.60</td>
<td>2.26</td>
<td>0.52</td>
<td>18</td>
</tr>
<tr>
<td>Damage water closet</td>
<td>1.90</td>
<td>1.90</td>
<td>1.80</td>
<td>2.22</td>
<td>2.40</td>
<td>2.04</td>
<td>0.51</td>
<td>20</td>
</tr>
<tr>
<td>Dampness on lobby and corridor wall</td>
<td>2.60</td>
<td>2.00</td>
<td>1.44</td>
<td>1.89</td>
<td>2.10</td>
<td>2.02</td>
<td>0.51</td>
<td>20</td>
</tr>
<tr>
<td>Workshop</td>
<td>2.80</td>
<td>1.30</td>
<td>2.20</td>
<td>1.89</td>
<td>1.90</td>
<td>2.02</td>
<td>0.51</td>
<td>20</td>
</tr>
<tr>
<td>Improper car parking</td>
<td>2.50</td>
<td>1.40</td>
<td>1.70</td>
<td>1.89</td>
<td>2.40</td>
<td>1.98</td>
<td>0.49</td>
<td>23</td>
</tr>
<tr>
<td>Wall cracks</td>
<td>2.40</td>
<td>1.40</td>
<td>1.60</td>
<td>2.20</td>
<td>2.10</td>
<td>1.94</td>
<td>0.49</td>
<td>23</td>
</tr>
<tr>
<td>Deface of walls with poster</td>
<td>2.10</td>
<td>1.50</td>
<td>1.80</td>
<td>2.22</td>
<td>2.10</td>
<td>1.94</td>
<td>0.48</td>
<td>25</td>
</tr>
<tr>
<td>Damage class board</td>
<td>1.90</td>
<td>1.50</td>
<td>1.80</td>
<td>2.33</td>
<td>2.20</td>
<td>1.94</td>
<td>0.48</td>
<td>25</td>
</tr>
<tr>
<td>Un-drain water on road/car parks</td>
<td>2.50</td>
<td>1.50</td>
<td>1.60</td>
<td>2.11</td>
<td>1.90</td>
<td>1.92</td>
<td>0.48</td>
<td>25</td>
</tr>
<tr>
<td>Un-drain toilet floor water</td>
<td>2.13</td>
<td>1.50</td>
<td>1.60</td>
<td>1.67</td>
<td>2.60</td>
<td>1.91</td>
<td>0.48</td>
<td>25</td>
</tr>
<tr>
<td>Pipe leakages</td>
<td>2.60</td>
<td>1.20</td>
<td>1.90</td>
<td>1.44</td>
<td>2.30</td>
<td>1.90</td>
<td>0.47</td>
<td>29</td>
</tr>
<tr>
<td>Defect in roof covering</td>
<td>1.90</td>
<td>1.10</td>
<td>1.20</td>
<td>2.60</td>
<td>2.40</td>
<td>1.84</td>
<td>0.46</td>
<td>30</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2.30</td>
<td>1.20</td>
<td>1.80</td>
<td>2.00</td>
<td>1.80</td>
<td>1.82</td>
<td>0.45</td>
<td>31</td>
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<td>Overflow of W.C water</td>
<td>2.00</td>
<td>1.50</td>
<td>1.40</td>
<td>1.78</td>
<td>2.30</td>
<td>1.80</td>
<td>0.45</td>
<td>31</td>
</tr>
<tr>
<td>Cob web in offices</td>
<td>2.20</td>
<td>1.20</td>
<td>1.50</td>
<td>1.89</td>
<td>2.00</td>
<td>1.76</td>
<td>0.44</td>
<td>33</td>
</tr>
<tr>
<td>Plant grow and algae on wall and roof top</td>
<td>2.30</td>
<td>1.00</td>
<td>1.30</td>
<td>2.22</td>
<td>2.00</td>
<td>1.76</td>
<td>0.44</td>
<td>33</td>
</tr>
</tbody>
</table>

Note: Very critical (4), Critical (3), Less critical (2), Not critical (1)
Respondents in *Yewa Senior Grammar School Ikorodu* (Yews) agreed that damage ceiling fans, doors and windows frame, fluorescent bulbs, faded paint, faulty electrical installation, overgrown green areas, water closet, door locks, dampness on lobby and corridor walls, un drained toilet floor water as less critical facilities defects and problems noticeable in their school buildings and environ.

Dust accumulation was identified as a critical facilities problem in *Ikorodu Senior Grammar School Ikorodu* (Iksnr) according to the respondents (see table 3) in the school buildings. They agreed that less critical facilities defects and problems in their learning environment were damaged ceiling in classrooms, doors and windows frames, air conditions, faded paint, faulty electrical installation, overgrown green areas, dampness on wall, cob web, floor finishes deterioration, damaged water taps and closets, class board, un-drain toilet floor water, pipe leakages and laboratories.

<table>
<thead>
<tr>
<th>Facilities defects and problems</th>
<th>Zr mean</th>
<th>Yewa mean</th>
<th>Iksnr Mean</th>
<th>Ayang mean</th>
<th>Iscs mean</th>
<th>Df</th>
<th>t-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage ceiling fans</td>
<td>2.70</td>
<td>2.20</td>
<td>1.40</td>
<td>3.70</td>
<td>2.90</td>
<td>4</td>
<td>7.96</td>
<td>.000***</td>
</tr>
<tr>
<td>Damage ceiling in classroom</td>
<td>3.60</td>
<td>1.40</td>
<td>2.40</td>
<td>2.00</td>
<td>2.70</td>
<td>4</td>
<td>7.111</td>
<td>.000***</td>
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<tr>
<td>Damage doors and windows frame</td>
<td>3.20</td>
<td>2.00</td>
<td>1.50</td>
<td>2.25</td>
<td>2.80</td>
<td>4</td>
<td>4.876</td>
<td>.002***</td>
</tr>
<tr>
<td>Damage air condition</td>
<td>2.80</td>
<td>1.40</td>
<td>2.00</td>
<td>2.56</td>
<td>2.80</td>
<td>4</td>
<td>2.438</td>
<td>.061</td>
</tr>
<tr>
<td>Burnt and damage fluorescence</td>
<td>2.60</td>
<td>2.20</td>
<td>1.30</td>
<td>2.40</td>
<td>2.90</td>
<td>4</td>
<td>3.093</td>
<td>.025**</td>
</tr>
<tr>
<td>Fade paints</td>
<td>2.90</td>
<td>1.70</td>
<td>1.56</td>
<td>2.50</td>
<td>2.50</td>
<td>4</td>
<td>2.929</td>
<td>.031**</td>
</tr>
<tr>
<td>Electrical installation</td>
<td>2.40</td>
<td>1.80</td>
<td>1.70</td>
<td>2.56</td>
<td>2.70</td>
<td>4</td>
<td>1.639</td>
<td>.181</td>
</tr>
<tr>
<td>Damaged door locks</td>
<td>2.50</td>
<td>1.90</td>
<td>1.20</td>
<td>2.50</td>
<td>2.80</td>
<td>4</td>
<td>5.533</td>
<td>.001***</td>
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<tr>
<td>Grounds: overgrowth of green areas</td>
<td>2.78</td>
<td>2.00</td>
<td>2.00</td>
<td>1.89</td>
<td>2.20</td>
<td>4</td>
<td>1.128</td>
<td>.356</td>
</tr>
<tr>
<td>Dust accumulation</td>
<td>2.33</td>
<td>1.80</td>
<td>2.50</td>
<td>2.11</td>
<td>2.10</td>
<td>4</td>
<td>0.624</td>
<td>.648</td>
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<tr>
<td>Dampness on toilet wall</td>
<td>2.50</td>
<td>1.20</td>
<td>1.70</td>
<td>3.22</td>
<td>2.30</td>
<td>4</td>
<td>6.303</td>
<td>.000***</td>
</tr>
<tr>
<td>Broken window and damage window raking</td>
<td>2.40</td>
<td>1.60</td>
<td>1.30</td>
<td>2.50</td>
<td>3.00</td>
<td>4</td>
<td>7.393</td>
<td>.000***</td>
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<tr>
<td>Dampness on Classrooms wall</td>
<td>2.50</td>
<td>1.50</td>
<td>1.90</td>
<td>2.44</td>
<td>2.40</td>
<td>4</td>
<td>1.695</td>
<td>.168</td>
</tr>
<tr>
<td>Rough connection of air condition duct pipes</td>
<td>2.80</td>
<td>1.10</td>
<td>1.70</td>
<td>2.78</td>
<td>2.33</td>
<td>4</td>
<td>4.521</td>
<td>.004***</td>
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<tr>
<td>Offices</td>
<td>2.80</td>
<td>1.20</td>
<td>2.00</td>
<td>2.00</td>
<td>2.60</td>
<td>4</td>
<td>3.340</td>
<td>.018**</td>
</tr>
<tr>
<td>Classroom</td>
<td>2.80</td>
<td>1.30</td>
<td>2.10</td>
<td>2.00</td>
<td>2.40</td>
<td>4</td>
<td>2.998</td>
<td>.028**</td>
</tr>
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<td>Damaged internal door</td>
<td>2.80</td>
<td>1.33</td>
<td>1.20</td>
<td>2.40</td>
<td>2.70</td>
<td>4</td>
<td>8.441</td>
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<td>Floor finishes deterioration</td>
<td>2.60</td>
<td>1.44</td>
<td>2.00</td>
<td>2.11</td>
<td>2.30</td>
<td>4</td>
<td>2.567</td>
<td>.051*</td>
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<td>Damaged tap</td>
<td>2.60</td>
<td>1.60</td>
<td>1.70</td>
<td>1.78</td>
<td>2.60</td>
<td>4</td>
<td>2.443</td>
<td>.061</td>
</tr>
<tr>
<td>Damage water closet</td>
<td>1.90</td>
<td>1.90</td>
<td>1.80</td>
<td>2.22</td>
<td>2.40</td>
<td>4</td>
<td>0.650</td>
<td>.630</td>
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<tr>
<td>Dampness on lobby and corridor wall</td>
<td>2.60</td>
<td>2.00</td>
<td>1.44</td>
<td>1.89</td>
<td>2.10</td>
<td>4</td>
<td>1.401</td>
<td>.250</td>
</tr>
<tr>
<td>Cob web: workshop</td>
<td>2.80</td>
<td>1.30</td>
<td>2.20</td>
<td>1.89</td>
<td>1.90</td>
<td>4</td>
<td>3.346</td>
<td>.018**</td>
</tr>
<tr>
<td>Improper car parking</td>
<td>2.50</td>
<td>1.40</td>
<td>1.70</td>
<td>1.89</td>
<td>2.40</td>
<td>4</td>
<td>2.634</td>
<td>.047*</td>
</tr>
<tr>
<td>Wall cracks</td>
<td>2.40</td>
<td>1.40</td>
<td>1.60</td>
<td>2.20</td>
<td>2.10</td>
<td>4</td>
<td>2.018</td>
<td>.108</td>
</tr>
<tr>
<td>Defaced of walls with poster</td>
<td>2.10</td>
<td>1.50</td>
<td>1.80</td>
<td>2.22</td>
<td>2.10</td>
<td>4</td>
<td>0.718</td>
<td>.584</td>
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<td>Damage class board</td>
<td>1.90</td>
<td>1.50</td>
<td>1.80</td>
<td>2.33</td>
<td>2.20</td>
<td>4</td>
<td>0.882</td>
<td>.483</td>
</tr>
<tr>
<td>Un-drain water on road/car parks</td>
<td>2.50</td>
<td>1.50</td>
<td>1.60</td>
<td>2.11</td>
<td>1.90</td>
<td>4</td>
<td>2.444</td>
<td>.061</td>
</tr>
<tr>
<td>Un-drain toilet floor water</td>
<td>2.13</td>
<td>1.50</td>
<td>1.60</td>
<td>1.67</td>
<td>2.60</td>
<td>4</td>
<td>2.092</td>
<td>.099</td>
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<tr>
<td>Pipe leakages</td>
<td>2.60</td>
<td>1.20</td>
<td>1.90</td>
<td>1.44</td>
<td>2.30</td>
<td>4</td>
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<td>.021**</td>
</tr>
<tr>
<td>Defect in roof covering</td>
<td>1.90</td>
<td>1.10</td>
<td>1.20</td>
<td>2.60</td>
<td>2.40</td>
<td>4</td>
<td>7.952</td>
<td>.000***</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2.30</td>
<td>1.20</td>
<td>1.80</td>
<td>2.00</td>
<td>1.80</td>
<td>4</td>
<td>1.734</td>
<td>.160</td>
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<td>Overflow of W.C water</td>
<td>2.00</td>
<td>1.50</td>
<td>1.40</td>
<td>1.78</td>
<td>2.30</td>
<td>4</td>
<td>1.626</td>
<td>.185</td>
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<tr>
<td>Cob web in offices</td>
<td>2.20</td>
<td>1.20</td>
<td>1.50</td>
<td>1.89</td>
<td>2.00</td>
<td>4</td>
<td>2.185</td>
<td>.086</td>
</tr>
<tr>
<td>Plant grow and algae on wall and roof top</td>
<td>2.30</td>
<td>1.00</td>
<td>1.30</td>
<td>2.22</td>
<td>2.00</td>
<td>4</td>
<td>3.877</td>
<td>.009***</td>
</tr>
</tbody>
</table>

Note: * denote less significant ** denote significant *** denote very significant

In *Ayangburan Senior High School* (Ayang) learning environment students and staffs indicate that damage ceiling fans is a very critical facilities defect noticeable in the school. Other defects identified as critical defects were damage air condition, faded
paint, faulty electrical installation, door locks, defects in roof covering, dampness on toilet wall, AC duct pipes, broken window and damaged window railings.

Respondents in Lagos State Civil Service Senior Model College Igbogbo (Lscs) agreed that most of their facilities were in critical conditions. They identified damaged ceiling in classrooms, ceiling fans, burnt fluorescents, doors and windows frames, air condition, faulty electrical installation, internal doors and locks, water taps, un-drain toilet floor water as facilities defects and problems of concern to the school.

In overall, using the Relative Criticality Index (in table 3) for all the five secondary schools selected for the study damaged ceiling fans (0.65) is the most critical facilities defect in the schools. Damaged classroom ceiling (0.61), doors and windows frames (0.59), air condition (0.58), burnt fluorescence bulbs (0.57), faded paint (0.56), faulty electrical installation (0.56), door locks (0.55), overgrown green areas (0.54), dust accumulation (0.54) and dampness on toilet wall (0.54) were ranked between 2nd-10th facilities defects and problems respectively.

From table 4, at 0.05 level of significant the facilities defects and problems identified as very significant were damaged internal doors, defects in roof covering, broken window and damaged window railing, damaged ceiling in classrooms and dampness on toilet wall. These defects were the most noticeable defects and problems in the schools buildings which affect the learning environment. Ceiling fans, door locks, faded paint, pipe leakages, offices, classrooms, workshop, burnt fluorescent bulbs, cob web in offices and classrooms, improper car park and floor finishes deterioration were termed to be significant facilities defects and problems in the selected secondary schools.

Table 5: Kendall’s Coefficient of Concordance

<table>
<thead>
<tr>
<th>N</th>
<th>Kendall’s Wallis</th>
<th>Chi-Square</th>
<th>Df</th>
<th>Asymp.sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.454</td>
<td>18.162</td>
<td>4</td>
<td>0.001</td>
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</tbody>
</table>

According to table 5, the Kendall’s coefficient of concordance of 0.454 at 0.05 level of significant show that there is an agreement between the facilities defects and problems experienced in all the five selected secondary schools in the study area.

**DISCUSSION OF FINDINGS**

The five selected public secondary schools indicate almost similar facilities problems. From table 3, Zumaratul Islamiyyah senior Grammar School indicates damaged ceiling in classroom as a very critical defects. Yewa Senior Grammar School Ikorodu identified almost all the facilities problems in their learning environment as less critical. This may be that a bit of maintenance management is practice in the school. Dust accumulation was identified as a critical facilities problem in Ikorodu Senior Grammar School. According to respondents in Ayangburan Senior High School, Damaged ceiling fans is a very critical facilities defect noticeable in the learning environment. But in Lagos State Civil Service Senior Model College Igbogbo, they agreed that most of their facilities were in a critical condition.

Damaged door/window frames, faded paint, damaged air condition, ceiling fans, internal doors, water taps, AC duct pipes connection, pipe leakages, floor finishes, offices, classrooms, over grown green areas, workshop, improper car parking, un drained water on road/car park, cob web in classrooms, dampness on toilet walls and
door locks were critical facilities defects in Zumaratul Islamiyyah Senior Grammar School. Facilities identified as in critical state in Civil service Senior Model College Igbogbo were damaged ceiling in classrooms, ceiling fans, burnt fluorescents, doors and windows frames, air condition, faulty electrical installation, internal doors and locks, water taps and un-drain toilet floor water.

The study show that the significant facilities defects and problems in the five selected secondary schools in Ikorodu, Lagos State were damaged internal doors, ceiling fans, defects in roof covering, broken window and damaged window railing, damaged ceiling in classrooms and dampness on toilets wall. Asiyai (2012), attest that the maintenance carried out on school buildings such as repairing cracks on broken walls, broken ceiling roofs, electric fixtures, damage louvers, doors and windows were inadequate which confirm these findings. Classrooms, workshops, toilets, overgrown green areas, door locks water and sanitary facilities were in critical state of disrepair and were inadequate as in (Nakpodia 2012, Zubairu and olagunju 2012). The oral interviews compliment the findings of the study all the respondents agreed that the secondary school facilities were in critical state of disrepair and appalling. They believed that the schools need a speedy government intervention to restore the learning environment. The study also reveals that the five schools were prone to similar facilities defects and problems which is an indication of our government’s nonchalant attitude towards School buildings care. All the stakeholders in the education sector in Lagos state need a proactive approach in tackling these menaces.

CONCLUSIONS

A building cannot retain its original state forever due to various maintenance generators acting on it. Therefore building care is paramount to retain or restore the building to its original state or an acceptable standard. The study reveals that the maintenance of the secondary schools facilities has been neglected over the years. There is also a slow response to replacement of faulty components in the schools buildings which led to the present state of disrepair of the schools facilities. The most concerned facilities indicated were internal doors, ceiling fans, defects in roof covering, broken windows and damaged window railings, ceiling in classrooms, dampness on toilet wall, classroom, workshops, offices, electrical fittings, faded paint, pipes leakages, door locks, floor finishes, cob web, and improper car parking. A proactive approach to the maintenance of the schools facilities by the school management board and the state government is essential to maintain functional facilities that can enhance effective and efficient learning process in the schools. Students and staffs should be trained on how to carry out minor maintenance works. Government should ensure that there is available fund for minor repair and replacement of faulty components in the schools budget. A further study is required in evaluating the performance of secondary facilities in Lagos State and how it affects teachers and students performance. Sick building syndrome experienced in secondary school buildings should also be researched into.

REFERENCES


POST-CONTRACT CONSTRUCTION DISPUTES IN THE GHANA HEALTH SECTOR: CAUSES AND EFFECTS

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\textit{Department of Building Technology, Kumasi Polytechnic, Kumasi, Ghana}

Construction projects complexity is characterized by disputes. Disputes have become part of the nature of construction projects due to the existence of human relationships in contract formation. Disputes normally arise from disagreements and may have far-reaching consequences on the projects as well as the objectives of the project. The health sector is one of the paramount areas in nation development where infrastructure is critically needed to save lives. The aim of this paper is to find out how post-contract disputes arise and the negative effects they have on the success of construction projects in the health sector in Ghana. Desk-based study of relevant documents and reports was carried out to examine the existence of disputes in construction projects in the Ghana health sector. To saturate the desk-based study stakeholders within the health sector were interviewed. A survey was further carried out to inquire from parties working on construction projects about the causes and effects of post-contract disputes on the success of the projects. It was found out that poor communication amongst contract parties and stakeholders, excessive delays in honoring payment certificates and reluctance to seek clarification of consultant’s instructions are the major causes of disputes in the construction industry. Also, delays and cost overrun, loss of professional reputation both national and international, poor health care delivery and even loss of lives are important effects of post-contract disputes.

Keywords: causes and effects, disputes, Ghana, health sector, post-contract disputes

INTRODUCTION

The construction industry is very complicated such and intricately linked to that political and economic environment. The rise of disputes in this industry therefore has far-reaching consequences on various sectors of the national economy. Murdoch and Hughes (2000) described that there is a high level of organizational complexity in the construction industry, as many specialized skills and professions contribute to the process. Complex construction has brought about complex disputes and their effects on the success of construction projects seem to be significant. The health sector is responsible for health delivery in every nation. Some of the major construction undertaken by this sector is complex operating theaters, surgical wards, mother and baby wards, laboratories etc. Failure to initiate and complete such projects on time would affect health delivery and this could cause loss of lives and other serious implications. The nature of disputes is such that it often results in time overrun, cost overrun, litigation and complete abandonment of projects (Sambasivan and Soon, 2007). Many construction disputes arise out of disagreement and delay. Litigation in construction industry has therefore been frequent in both domestic and international

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construction projects. It is still very common in most parts of the world, even in cases where modern management techniques have been adopted and implemented (Hinchey and Schor, 2002). However, a couple of studies done on the subject of construction disputes have reported some effects such as delay in large civil construction works and building projects in the United States of America (ENR, 2000), Ghana (Fugar and Agyakwah, 2010), Hong Kong (Kaming et al., 1997; Kunaraszamy and Chan, 1998), and Lebanon (Faridi, and El-Sayegh, 2006). Disputes are deceptive in nature and may start with simple unassuming reasons that gradually lead to a substantial set of interrelated complex disputes in the contract agreement. Some disputes are caused by factors such as unrealistic contract duration and cost, differing site conditions, change in orders, delays, impact and ripple effects of delays, evaluation of the quantity and quality of works, owner furnished items differences in the interpretation of plans and specifications, unfulfilled duties, acceleration, inefficiency and disruption. These factors are general in nature and do not relate to a construction works within a specific sector. The objective of this study is to identify the causes and effects of post-contract disputes occurring in construction projects undertaken in the health sector in Ghana.

LITERATURE REVIEW

As long as human exists, disputes form part of life. Conflict resolution is therefore an important measure needed for human existence. With the formation of construction contract, relationship is established between persons forming the contract and such relationship become subject to disagreements and disputes (Hellard, 2007). Contract disagreements or disputes remain one of the main causes of delays in large building projects (Assaf and Al-khali, 2006; Al-Kharashi and Skitmore, 2009). Ayman (2000) in his survey on causes of delay on public projects also found out that contract disputes, among other factors such as change orders, poor weather and site conditions and late deliveries delays construction progress.

The presence of misunderstanding between two parties in a relationship, either contractual or non-contractual is an indication of the existence of dispute. “A dispute is defined as a class or kind of conflict, which manifests itself in distinct and justifiable and involves disagreement over issues capable of resolution by negotiation, mediation or third party adjudication (Brown et al., 1993). According to Kumaraswarmy and Yogeswaran (1997), “a dispute can be said to exist when a claim or assertion made by one party is rejected by the other party and that rejection is not accepted.”

According to Hellard (2007) there are five basic relationships that occur in the formation of construction contract: The relationship of the owner to the designer; The relationship of the designer to another design specialist(s); The relationship of the owner to the prime contractor; The relationship of the prime contractor to its subcontractors; and the relationship of the prime contractor to suppliers. With the existence of these contractual relationships, there is the likelihood of having disagreements, disputes, discords and conflicts (Orgen et al., 2011).

Causes of Disputes

Imperfection in contract documentation has been identified as one of the causes of disputes (Hohns, 1997). All drawings in the contract documents somehow have technical drafting errors or lack the needed dimensions or details. Many have errors which stem from the human nature of the designer and architect. The larger the project, the more the people involved, the more complex that drawings become as
well as the thoughts and the ideas. This consequently leads to more errors in documentation (Hall, 2002).

Inability to understand cost estimation often results in post-contract disputes too. According to Essex (1996) “Disputes arise when the job does not come out well, and too often the reason for this is the failure to initially figure the cost accurately”. Also the presence of competition in the construction industry and the desire to win at all cost could lead to disputes. Glover and Elliot, (2007) opined that in competitive contracting market, contractors work at extremely low mark up levels. The successful contractors during the contract execution may use either fair or foul means to recoup their investment via compromising on quality and also raising illegitimate claims

**Party-related causes**

The conflict of needs of the parties involved has a potential to bring misunderstanding. According to Carmicheal (2002) construction disputes and confrontations arise because the people involved have needs. From the contractor’s side the needs are usually money or profit related. The designer has the ideas, his building or design which might be his monument to himself, his reputation, his artistic temperament, his money, his insurance premium and similar needs. The owners have needs as well; political careers, corporate careers, the need to have the space for a certain day. When something unanticipated or not properly recognized interferes with the fulfillment process, goals and security are jeopardized, communications become strained and strained seem always to be followed by demands, refusals other more intense strains, hard, then harder positions and money losses. Fenn (1997) identified the following factors as causes of construction disputes caused by clients: Failure to respond in timely manner; poor communications amongst members of the team; inadequate tracing mechanisms for request of information; deficient management, supervision and coordination efforts on the part of the project team; the absence of team spirit among the participants; reluctance to check for constructability, clarity and completeness; failure to appoint a project manager; discrepancies/ambiguities in contract documents. Hall (2002) identified causes of construction disputes emanating from the consultants outfit as: failure to understand its responsibilities under the design team contract; over design and underestimating the costs involved; late information delivery and cumbersome approach to request for information’s; design and specification oversights and errors or omissions resulting from uncoordinated civil, structural, architectural and electrical designs; incompleteness of drawing and specifications. Carmicheal (2002) identified causes of construction disputes normally caused by contractors as follows: inadequate contractors management, supervision and coordination; delay/suspension of works; failure to plan and execute the changes of works; failure to understand and correctly bid or price the works; lack of understanding and agreement in contract procurement; reluctance to seek clarification; inadequate contract scheduling and update requirements.

**Effects of post-contract disputes**

Increased costs reduced the quality of works and service and prolonged construction completion periods are primary consequences of disputes. There have been numerous abandoned projects in the Ghana (Fugar and Agyakwa-baah, 2010) including the health sector nationwide, and these have negative implications for the health and lives of citizens. Whenever disputes arise, projects suffer, and in the health service, it affects proper health care delivery and even at times causes death due to inadequate infrastructure. Some disputes are of a minor nature and are settled quickly, fairly and
amicably by the building team. From time to time, however, more serious issues confront the disputed parties. Hall (2002) observed that consequences of the construction disputes are always detrimental to stakeholders in the construction project. Below are some of the negative effects of construction disputes on client organization; additional managerial and administration expenses; loss of organizational reputation; loss of profitability and perhaps business viability; time delays and cost overruns; loss of professional reputation; deterioration of relationship and break down in cooperation; high tender prices; rework and relocation costs for men, equipment and materials.

Resolution of disputes

Some conflicts and disputes are not avoidable, proper management of conflict will ease the impact it has on the construction process, but resolution must follow quickly. Dispute can be resolved by using methods such as negotiation and alternative resolution methods or mediation, arbitration and litigation. Cheung, et al., (2000) in their work on project dispute resolution pointed out that there can be satisfaction if a neutral panel is employed in resolving disputes. Orgen et al. (2011) also found out that the success of dispute resolution method depends on how well it is able to provide a win-win situation for the parties involved.

RESEARCH METHODS

The general approach is a case study. The construction projects undertaken by government hospitals in the Kumasi Metropolis were selected for the study. Thus data was collected from the stakeholders from the client, contractor and consultant’s teams working on the selected projects. The process of selection of the respondents was done on the basis of non-proportionate quota sampling (Doherty, 1994); for each project 3 respondents were selected (1 from the client’s building team, 1 from the contractor’s team and 1 from the lead consultant’s team) as a non-quota sampling method was used in order to have an evenly distributed views from all parties. Construction projects completed before year 2011 were excluded in order to ensure that data obtained for the study is recent. First, with the aid of unstructured interviews of construction professionals in the selected hospitals, information on the likely causes and effects of disputes on construction projects were collected. Through review of pertinent literature more information on the causes and effects of disputes were obtained. At a second data collection stage, structured questionnaire was used to inquire from the projects stakeholders the importance of the causes and effects (variables) of disputes on construction projects were collected. Through review of pertinent literature more information on the causes and effects of disputes were obtained. At a second data collection stage, structured questionnaire was used to inquire from the projects stakeholders the importance of the causes and effects (variables) of disputes on construction projects. The stakeholders selected involved team members from the client, contractors and consultant’s organizations. A 5-point likert scale was adopted to enable respondents rank the importance of the variables. Data analysis was carried out using the Relative Importance Index (RII) technique cited in the work of Lim and Alum (1995). The formula for computing the indices is given below

\[ RII = \frac{5n_3 + 4n_4 + 3n_3 + 2n_2 + n_1}{5N} \]

Where; \( n_3 \) =number of respondents ranking very often for a given factor
\( n_4 \) = number of respondents ranking often for a given factor
\( n_3 \) = number of respondents ranking average for a given factor
\( n_2 \) = number of respondents ranking rare for a given factor
n₁ = number of respondents ranking very rare for a given factor
N = number of respondents
Higher, RII indicates higher importance of variable.

RESULTS AND DISCUSSION

Data on 15 construction projects were obtained thus 45 respondents were expected to answer the questionnaire distributed. Out of 45 respondents 32 responded to the questionnaires.

Table 1 - Causes of post-contract disputes in the health sector

<table>
<thead>
<tr>
<th>Rank</th>
<th>Variable</th>
<th>R.I.I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Awarding contracts based on lowest bid</td>
<td>0.968</td>
</tr>
<tr>
<td>2nd</td>
<td>Poor communications amongst members in the team</td>
<td>0.762</td>
</tr>
<tr>
<td>3rd</td>
<td>Failure to respond in timely manner</td>
<td>0.725</td>
</tr>
<tr>
<td>3rd</td>
<td>Deficiency in management, supervision and coordination efforts on the project</td>
<td>0.725</td>
</tr>
<tr>
<td>5th</td>
<td>Failure to appoint a project manager</td>
<td>0.700</td>
</tr>
<tr>
<td>6th</td>
<td>Reluctance to check for constructability, clarity and completeness</td>
<td>0.693</td>
</tr>
<tr>
<td>6th</td>
<td>Inadequate tracing mechanisms for requested information</td>
<td>0.693</td>
</tr>
<tr>
<td>7th</td>
<td>The absence of team spirit amongst the participants</td>
<td>0.675</td>
</tr>
<tr>
<td>1st</td>
<td>Incompleteness of drawings and specifications</td>
<td>0.918</td>
</tr>
<tr>
<td>2nd</td>
<td>Design and specification oversights and omissions resulting from uncoordinated civil, structural, architectural and electrical designs</td>
<td>0.906</td>
</tr>
<tr>
<td>3rd</td>
<td>Over design and underestimating the costs involved</td>
<td>0.843</td>
</tr>
<tr>
<td>4th</td>
<td>Failure to understand its responsibilities under design team contract</td>
<td>0.831</td>
</tr>
<tr>
<td>5th</td>
<td>Discrepancies/ambiguities in contract documents</td>
<td>0.693</td>
</tr>
<tr>
<td>1st</td>
<td>Reluctance to seek clarification</td>
<td>0.850</td>
</tr>
<tr>
<td>2nd</td>
<td>Failure to plan and execute the changes of work</td>
<td>0.825</td>
</tr>
<tr>
<td>2nd</td>
<td>Failure to understand and correctly bid or price the works</td>
<td>0.825</td>
</tr>
<tr>
<td>3rd</td>
<td>Inadequate contractors management, supervision and coordination</td>
<td>0.650</td>
</tr>
<tr>
<td>4th</td>
<td>Delay due to suspension of works</td>
<td>0.575</td>
</tr>
<tr>
<td>6th</td>
<td>Lack of understanding and agreement in contract procurement system</td>
<td>0.475</td>
</tr>
</tbody>
</table>

From Table 1, it can be realized that among client-related causes, the practice of awarding contracts based on lowest bid is regarded as the most important cause of post-contract disputes. This could imply that the investigations carried out to ascertain the realistic nature of bidder’s prices is insufficient. Thus, a successful contractor, in his bid to make profit with unrealistic rates, encounter difficulties and this eventually sparks disagreements among parties.

Loader (2002) observed that the presence of tight timescales for preparation of bids is usually an attribute within certain client organizations and this practice usually mounts pressure on project consultants to subsequently prepare bids for quick submission leading to reduced quality of documents. The consequent result is unforeseen variations retarding the project’s progress. Amongst the consultant related causes, incompleteness of drawings and specifications stands out as the most important. The
health sector normally works in emergency situations and consultants are put under pressure to design and commence construction within a relatively short period. It was found out that the reluctance of contractors to seek clarification, especially about instructions given or contract information before execution normally leads to disputes during the construction stage. This was found as the most important contractor-related causes of disputes.

Table 2 – Effects of post-contract disputes in the health Sector

<table>
<thead>
<tr>
<th>Rank</th>
<th>Questions</th>
<th>R.I.I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Incurring additional expenses in management and administration of projects</td>
<td>0.869</td>
</tr>
<tr>
<td>2nd</td>
<td>Loss of professional reputation</td>
<td>0.808</td>
</tr>
<tr>
<td>3rd</td>
<td>Loss of lives</td>
<td>0.806</td>
</tr>
<tr>
<td>4th</td>
<td>It affects the cash flow of the Institution</td>
<td>0.791</td>
</tr>
<tr>
<td>5th</td>
<td>It affects the budget of the Institution</td>
<td>0.783</td>
</tr>
<tr>
<td>6th</td>
<td>Poor Health Care delivery</td>
<td>0.781</td>
</tr>
<tr>
<td>7th</td>
<td>It affects capital intensive projects</td>
<td>0.753</td>
</tr>
<tr>
<td>8th</td>
<td>Affects the strategic plan of the Institution</td>
<td>0.753</td>
</tr>
<tr>
<td>9th</td>
<td>Time delays and costs overruns</td>
<td>0.747</td>
</tr>
<tr>
<td>10th</td>
<td>It prevents expatriate medical team partnership</td>
<td>0.743</td>
</tr>
<tr>
<td>11th</td>
<td>It causes decrease in revenue to the Institution</td>
<td>0.709</td>
</tr>
<tr>
<td>12th</td>
<td>It contributes to total abandonment of projects</td>
<td>0.701</td>
</tr>
<tr>
<td>13th</td>
<td>Bad reputation for the Institution both National and International</td>
<td>0.701</td>
</tr>
<tr>
<td>14th</td>
<td>Affects inflows of donor funds</td>
<td>0.698</td>
</tr>
<tr>
<td>15th</td>
<td>It contributes to under infrastructural development</td>
<td>0.684</td>
</tr>
<tr>
<td>16th</td>
<td>Causes litigation</td>
<td>0.6648</td>
</tr>
<tr>
<td>17th</td>
<td>High tender prices</td>
<td>0.604</td>
</tr>
<tr>
<td>18th</td>
<td>Loss of profitability and business viability</td>
<td>0.591</td>
</tr>
<tr>
<td>19th</td>
<td>Affects staff strength of the Institution</td>
<td>0.587</td>
</tr>
<tr>
<td>20th</td>
<td>Rework and relocation costs for men, equipment and materials</td>
<td>0.494</td>
</tr>
</tbody>
</table>

Incurring additional expenses in management and administration of projects as a result of disputes and disputes resolution was found out as the most important effect of post-contract disputes in the health sector in Ghana. This could probably be due to the increase in project cost that comes as consequence of delays when disputes bring construction works to a halt and is resumed after a long period of resolution. The cost of resolving the disputes also adds to the overall project costs. Other important effects in the health sector, as result of post-contract disputes include loss of professional reputation, loss of lives and poor healthcare care delivery. These consequences are detrimental to the success of project (Hall, 2002) and need to be minimized in order to forestall unnecessary loss of human lives and also prevent avoidable poor health care delivery in Ghana.

Table 3 - Resolution of post-contract disputes

<table>
<thead>
<tr>
<th>Methods of Resolving Disputes</th>
<th>No. of Respondents</th>
<th>Total Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADRs</td>
<td>21</td>
<td>65.7</td>
</tr>
<tr>
<td>Arbitration</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Litigation</td>
<td>3</td>
<td>9.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>32</td>
<td>100</td>
</tr>
</tbody>
</table>
As earlier mentioned disputes are integral part of human relationships and humans themselves always find ways of resolving them. There are different views as to the best method of methods of resolving construction disputes. Table 3 outlines few of the methods normally adopted in the construction industry for resolution of contract disputes. Majority of the project stakeholders in the health sector find ADR’s as the best method of resolving disputes that occur during the execution of a construction contract. This could probably be due to its popularity and its out-of-court settlement feature.

CONCLUSION

The main objective of the study was to identify the impact and causes of post-contract disputes on the success of construction projects in the health sector. Major causes of post-contract disputes identified include poor communication amongst contract parties and stakeholders, excessive delays in honoring payment certificates and reluctance to seek clarification of consultant’s instructions. It was also found out that delays and cost overrun, loss of professional reputation both national and international, poor health care delivery and even loss of lives are important effects of post-contract disputes on the success of construction projects in the Ghanaian health sector. The effects of post-contract disputes in construction projects in the health sector in Ghana have been observed to contribute to even the loss of human lives and all measures required to be employed to minimize such disputes quickly must be adopted by all project participants. It was found out from the results that the most preferred method of resolving post-contract disputes was ADRs (mediation, conciliation and negotiation). The ADR resolution methods should be capitalized on, by especially projects consultants (referees), for the quick resolution of disputes since most project stakeholders are more comfortable with this method.

REFERENCES


This paper investigates the survival mechanisms of the urban poor in Lagos Metropolis. The study considers their socio economic characteristics as well as their livelihood patterns and other safety mechanisms employed in the absence of formal social security systems. The research adopts a purposive selection of thirty one low income residential neighbourhoods in the Lagos Metropolis. Data was obtained by the administration of structured questionnaires and analysis was done by both parametric and non-parametric methods. Random sampling of 396 household heads was carried out. The research revealed the importance of informal activities, particularly home based enterprises, as a major source of employment, income and social security in the study area. Furthermore, participation in social organizations are essential safety mechanisms identified in the study. The study concludes by recommending means of exploiting the identified strengths of the informal systems and these include the adoption of pro-poor planning strategies including civic engagement.

Keywords: survival, Lagos, pro-poor, informal enterprises

INTRODUCTION

The Human Development Report (2011) rates Nigeria as the 31st poorest country in the world based on a comparative measure of life expectancy, literacy and standards of living. Over 64% of her population, approximately 81.5 million people are surviving on less than US$1.25 daily, the global absolute poverty benchmark. The UN-Global Urban Observatory (2010) further estimates that approximately 62% of Nigerian urban households live in slum conditions. Slums are the most acute scenarios of urban poverty, physical and environmental deprivation and are typically defined as including a wide range of low-income settlements and/or poor human living conditions. Urban poverty, in particular, has been exacerbated in Nigeria by low levels of social development resulting from corruption, misallocation of funds, poor investment habits, poor family planning habits, minimum wage laws and declining life expectancy (Oduwaye and Lawanson, 2007)

Lagos stands at the top of the Nigerian urban system. (Onibokun, 1997). Federal Office of Statistics (2005) records show that despite being responsible for 62% of the gross national product and 45% of the industrial labour force of Nigeria, most of the population of Lagos live below the poverty line. According to Davis (2006), Lagos is simply the biggest node in the shantytown corridor of 70 million people that stretches from Abidjan to Ibadan: probably the biggest continuous footprint of urban poverty on earth. More than 100 blighted areas have been identified thus far, making up about

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70% of the entire land area (Omirin and Nubi, 2007). Furthermore, UNDP (2003) estimates that 51% of men and 54% of women resident in Lagos fall under the absolute poor category. Their predominant economic activities are in the informal sector, which according to the Lagos State Government (2004) employs between 50% and 75% of the working age population.

The informal economic sector is described by Olanrewaju (1990) as characterized by small-scale operations, labour-intensive techniques, low-income families, private and indigenous ownership of enterprises that are largely unprotected by government. The International Labour Organization (2002) describes the main features of this sector as economic units with ease of entry; small scale of the activity; self-employment, with a high proportion of family workers and apprentices; little capital and equipment; labour intensive technologies; low skills; low level of organisation with no access to organised markets, formal credit, education and training or services and amenities; cheap provision of goods and services otherwise unavailable; low productivity and low incomes.

It is therefore imperative to understand how they survive the urban milieu, given the high costs of living, distinct inequities and social exclusion situation of the poor in the Lagos Metropolis. The study investigates the dynamics of survival for the urban poor of the Lagos Metropolis through an examination of their livelihood and lifestyle patterns.

**STUDY AREA**

The study is set in the Lagos Metropolis, South Western Nigeria, on the narrow coastal plain of the Bight of Benin. Lagos Metropolis is situated within latitudes 6°23′N and 6°41′N and longitudes 2°42′E and 3°42′E. It comprises settlements that have grown from predominantly farming and fishing villages to highly urbanized settlements. Lagos Metropolis is bounded in the west by Ojo and Ijanikin, Lekki Peninsula in the east and Ikorodu and Alagbado towns in the north. Water is the most significant topographical feature in Lagos State as water and wetlands cover over 40% of the total land area within the State.

Lagos is regarded as a mega city, because its population is estimated to be about 12 million people, with a population density of 20,000 persons/sq km (Mabogunje, 2002). As mapped from the SPOT5 2.5 meter image of 2004, the contiguously built up area of Lagos metropolis is about 872 square kilometers. Lagos state is on a built-up land area of about 18,558 Hectares made up of about 9,669 hectares (52.1%). residential, commercial, 1,021 hectares (5.5%); industrial, 1,448 hectares (7.8%); institutional and special areas, 2,784 hectares (14%); transportation 3,340 hectares (18%), and open spaces 52 hectares (2.8%). The Lagos metropolis comprises 88.7% of Lagos State (Lagos State Economic Summit, 2001).

Lagos has remained the country’s economic powerhouse, accounting for some 65% of Nigeria’s industrial infrastructure and contributing more than half of national economic development (Okunlola, 2007). Commercial activities are very strong in the city and are carried out at both the formal and informal levels (Abiodun, 1997). However, Lagos is presently characterized by commercial ribbon street development such that virtually all residential areas are in a chaotic state with indiscriminate mix of commercial, light industry, transport and religious land uses (Oduwayne, 2005).
LITERATURE REVIEW

The theory of social exclusion has contributed significantly toward the conceptual understanding of poverty. Social exclusion is defined as living in conditions of deprivation and vulnerability, such as poverty; inadequate access to education, health and other services; lack of political influence, civil liberties, and human rights; geographic isolation; environmental exposures; racism or historical trauma; disruption of social capital and social isolation; exposure to wars and conflicts; alienation or powerlessness (UNDP, 1997). Poverty is also the result of marginalization experienced in different processes in the realms of rights, resources and relationships. A further strength of the approach is that it encourages poverty analysts to look at the trajectories of disadvantage that extend over years and are characterized by various form of deprivation. (Egzibber et al (1994).

The cycle of poverty suggests that the poor remain in poverty because of their adaptations to the burdens of poverty. As noted by Payne (1998) poverty continues as a result of people trapped in an array of social situations which include low income, poor education, poor housing, insecure tenure, or poor health as shown in Figure 1.


Fig 1: The Cycle of Poverty

These deprivations collectively work in a cyclical trap. According to Lewis (2003), those trapped in the cycle of poverty have a strong feeling of marginalization, helplessness and dependency. They operate in a perpetual state of vulnerability. From a poverty standpoint, Moser (1998) defined vulnerability as a dynamic concept of susceptibility to risks of falling into poverty. The more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their
insecurity. Hence the World Bank (2002) recommends that sustainable poverty reduction can only be achieved when countries implement policies aimed at improving economic growth, distribution of income, wealth and social development.

There is overwhelming evidence to suggest that urban poverty and informal employment are closely related. The studies of Henry (1978), Strassman (1987), UNCHS/ILO (1995), and Chen (2009), among others attest to this. These have been reinforced by empirical studies of Sinai (1998), Ghafur (2002), Nahiduzzaman (2006) and Oduwaye and Lawanson (2007).

The informal economy as the highest employer of the urban poor around the world, allows all but the destitute and criminally minded to eke a living, howbeit subsistent (Tipple, 2005). Part of what allows them to keep operating is their use of personal and domestic assets, such as living quarters, vehicles, and furniture for their business (Todaro, 1978; Lipton, 1980). Participants in the informal sector are unable to separate economic life from such other aspects of social life as culture, religion, kinship and lineage. Furthermore, informal sector employment is a necessary survival strategy especially in many countries that lack social safety nets such as unemployment insurance and effective pension schemes. (Yasmeen, 2001). Hence this study attempts to investigates the interplay amongst these facets of urban living.

**RESEARCH METHOD**

This study adopts the survey research design.

The target population are household heads residing in identified low income communities of the Lagos metropolis. The low income settlements with the highest population were selected in each local government area. They are Agege (Papa Ashafa and Keke), Ajeromi Ifelodun (Alaba Oro, Tou and Olodi), Alimosho (Abule Egba and Ikorodu), Amuwo Odofin (Agboju and Mile 2 Estate), Apapa (Ijora Oloye and Malu Road), Eti Osa (Obalende), Ifako Ijaiye (Old Ifako and Agbado Ijaiye), Ikeja (Oke Ira), Kosofe (Agboyi and Ikosi), Lagos Island (Olowogbowo and Epetedo), Lagos Mainland (Ebute Meta and Iddo), Mushin (Mushin and Itire), Oshodi Isolo (Bolade Oshodi and Oke Afa), Ojo (Ajangbadi and Alaba), Somolu (Bajulaiye and Bariga) and Surulere (Ojuelegba and Orile).

A census of residential buildings with more than ten households per building in these communities was undertaken. This came to 2109 across the study area, and was used as the sample frame. 25% were then selected as the sample size hence proportional sampling of 17 households per community was done. Data administration was with the use of close-ended structured questionnaires. The questionnaires were designed in order to obtain information on key components of poverty, livelihood and lifestyle in the study area. Further information was also solicited with regards to socio-economic and socio-cultural profiles including expenditure on consumption and social participation. Out of 527 questionnaires administered, 438 were retrieved. Of these 42 questionnaires could not be used for analysis because they were not fully completed or there were gaping irregularities in some key responses. As such, only 396 (75.14%) were certified fit for analysis and this is sufficient for reliable analysis as the sample confidence interval is better than 0.05.

Data was analysed with the use of descriptive statistics as well as inferential statistics including chi square and test of homogeneity of variance.
RESULTS

Socio Economic Profile of the Respondents

The major household characteristics considered were gender, age, educational attainment, and household size of respondents. The respondents consist of 53.78% male and 46.2% female. Results indicate that most of the respondents are within the working age group of 16 to 45 years, making up over 80% of the population.

About 73% of the population are literate according to UNESCO standards as they have a minimum of secondary school education. Furthermore, about 48% of the respondents live in Brazilian type (face me-I face you) houses in which there are many rooms across a corridor, sharing household facilities with other residents. Average household size is 4-6 for the entire population. Households of between seven and nine make up about 15.91% of the respondents. Large households of more than ten people comprise 3.78% of all the respondents and was particularly evident in neighborhoods like Ajegunle (12) and Mushin (10). See Table 1.

Table 1: Household Characteristics of Respondents

<table>
<thead>
<tr>
<th>Variable</th>
<th>N=396</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>213</td>
<td>53.78</td>
</tr>
<tr>
<td>Female</td>
<td>183</td>
<td>46.22</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥15</td>
<td>8</td>
<td>2.02</td>
</tr>
<tr>
<td>16-30</td>
<td>165</td>
<td>41.66</td>
</tr>
<tr>
<td>31-45</td>
<td>162</td>
<td>40.91</td>
</tr>
<tr>
<td>46-60</td>
<td>50</td>
<td>12.63</td>
</tr>
<tr>
<td>≤61</td>
<td>11</td>
<td>2.78</td>
</tr>
<tr>
<td>Highest level of education attained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Formal Education</td>
<td>30</td>
<td>7.58</td>
</tr>
<tr>
<td>Primary Education</td>
<td>77</td>
<td>19.44</td>
</tr>
<tr>
<td>Secondary Education</td>
<td>162</td>
<td>40.91</td>
</tr>
<tr>
<td>Tertiary Education</td>
<td>127</td>
<td>32.07</td>
</tr>
<tr>
<td>Household size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>94</td>
<td>23.74</td>
</tr>
<tr>
<td>4-6</td>
<td>225</td>
<td>56.81</td>
</tr>
<tr>
<td>7-9</td>
<td>63</td>
<td>15.91</td>
</tr>
<tr>
<td>≤10</td>
<td>14</td>
<td>3.54</td>
</tr>
<tr>
<td>Housing Tenureship</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner occupied</td>
<td>59</td>
<td>14.87</td>
</tr>
<tr>
<td>Inherited/ family owned</td>
<td>47</td>
<td>11.84</td>
</tr>
<tr>
<td>Tenant</td>
<td>275</td>
<td>69.30</td>
</tr>
<tr>
<td>Squatter</td>
<td>15</td>
<td>3.78</td>
</tr>
<tr>
<td>No of rooms for exclusive household use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>81</td>
<td>20.41</td>
</tr>
<tr>
<td>2</td>
<td>142</td>
<td>35.78</td>
</tr>
<tr>
<td>3</td>
<td>123</td>
<td>30.99</td>
</tr>
<tr>
<td>≤4</td>
<td>50</td>
<td>12.60</td>
</tr>
<tr>
<td>No of households in the buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>3.05</td>
</tr>
<tr>
<td>2-4</td>
<td>96</td>
<td>24.19</td>
</tr>
<tr>
<td>5-8</td>
<td>202</td>
<td>60.90</td>
</tr>
<tr>
<td>9-12</td>
<td>52</td>
<td>13.104</td>
</tr>
<tr>
<td>≤13</td>
<td>22</td>
<td>5.54</td>
</tr>
</tbody>
</table>

Other household characteristics revealed by the study include the fact that over 60% of the respondents are migrants to Lagos, who have lived in their neighbourhoods for more than ten years. The initial reason for moving to these communities was affordability. This is especially true in Obalende, Tolu and Ijora.
Income, Employment and Asset Ownership Profile of the Respondents

The informal economy is the highest employer of labour in the study area with almost 80% of the respondents earning their incomes by participating exclusively in informal economic activities. For the 20% employed in the formal sector, about 10% are government workers while the others are employed as junior staff in private concerns. Those formally employed work mostly as drivers, janitors and office assistants and are compelled to supplement their meagre incomes with informal activities. The highest percentage of respondents are involved in informal trade activities usually home based enterprises and petty trading. The informal service sector employs about 39% of the respondents and they are involved in diverse activities such as food vending, barbing, tailoring, sign-writing, hair dressing and auto repair in various forms. The respondents involved in the informal manufacturing sector are only 7% of the population. The reason for this low quantum may be the relative intense training and capital outlay required to participate in this sector. Activities in this sector include production of sachet water, cobblering, nylon production, carpentry and metal works.

Table 2 also reveals that over 70% of the businesses are sole proprietorships which is the nature of most informal survivalist enterprises that dominate the entire study area. Partnerships account for about 24% of all businesses. Over 70% of the enterprises employ between one and four apprentices, mostly members of their families. Unpaid family workers make up about 8% of the staff strength. Furthermore, more than 80% of the respondents run kinship based enterprises in which the ownership of the business lies with them and/or members of their families. Owner managed businesses in the high density areas account for 71.37% of all businesses sampled and this further corroborates the survivalist nature of these businesses. Business registration is quite low in the study area as only 25% of respondents have local government trade permits and 11% have registered their business names with the Corporate Affairs Commission. The major sources of funding for most of the businesses are a combination of savings, thrift and cooperative loans. Only two respondents making up less than 1% have ever taken bank loans and this is because of the high interest rates and the difficulty of getting collaterals. Furthermore, most of the businesses are quite small and lack legal status and so are unable to access credit. 34% of respondents have obtained cooperative society loans, which were repaid within twelve months. They expressed satisfaction with the procedure and methods of payment as well as the flexible interest rates.

It was discovered that about 49% of the respondents rely solely on their home enterprises. The modal monthly income from home enterprises is ₦7,500 – ₦15,000 and about 30% of respondent fall within this category. While 53.85% of respondents earn less than ₦15,000 monthly from their home enterprise, 24.64% earn below the national minimum wage of ₦7,500 and so automatically fall under the absolute poor category.

Respondents rely on multiple streams of income for survival. About 20% of respondents are also employed in the formal sector of the economy, particularly as junior staff in government organizations. Other sources of income include income from abroad (16.5%) and returns from thrift/cooperative collaborations (24.9%). This confirms the generally held view that cooperative societies are the insurance of the low income earner. Other members of the family also contribute to family survival. They include spouses (69%), children (17.5%) and other relatives (13.46%).
With regards to possession of assets, more than 55% of respondents returned positive responses to ownership of house and land, though in most cases, these properties are family owned and located in their native villages. About 40% of respondents own cars or motorcycles, most of which are used for income generation as taxi-cabs, kabukubu or okada. On possession of household items, a clear demarcation could not be determined on which assets are used for business and which are used exclusively for the household. An example is the electricity generating set. Over 64% of the respondents own electricity generating sets, primarily because they consider it as essential for their business survival. However, these sets are also used in the household after the business day is over. While all respondents have electric fans, only 3.5% own air conditioners, which are considered as business incentives mainly for those in commercial business centres. The DVD player is considered an essential item for recreation; hence more than 80% of the respondents in the study area own them. The proliferation of cheap imported/second hand items makes the possession of household item such as television, compact disc player and refrigerator easily accessible to most households.

Table 2: Income, Employment and Asset Ownership Profile of Respondents

<table>
<thead>
<tr>
<th>Category of informal sector</th>
<th>N=396</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade</td>
<td>193</td>
<td>49.02</td>
</tr>
<tr>
<td>Service</td>
<td>156</td>
<td>39.62</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>30</td>
<td>7.62</td>
</tr>
<tr>
<td>Source of business funding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank loan</td>
<td>2</td>
<td>0.51</td>
</tr>
<tr>
<td>Thrift</td>
<td>199</td>
<td>50.55</td>
</tr>
<tr>
<td>Cooperative loan</td>
<td>134</td>
<td>34.03</td>
</tr>
<tr>
<td>Savings</td>
<td>162</td>
<td>41.15</td>
</tr>
<tr>
<td>Family aid</td>
<td>84</td>
<td>21.34</td>
</tr>
<tr>
<td>Monthly income from informal enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ N7,500</td>
<td>97</td>
<td>24.64</td>
</tr>
<tr>
<td>N7,500 - N15,000</td>
<td>115</td>
<td>29.21</td>
</tr>
<tr>
<td>N15,000 - N30,000</td>
<td>94</td>
<td>23.59</td>
</tr>
<tr>
<td>N30,000 - N60,000</td>
<td>61</td>
<td>15.49</td>
</tr>
<tr>
<td>≥ N60,000</td>
<td>27</td>
<td>6.86</td>
</tr>
<tr>
<td>Other Income Source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office Job</td>
<td>82</td>
<td>20.83</td>
</tr>
<tr>
<td>Inheritance</td>
<td>38</td>
<td>9.65</td>
</tr>
<tr>
<td>Rent</td>
<td>17</td>
<td>4.32</td>
</tr>
<tr>
<td>Income from Abroad</td>
<td>65</td>
<td>16.51</td>
</tr>
<tr>
<td>Cooperatives/Thrift</td>
<td>98</td>
<td>24.89</td>
</tr>
<tr>
<td>Other family income earner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse</td>
<td>272</td>
<td>69.08</td>
</tr>
<tr>
<td>Children</td>
<td>69</td>
<td>17.53</td>
</tr>
<tr>
<td>Relatives</td>
<td>53</td>
<td>13.46</td>
</tr>
<tr>
<td>Land</td>
<td>213</td>
<td>53.79</td>
</tr>
<tr>
<td>Possession of assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>210</td>
<td>53.03</td>
</tr>
<tr>
<td>Car</td>
<td>119</td>
<td>30.05</td>
</tr>
<tr>
<td>motorcycle</td>
<td>41</td>
<td>10.35</td>
</tr>
<tr>
<td>Generator</td>
<td>257</td>
<td>64.89</td>
</tr>
<tr>
<td>Air conditioner</td>
<td>14</td>
<td>3.53</td>
</tr>
<tr>
<td>Electric Cooker</td>
<td>123</td>
<td>31.06</td>
</tr>
<tr>
<td>Deep Freezer</td>
<td>182</td>
<td>45.96</td>
</tr>
<tr>
<td>DVD Player</td>
<td>335</td>
<td>84.60</td>
</tr>
<tr>
<td>Electric kettle</td>
<td>218</td>
<td>55.50</td>
</tr>
</tbody>
</table>

Kruskal Wallis test was done to determine if significant differences existed between socio economic and employment factors in the study area. Table 3 reveals that there
are significant differences in at least one of the factors determining the nature of informal enterprise in the sampled area.

Table 3 Kruskal Wallis Test for SocioEconomic and Employment Profile of Respondents

<table>
<thead>
<tr>
<th></th>
<th>Chi Square Value</th>
<th>df</th>
<th>Asymp Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Years</td>
<td>101.737</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Marital Status</td>
<td>103.038</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Position in Household</td>
<td>73.879</td>
<td>50</td>
<td>.016</td>
</tr>
<tr>
<td>Position in Business</td>
<td>138.996</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Age of Business</td>
<td>106.141</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Form of Business</td>
<td>141.867</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Primary Employment</td>
<td>123.530</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Category of Secondary Business</td>
<td>149.783</td>
<td>49</td>
<td>.000</td>
</tr>
<tr>
<td>Location of Business Premises</td>
<td>199.801</td>
<td>50</td>
<td>.000</td>
</tr>
<tr>
<td>Business Registration Status</td>
<td>216.577</td>
<td>50</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Expenditure and Consumption Profile of Respondents**

Average monthly expenditure falls between ₦1,000 and ₦10,000 ($6 - $65). Most households expended less than five thousand naira on any expenditure monthly. No household spent more than twenty thousand on waste disposal, water supply or electricity, however five respondents expended more than twenty thousand naira on fuelling their electricity generating sets to power their businesses and also for security and transport. About 7% of the respondents spent more than ten thousand naira monthly to meet social obligations such as donations, dues and levies to town associations, church societies, community associations and social clubs.

Across the sampled area, monthly funds of between ₦5000($30) and ₦10000($65) were expended in the following areas by more than 25% of the respondents for transportation. Mode values across the neighborhoods show that less than ₦5000($30) is expended monthly on housing, medicals, telephone, water, waste management, energy, security, transportation and social obligations respectively.

Table 4 shows the dispersion values across the groups. Standard deviation away from the mean is considered normal in all the cases. It was also observed that all the variables were positively skewed. This means that the mode value is higher than the median, which is higher than the mean. Variance from the mean was also negligible, except in the expenditure on food and beverages.
Table 4: Dispersion analysis of Monthly Expenditure on Consumption

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Standard Deviation</th>
<th>Variance</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>0.691</td>
<td>0.477</td>
<td>2.775</td>
</tr>
<tr>
<td>Food</td>
<td>1.328</td>
<td>1.763</td>
<td>0.525</td>
</tr>
<tr>
<td>Medical</td>
<td>0.635</td>
<td>0.403</td>
<td>2.974</td>
</tr>
<tr>
<td>Telephone</td>
<td>0.550</td>
<td>0.302</td>
<td>2.953</td>
</tr>
<tr>
<td>Water</td>
<td>0.328</td>
<td>0.108</td>
<td>3.907</td>
</tr>
<tr>
<td>Waste</td>
<td>0.299</td>
<td>0.089</td>
<td>5.328</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.392</td>
<td>0.153</td>
<td>3.152</td>
</tr>
<tr>
<td>Generator</td>
<td>0.614</td>
<td>0.377</td>
<td>2.718</td>
</tr>
<tr>
<td>Security</td>
<td>0.383</td>
<td>0.147</td>
<td>4.624</td>
</tr>
<tr>
<td>Transport</td>
<td>0.597</td>
<td>0.357</td>
<td>2.099</td>
</tr>
<tr>
<td>Social obligations</td>
<td>0.608</td>
<td>0.370</td>
<td>2.953</td>
</tr>
</tbody>
</table>

Social Security Profile of Respondents

Participation in social groups (cooperative/ thrift society and/or local chapter of artisans association) was discovered to be a key parameter for the survival of the HBEs in the study area. These groups are the social security mechanism in place for low income earners. The key variables considered were membership of social groups, as well as knowledge and participation in poverty alleviation programmes.

It was discovered that 61% of respondents belong to social groups. These social groups, usually under the aegis of crafts and tradesmen associations double as cooperative, credit and thrift societies. The respondents were asked to rank the various poverty alleviation programmes in order of effectiveness and sustainability. the respondents were mainly interested in the following groups activities in order of priority -Self-help groups; faith based organization; Lagos State Government; Federal Government. While the government programmes were structured, selection of participants was based on political affiliation. Only 45% of respondents had participated in any poverty alleviation programmes.

In order to determine if there is any significant difference among the various types of poverty alleviation programmes, the test of homogeneity of variance was done. The results are shown in Table 5.

Table 5: Test of Homogeneity of Variance of Types of Poverty Alleviation Programmes

<table>
<thead>
<tr>
<th></th>
<th>Levene statistic</th>
<th>Df1</th>
<th>Df2</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>7.744</td>
<td>47</td>
<td>594</td>
<td>.000</td>
</tr>
<tr>
<td>NGO</td>
<td>6.903</td>
<td>46</td>
<td>588</td>
<td>.000</td>
</tr>
<tr>
<td>Religious organizations</td>
<td>10.499</td>
<td>46</td>
<td>594</td>
<td>.000</td>
</tr>
<tr>
<td>Cooperative societies</td>
<td>10.071</td>
<td>47</td>
<td>594</td>
<td>.000</td>
</tr>
<tr>
<td>Self help organizations</td>
<td>7.696</td>
<td>47</td>
<td>603</td>
<td>.000</td>
</tr>
</tbody>
</table>

Since the P-Values are all less than α=.05, the conclusion is that there is difference in homogeneity of variances occurrence in at least one of the sampled neighbourhoods.
DISCUSSION

The study revealed that the urban poor in the Lagos Metropolis survive primarily by their involvement in the informal sector of the economy as well as the strong kin based networks and cooperative alliances which serve as a social security mechanism. As such, developing effective poverty alleviation strategies for this set of urban residents must take these into consideration.

The informal economic sector must be accepted as a reality of the urban age. The poor make up a significant percentage of the city and their potentials must be harnessed in order for the city to thrive. An initial step to achieving this can be the integration of the informal sector into the urban land use system. Zones must be designated for them to carry out their activities in a lawful manner. The regulation of the sector can also be done by recognizing their cooperative associations as stakeholders in the urban system. Membership of a registered/recognized cooperative must offer more than the self-help advantages current systems provide. Members must be recognized as legitimate income earners in the city, their contributions to the economy of the city must not be cloaked under ‘the Shadow economy’ and the Cooperate Affairs Commission as well as local ministries of economic planning and commerce must facilitate the establishment of a cadre that caters to owners and operators of micro-enterprises.

The cooperatives can be further strengthened by the support of government. Government can facilitate the establishment of a system by which the cooperatives can engage with formal financial institutions on behalf of their members. With this, more informal enterprises, especially the manufacturing sub-group will be able to access formal funds and eventually metamorphose into cottage industries and growth enterprises.

Social mobilization and community engagement which are strengths of the urban poor must also be utilized in the form of participatory planning. This mechanism will be beneficial in order to re-orientate the citizenry on urban planning practices as well as the dissemination of information on urban sanitation and general well being of the residents.

CONCLUSION

For a city to be sustainable, it must provide an enabling environment for the prosperity of her citizens by ensuring policies formulated and implemented are those that protect and enhance the immediate and long-term well being of citizens, especially the vulnerable and marginalized. Effective urban poverty control can only be actualized through the application of a pragmatic approach involving civic reorientation, urban redevelopment and the entrenchment of a result-oriented system of urban management encapsulated in the Pro-poor planning concept of urban development.

Pro-poor planning integrates community development mobilization, economic development and urban planning. Communities suffering economic insufficiency, stagnation or decline must adopt strategies that remedy such through activities aimed at harnessing local resources including human and natural to improve the quality of life. Pro-poor planning helps to increase employment opportunities, access to necessary public goods and services as well as creating opportunities for the private sector development thus catalyzing the improvement of general well being and quality of life for all city dwellers. The focus must be to ensure that strategies for urban development assist the viability of informal enterprises and the proven survival
strategies of the urban poor, accepting them as part of the urban fabric and working with them to achieve sustainable development which has positive economic and social impacts.

This paper has highlighted the importance of the social kin network in the survival strategies of the urban poor in Lagos. The importance of the cooperative networks as social security agencies was also highlighted. The paper also revealed that for poverty alleviation and slum upgrading to be effective, interventions must be channelled through these systems.

ACKNOWLEDGMENT

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 PROCUREMENT FOR NATIONAL TRANSFORMATION: ADOPTING MODERN TECHNOLOGY METHODS THE ALTERNATIVE FOR ADEQUATE HOUSING DELIVERY IN NIGERIA

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Ahmadu Bello University, P.M.B 1069, Zaria, Nigeria

Nigeria is fast growing in population with concomitant problems of adequate provision of basic amenities and infrastructures. One of these basic facilities needing adequate attention is housing. Nigeria’s past governments’ effort have been aimed at direct provision of housing for the public. Regrettably, all their ambitious housing programmes have consistently failed to meet the expected target. The proponents have argued that the laudable attention accorded the issue of housing provision for the teeming population of this country was developed by the apparent inadequacies in our housing programmes and delivery systems. Some proponents opined that these inadequacies are due to the fact that the commonest project delivery method being used in Nigerian public sector is still the traditional design-bid-build method, which involves the appointment of consultants, contractor with much of the finance coming from the government. This paper assesses Traditional method of housing procurement using SPSS statistical tool, percentages and ranking from which conclusion was drawn. The study found out that the Traditional Methods of procurement in use in Nigeria cannot help the Nation’s adequate housing problems, hence, it proffers suggestions for adoption of modern technology methods as an alternative for adequate housing delivery in Nigeria.

Keywords: housing; procurement; traditional procurement; modern technology methods.

INTRODUCTION

Nigeria is fast growing in population with concomitant problems of adequate provision of basic amenities and infrastructures. Yet the laudable attention accorded the issue of housing provision for the teeming population of this country was developed by the apparent inadequacies in our housing programmes and delivery systems. These inadequacies are due to the fact that the commonest project delivery method being used in Nigerian public sector is still the traditional design-bid-build method, which involves the appointment of consultants, contractor with much of the finance coming from the government, Ibrahim (2007).

Empirically, Nigeria’s past governments’ efforts have been aimed at the direct provision of housing. Yet all their ambitious housing programmes have consistently failed to meet the expected target. Again, the massive urbanization, together with the competition for resources represented by Nigeria’s growing industrialization, improvement of transport, etc, has presented enormous deficiencies in both the quality

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and quantity of housing making it inadequate in supply and unsatisfactory in demand, Ikekpeazu, (2004).

However, demand for housing is created out of individual household desire and preferences for various mixes of housing services. The level of this demand depends on the relative balance of changes in several different factors such as population growth, demographic structure (age, household size) disposable income, preferences and tastes, taxation and investment policies (Lovei, 2000). By this it is imperative to evaluate household incomes and provide housing finance to bridge up for those who cannot afford their desired housing services. This has not been the case in Nigeria as Governments in the past have tried with some promising schemes that never saw the light of the day.

For instance, the National Housing Policy (NHP) formally launched on the 20th February, 1991; had a mission of pursuance of adequate housing development in Nigeria. The UN definition of adequate housing requires such housing to be, among others, affordable. This means satisfactory housing that is available at a cost to the end-user or consumer that is not more than some reasonable proportion of his/her income. Although different proportions are adopted by different nations, the UN set this proportion at 25%, UNCITRAL (2001).

The NHP also states that “the ultimate goal of the NHP shall be to ensure that all Nigerians own or have access to decent housing accommodation at an affordable cost by the year 2000 AD,” since it is a basic need which has a profound impact on the wealth, welfare and productivity of an individual. Today, more than 12 years of the targeted date, just in Abuja the Federal Capital Territory (FCT) alone, less than 10% of the population can afford the decent accommodation. There has not been much change from what Ajator (2004) posited that, ‘majority of the public servants in the cities like Abuja live in the slums or outskirts areas’.

The questions that call for academic attention are: why is there inadequate housing delivery in Nigeria? Could it be poor implementation of procurement methods as argued by proponents? What do the stakeholders think about this? What is the remedy for the problems?

Hence, this paper seeks to investigate the Traditional procurement methods in use in Nigeria and elsewhere in the world in order to suggest solutions for the way forward.

**HOUSING PROCUREMENT**

Housing procurement can be defined as the act of obtaining or acquiring a house. The various housing procurement practices common in Nigeria includes:

- Self-production method
- Conventional method
- Traditional method
- Management procurement methods
- Design and build method

Procurement in general sense means purchasing or buying, but in construction terms it means acquiring or obtaining a product, service or facility that is paid for public or private use, Musa-Haddary (2010). Project procurement, which could be referred to construction development that includes housing delivery, is a must for national transformation.
PROBLEMS WITH HOUSING PROCUREMENT

One of the major housing policy initiatives was the Policy on Affordable Housing that was initiated in 1979 by the Shehu Shagari Administration. The policy though laudable was unable to meet the nation’s housing needs because it was based on the unsustainable tenet that houses will be provided by government (this remains the anomaly that we must resolve).

The implementation of the 2002 housing policy reforms was a promising beginning, but a lot remains to be done. In a recent news report on the Nigerian Housing Sector aired on African Independent Television (AIT), it was stated that between 1973 and 2006, the Federal Housing Authority (FHA) built only 30,000 housing units nationwide. According to Mr. Tunde Ipinmosho of the Federal Housing Authority (FHA), the current housing deficit is about 12 million homes. If we take the current population of 150 million Nigerians as reported by the National Population Commission after the recent census exercise and assume 30 percent of the population as working adults we have 42 million estimated working adults that need decent and satisfactory accommodation over there head.

Another government agency responsible for procurement of housing in Abuja is Federal Capital Development Authority (FCDA). According to Jantabo, (2002) FCDA has only succeeded in delivering 10% housing required by over 1 million populations in the Federal Capital Territory (FCT). In this research he recommended that government should look into existing procurement methods being used in the country for they are not viable for the Sustainable Development the country was in dare need. Ten years later, Dada (2012) posited that, ‘Nigeria must adopt the new innovative trend in her quest for adequate housing delivery if the country must achieve the National Transformation Agenda she is professing’. Reasons for this are that Nigeria public and private developers have continue to hold on to the Traditional method of housing delivery which is polarized by politics and bottle-neck procedures that cause cost and time overruns, Qurix (2012), making it provision inadequate to meet the demand for it, Musa-Haddary (2010).

Therefore, as is averred “…nothing is permanent except change…”, there is the need for Nigeria to change from the traditional procurement systems in practice and adopt the new procurement delivery systems, such as Modern Methods of Construction (MMC), which according to Qurix (2012) are innovations that are driven and amplified by globalization, closed loop resource utilization, transformation of technological potentials, environmental and demographical challenges.

CONTEMPORARY GLOBAL CONSTRUCTION TECHNOLOGY

In the history of art, however, the term ‘modern’ is used to refer to a period dating from roughly the 1860s through the 1970s and describes the style and ideology of art produced during that era. It is in this more specific use of modern that is intended when people speak of modern art. The term ‘modernism’ is also used to refer to the art of the modern period. With the increasing urbanization of populations, it was beginning to be looked to as the source for ideas to deal with the challenges of the day. The popular culture then, as it was studied in the University, was not derived from high culture, but instead from its own realities; popularly mass production that did fuel much of modernist innovations, Qurix (2012), Abdolalipour, Shafiee and Rezaiee (2011).
In the 21st century Nigeria, the strive for National Transformation, the basic essence of modernism can still be applicable today being that of the societal basic challenges or realities in terms of sustainable architectural technology, appropriate technology, technical and vocational education, suitable construction materials, procurement procedures and their practical realities; including need for livable human settlements.

**MODERN PROCUREMENT OPTIONS**

Modern and contemporary technology makes home ownership affordable, which according to Qurix (2012) it establishes viable housing finance infrastructure and makes use of creative financing instruments that enable families afford these houses.

Examples of useful technological innovations available in the real sector (construction industry) amongst others are:

- **Moladi Technology** - Borne out of the need to reduce the cost of building houses, thereby, making ownership of homes easily accessible by the low income earners.

- **The Modular System** - meant for mass housing production which according to Uroko (2010) can bring down cost of building by 30% and speed of construction up by 50%.

At the bottom of these is the underlying reality- the coming together of public and private sectors in partnership to put to use the available technology for National Transformation, hence the choice of public, private, partnership (PPP) models.

**Public Private Partnership (PPP)**

In PPPs the private sector contractors usually become the long-term services providers instead of just upfront asset creators with the combination of some or all of the under mentioned functions:

- Design;
- Construction cost/time management
- Construction;
- Finance (admix of public and private sources);
- Facilities management;
- Service delivery of a public service facility.

The following success keys are imperative for PPPs as with all forms of procurements: *partnering, communication and commitment (PCC)*. And the greatest attraction for the usage of PPPs is the medium term removal of public borrowing and the much needed certainty to cost and delivery time of public sector projects. Also depending on the model adopted PPPs offer the good side synergies between traditionally diverse process in the delivery and operationlization of built facilities (Duncan, 2006).
ADAPTING PPP MODELS:
There are various PPP models varying from short-term simple management contracts (with or without investment requirements) to long-term and very complex BOT form, to divestiture. BOT option is proffered in this study for national transformation.

CONCEPT OF BOT
Askar et al (2002) specified that the term ‘BOT’ is used mainly in the area of infrastructure project financed by the private sector.
Nassar (1996) posited that BOT is a model which entails a concession company providing the finance, design, construction, operation and maintenance of a privatized infrastructure project for a fixed period at the end of which the project is transferred free of charge to the host government. This gives the theory of BOT as:
Build: A private company (or consortium) agrees with a government to invest in a public infrastructure project (such as road, power station or dam). The company then secured their own financing to construct the project.
Operate: The private developer then owns, maintains and manages the facility for an agreed concessionary period (mostly between 15-25 years) and recoups their investment through charges or tolls (e.g. road tolls or electricity sales).
Transfer: After the concessionary period the company transfers ownership and operation of the facility to the government or relevant state authority free of charge.

BOT is closer to total product delivery, where in addition to financing and development, the supplier is responsible for the operation of the facility. BOT allows the government look to the private sector to finance projects using the project anticipated revenues as security, rather than rely on a direct sovereign guarantee of the project debt. It is supported by the World Bank group ostensibly as a strategy for increasing efficiency, reducing the drain on state revenue and enhancing private sector development. Hitherto, many governments have adopted the BOT approach so that the private sector has to operate the facility and transfer it to the government after a specified concession period.

It is relatively an assured method of approach to infrastructure development, which enables direct private sector investment in large scale projects such as roads, bridges and power plants etc. It has been observed that scope of BOT is fast widening to cover even transport sector elsewhere in the world (Ibrahim, 2005), yet it is not well practiced in Nigeria.
The reasons for this are because it is yet to yield desired result (Ibrahim, 2007), it is wrongly implemented, Dahiru (2009).

TYPES OF BO (BUILD OPERATE) MODELS
BOT is a generic term that takes different forms as Build-Operate-Own (BOO), Build-Transfer-Operate (BTO) Build-Lease-Transfer (BLT). The theories of these forms have close variance.
BOT: The private sector (Concession Company) is responsible for design, finance, construction, operation and maintenance of the facility. The concession company retains the title of ownership during the concession period. The facility is transferred to the good at the end of the concession period. E.g. channel tunnel, France and UK.

BOO: The private sector (Concession Company) is responsible for design, finance, construction operation and maintenance of the facility. Here the title of the ownership remains with the concessionaire. There is no transfer of ownership to government. Example: Taweelah A2, Abu Dhabi.

BTO: The private sector (Concession Company) constructs the facility and transfers the ownership to the government. The concessionaire operates the facility by taking contract to operate the facility. Example: Telecom Asia communication network, Thailand.

BLT: The private sector (Concession Company) constructs the facility and leases it to the government. The facility will be transferred to the government at the end of concession period.

Proponents have opined that the use of BOT concept in Nigeria has become imperative because the government does not have adequate finances to bridge the critical infrastructure gap and improve investment (Nigeria’s Economic Reform, 2007). The Nigeria’s Infrastructure Summit (2008) show that, the country requires extensive infrastructure to meet the various social and economic development challenges. Consequently, World Bank (2008) has ranked the country 108 out of 178 economies in the world. This is due to the high costs of investment in the country caused by the wide range of infrastructure deficit.

So far the government of Nigeria had offered various BOT infrastructure projects ranging from tourism facilities, building projects, airport terminals, seaports, railways, roads and bridges. This new form of financing of these public infrastructures that attract high capital outlay is part of the government’s efforts in bridging the critical infrastructure gap for sustainable development. Thus, Nigeria is among the developing countries which have been able to exploit the benefits and earn the advantages from the BOT projects.

Although the federal government of Nigeria has mastered all the potential benefits of embracing BOT concept, it is noted that the partnership has not been really successful in the point of view of domestic and foreign investors as well as the government due to numerous constraints. This has also been reported by Wigwe (2008) that the trend of the BOT projects in Nigeria did not get the success in its realization and relevance.

Thus, the Nigeria’s BOT projects are constituted with constraints which are affecting its success in the country.

However, Nigeria is like many African countries where the implementation of BOT projects is influenced by unstable investment environment such as political, economic, legal, and social risk factors, which hinder its effective implementation in the country.
THE BENEFITS OF THE BOT

Many benefits abound in BOT project; these benefits are beneficial to all. Sidney (1996) gave the following benefits that are inherence in the functions of the BOT to the citizens of the host country as follows:

i. General taxes will not have to be increased, nor will revenue bonds have to be issued to pay for the project.

ii. When projects receive income from tolls for instance, only the users of BOT facilities will be required to pay for them. Citizens can select to use alternate routes if toll rates are not reasonable, which exerts pressure on the consortium to keep toll rates as low as possible.

METHODOLOGY

The study carried out in-depth literature review on the theory and practice of contemporary global construction technology contractual arrangements; financial risk and cost benefit analysis among other variables were used. Interviews, consultations with key stakeholders were conducted and structured questionnaire was used to sort information from the stakeholders comprised of End-users; Professional in the Construction Industry (Consultants) and Developers, to assess their various opinions on the research questions. This was done to ascertain the corporate understanding of the research problem and what should be done to solve it.

SURVEY DESIGN AND ADMINISTRATION

The respondents were three categories End-users 62%, Professionals 31% and Developers 7% as shown in figure 1. A total of 150 questionnaires were distributed among end-users in capital cities of Kaduna, Kano, Gombe states and Federal Capital Territory Abuja. A total of 138 questionnaires were returned correctly filled. 78 professional in the construction industry in the area of study as well as 48 developers filled the questionnaire given to them to get their response on the opinions of the end users.

![Pie-chart showing category of respondents](image)
Table 1: Facilities perceive to be provided in a decent accommodation

<table>
<thead>
<tr>
<th>Facilities</th>
<th>No.</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedroom</td>
<td>138</td>
<td>1.90</td>
<td>.595</td>
<td>.051</td>
<td>5th</td>
</tr>
<tr>
<td>Living Room</td>
<td>138</td>
<td>2.74</td>
<td>.441</td>
<td>.038</td>
<td>1st</td>
</tr>
<tr>
<td>Kitchen</td>
<td>138</td>
<td>1.72</td>
<td>.551</td>
<td>.047</td>
<td>7th</td>
</tr>
<tr>
<td>Dining room</td>
<td>138</td>
<td>1.02</td>
<td>.146</td>
<td>.012</td>
<td>11th</td>
</tr>
<tr>
<td>Toilet</td>
<td>138</td>
<td>2.25</td>
<td>.465</td>
<td>.040</td>
<td>2nd</td>
</tr>
<tr>
<td>Bathroom</td>
<td>138</td>
<td>2.08</td>
<td>.568</td>
<td>.048</td>
<td>3rd</td>
</tr>
<tr>
<td>Shower room</td>
<td>138</td>
<td>1.47</td>
<td>.707</td>
<td>.060</td>
<td>9th</td>
</tr>
<tr>
<td>Store</td>
<td>138</td>
<td>1.13</td>
<td>.338</td>
<td>.029</td>
<td>10th</td>
</tr>
<tr>
<td>Games room</td>
<td>138</td>
<td>1.48</td>
<td>.642</td>
<td>.055</td>
<td>8th</td>
</tr>
<tr>
<td>Study room</td>
<td>138</td>
<td>2.08</td>
<td>.695</td>
<td>.059</td>
<td>3rd</td>
</tr>
<tr>
<td>Laundry</td>
<td>138</td>
<td>1.84</td>
<td>.697</td>
<td>.059</td>
<td>6th</td>
</tr>
</tbody>
</table>

Table 2: Factors Responsible for poor implementation of Traditional method

<table>
<thead>
<tr>
<th>Description</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social unrest</td>
<td>38</td>
<td>28</td>
</tr>
<tr>
<td>Professional negligence</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Economic environment</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Political instability</td>
<td>66</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 3: Ranking Factors responsible for the unsuccessful Traditional projects in Nigeria.

<table>
<thead>
<tr>
<th>Factors</th>
<th>No.</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>RANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cost of projects</td>
<td>138</td>
<td>2.44</td>
<td>.705</td>
<td>.060</td>
<td>3rd</td>
</tr>
<tr>
<td>Maintenance of Facilities</td>
<td>138</td>
<td>2.27</td>
<td>.700</td>
<td>.060</td>
<td>5th</td>
</tr>
<tr>
<td>Substandard materials</td>
<td>138</td>
<td>2.27</td>
<td>.760</td>
<td>.065</td>
<td>5th</td>
</tr>
<tr>
<td>Kickback</td>
<td>138</td>
<td>2.46</td>
<td>.641</td>
<td>.055</td>
<td>2nd</td>
</tr>
<tr>
<td>No transparency in award</td>
<td>138</td>
<td>2.70</td>
<td>.459</td>
<td>.039</td>
<td>1st</td>
</tr>
<tr>
<td>Quality accommodation</td>
<td>138</td>
<td>1.96</td>
<td>.671</td>
<td>.057</td>
<td>9th</td>
</tr>
<tr>
<td>Availability</td>
<td>138</td>
<td>2.09</td>
<td>.714</td>
<td>.061</td>
<td>8th</td>
</tr>
<tr>
<td>High Rent</td>
<td>138</td>
<td>2.17</td>
<td>.868</td>
<td>.074</td>
<td>7th</td>
</tr>
<tr>
<td>Poor execution of projects</td>
<td>138</td>
<td>2.34</td>
<td>.560</td>
<td>.048</td>
<td>4th</td>
</tr>
<tr>
<td>Recreation Facilities</td>
<td>138</td>
<td>1.48</td>
<td>.642</td>
<td>.055</td>
<td>10th</td>
</tr>
</tbody>
</table>

Table 4: Respondents preference of modern construction technology in provision of housing

<table>
<thead>
<tr>
<th>Description</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proficient facility delivery</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Proficiency in Facility Management</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>Provision of utilities</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Provision of quality accommodation</td>
<td>72</td>
<td>52</td>
</tr>
</tbody>
</table>

Table 5: Professionals’ response to identified factors hindering Traditional projects

<table>
<thead>
<tr>
<th>Description</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed</td>
<td>55</td>
<td>71</td>
</tr>
<tr>
<td>Not agreed</td>
<td>23</td>
<td>29</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSIONS

Tables 1-4 are responses of the end users. The analysis of the survey response data on what facilities the respondents perceived to make a decent accommodation produced mean ranging from 1.02 – 2.74 ranking living room 1st and dining room 11th. The end users indicated living room, toilet, bathroom, study room, bedroom, laundry and kitchen to be among the features of a decent accommodation which are lacking in their shelter making life difficult. This confirmed Ikekpeazu, (2004) assertion as presented in literature review that majority of Nigerians in cities like Abuja, live in slums and outskirt. This is where BOT system is relevant because it considers users’ needs and preference at the design stage.

Table 2 presents what the end users think of the questionnaire assumed four factors responsible for poor implementation of traditional method of procurement. Political instability factors = 48 percent; social unrest = 28 percent; professional negligence = 14 percent and economic environment = 10 percent. The result could be true, for instance, political instability has seen many projects, well intentioned policies and schemes abandoned due to lack of continuity; this is a major factor to the dearth of housing in the country. Social unrest has often time caused time overruns, which has always caused upward review of contract sum because of delay in contract delivery period. Where there is shortage of a commodity it purchasing price becomes high; where there is upward review of contract sum it means high cost of production likewise the selling price. Professionals under Traditional Method of procurement do not bother about the design needs of the end users, the designers are at the liberty to design what is fanciful to them not minding economic status of the targeted users. Socio-cultural and religious beliefs are often not considered.

Table 3 shows ranking of 10 factors responsible for the unsuccessful Traditional projects in Nigeria: No transparency in the award of contract ranked 1st with the mean 2.70, kick back (10%) ranked 2nd with the mean 2.46; High cost of projects ranked 3rd with the 2.44; poor execution of projects ranked 4th and mean 2.34; maintenance of facilities and use of substandard materials were equally ranked 5th with mean =2.27; high rent, availability, quality accommodation and recreation facilities ranked 7th, 8th, 9th and 10th respectively. This may be as a result of the perception that contracts are given to compensate political loyalist and or sponsors to recoup what they must have spent in the course of campaign.

Table 4 shows four factors that would make end users prefer modern technology methods in housing provision to traditional methods with provision of quality housing = 52 percent; proficiency in facility management = 22 percent; proficiency in facility delivery = 17 percent and provision of utilities = 9 percent. The results from this table show that the end users believe if modern technology methods are employed there will be mass production of quality housing that will meet the target. If this happened it will bring down the building cost.
Table 5 presents the response of the professionals on whether they agree with the factors identified by end users being the factors hindering progress in the use of traditional methods, 71 percent agreed and 29 percent did not agree. Interestingly, the professionals in the industry agreed with the users’ opinion confirming that among other factors hindering success in using traditional methods there is professional negligence.

Table 6 presents the response of the Developers on whether they agree with the factors identified by end users being the factors hindering progress in the use of traditional methods, 73 percent agreed while 27 percent did not agree. Most importantly is the response of some of the developers 73% agreed with the end users’ opinion. The 27% that disagree could be the number that represents those who enjoy the favour of the people in government.

CONCLUSION

Construction management literature confirmed the dominancy of the Traditional Procurement method in housing delivery. It also confirmed that it is wrongly implemented in public contracts, which has resulted in its poor performance of housing delivery. Consequently there is the need for right economy and societal value reorientation including virtues for contemporary development activities. The end users responded emphatically to the need for change in procurement method being used in Nigeria. It is pertinent to say at this point that the quest for procurement for national transformation would not be achieved using Traditional Method of procurement in practice, appropriate technological methods have to be adopted.

Appropriate technology saves cost, addresses technical and social needs of any society. It is worthy to note that the traditional procurement method no longer fits into the present day dare need for provision of massive infrastructure to meet the yearnings of the Nigeria’s teeming population. Nigeria’s quest for national transformation in the 21st century can only come true if drive is geared toward establishing definite sustainable construction technology techniques that are adaptable to the society. Modern Method of Construction focused attention on finding strategies to promote economic and social advancement.

The PPP models has a success key to achieve this through BOT system as revealed by literature and economic appraisal. Hence, this study suggest the adoption of BOT concept which is an integrative procurement model designed to provide unique opportunity for financing public infrastructure facilities and boost the economical growth of the country without utilization of government finances.

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PROJECT COST RISK AND UNCERTAINTIES: TOWARDS A CONCEPTUAL COST CONTINGENCY ESTIMATION MODEL

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The application of deterministic approaches in the estimation of cost contingency for developmental projects is challenging because it is full of subjectivity, dwelling greatly on experience and organisational process asset. To date however, the built environment lacks standardized methods to be adopted in the estimation of cost contingency, further hampered by the lack of understanding and application of risk methods. In response to the above challenge, a systematic risk methodology for the estimating of cost contingency based on empirical judgment has been the driving force behind this research. The failure mode effect analysis (FMEA) and the theory of evidence are presented as qualitative and quantitative risk tools respectively. The research adopted quantitative methods with data gathered through structured questionnaires distributed to built-environment professionals based on the theoretical framework. Analysis of data using the failure mode effect analysis (FMEA) and evidential reasoning method revealed that systemic risk accounted for the approximately two-thirds of the cost drivers related to construction cost uncertainty mainly in the form of design and economic risk. The substructure, finishes and essential building services were identified as work sections prone to high scope changes and scope creep, with a propensity to causing cost overruns. To this end, a four stage conceptual model was developed which translated into a 3-phase implemented model. The proposed risk management framework for the estimation of cost contingency is presented by an integrated cyclical evolutionary process contemporaneous with the design management process. The process selects high priority risk and work sections based on the data sources and hypotheses to generate the mass, belief and plausibility based on the Dempster’s combination hypotheses. Using the hyper text pre-processor (php) as the system requirement, the model was tested and evaluated using an action exercise which found values to be realistic in comparison to the actual closing account figures of completed projects.

Key words: cost risk, systemic risk, project specific risk, mass, belief, plausibility, hyper text pre-processor

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INTRODUCTION

Risks are things of uncertain future outcomes (Hollmann, 2007). The concept of risk and uncertainty in project management has been construed by many practitioners as a rather congruent analogy. Since risk is a dynamic event which takes place within a complex network of numerous interconnected cause and effect loop which generate feedback within the project system, a systemized framework can be used to predict its effect (Rodrigus, 2001). Perminova et al (2008) holds that managing uncertainty on project cannot be paralleled with risk. Traditional risk management is associated with planning and taking measures to mitigate “known known” and “known unknown” risk on a project. The concept of uncertainty management which is rather associated with “unknown unknown” risk of the project is very difficult to predict. Over the years however, the risk identification process for estimation of cost contingency is more analytical towards systemic risk (known-unknown) at the neglect of project specific risk (unknown unknown).

According to Ali (2005) most firms have adopted a rule of thumb which is applied during estimation to take care of risk in relation to project cost. Patrascu (1988) revealed that this method takes the least time and effort and is currently the most popular and unambiguous method applied by estimators. In the case where the project goes to tender, subjectivity of the various tender sums submitted has a reflection on the contingency sum thus resulting in the tenders submitting different contingency sums. Gunhan and Arditi (2007) from Touran (2003) stated that one of the simplest methods of estimating contingency margins for construction projects is to consider a percentage of the estimated contract value such as 10% across the entire project typically derived from intuition, past experience and historical data, organizational process asset, enterprise environmental factors and expert judgment.

Thompson and Perry (1992) hold that the deterministic method however does not justify the degree of confidence that the contingency will provide against cost overruns thus making it very difficult to defend figures generated from this method. Hartman (2000) postulated that this method is an unscientific approach and a reason why so many projects are over budget. According to Lhee et al (2009) applying deterministic approaches in determining contingency such as a fixed percentage of the project cost is not appropriate because it provides an arbitrary value based on only project cost. This method of estimating cost contingencies should be restricted to preliminary design cost estimates such as blue sky estimates, feasibility estimates or order of magnitude estimates.

THEORETICAL FRAMEWORK

The theoretical framework for the above work is based on the Dempster-Shafer theory (DST) also known as the theory of belief functions, a mathematical theory of evidence, a generalization of the Bayesian theory of subjective probability. Noklov et al (2008) holds that whereas Bayesian theory requires probabilities for each question of interest, belief function permits the use of degrees of belief for one question on the probabilities for related questions. The above research uses the failure mode effect analysis (FMEA) as a qualitative tool and the evidential reasoning method as a quantitative tool. In the application of the FMEA, risk priority numbers (RPN) are determined using the likelihood of occurrence of a risk, the
possible impact if it occurs and the detectability of a risk prior to its occurrence. With respect to the DST, the mass, belief and plausibility functions are estimated based on various data sources calculated using probabilistic analysis of these hypothesis.

**EMPIRICAL REVIEW AND CONCEPTUAL FRAMEWORK**

Ali (2005) holds that the method of estimating using risk analysis with a systematic methodology such as risk identification, risk analysis, risk quantification and risk monitoring and control as applied to cost estimation is ideal; with risk identification is carried out to identify factors that may affect project cost. Risk measurement and assessment are tools of risk analysis and quantification carried out to determine the maximum risk allowance and average risk allowance for each risk factor. The maximum and average risk allowances are then used to calculate the base contingencies. Keith (2007) proposed with various tools, a risk management framework of risk identification, risk analysis, risk mitigation and plan, risk allocation and risk monitoring and control for the cost risk management process. Keith (2007) holds brainstorming, scenario planning, expert interviews, Delphi methods and influence diagramming were strong risk identification tools.

Fig 1: Conceptual framework

Adopted and modified from Holman (2007)

The conceptual framework for the above research for the estimation of contingency is depicted in figure 1. The process is an integrated team effort of risk management planning resulting in risk identification for the purpose of developing a risk breakdown structure. Due to the peculiar nature of the various risk categorization, there is need to use empirically based models. These would help parametrically systemic project risk through the application of historical. Ideally, cost risk analysis should commence at the concept formation stage evolving to the project implementation stage through an unending cyclical evolitional with cost planning, cost
forecasting, cost estimating and the financial treatment of cost risk. Along the same cyclical evolution, the risk management process commences with risk management planning process through risk quantification evolving to risk update of secondary and residual risk. The above cost risk process is rather through, evolutional and systematic, intertwined to cover the entire risk framework. Taking a cue from Hollmann (2007), the initial risk identification process is to categorise risk into endogenous or exogenous risk, systemic and project specific risk. Hollmann (2007), postulates that whereas the best approach to measuring systemic risk is by the use of empirically based parametric models, an expected monetary value can be deduced from Monte Carlo Simulation for the estimation of project specific risk. Based on data hypothesis, project specific risk would be modeled contemporaneously with systemic risk based on evidential reasoning methods.

RESEARCH METHOD
The main objective of this paper is to:

Determine Using FMEA to select the most significant factors affecting project cost contingency

Conduct FMEA on work sections prone to high scope changes

Develop a conceptual model for the estimation of project cost contingency.

Population
This paper is based on the quantitative methodological research procedures. Based review of related literature and ethnographic studies, a survey questionnaire was designed and administered to stakeholders and professionals in the built environment working on developmental projects in Ghana aimed at achieving the research objectives. A sample size of 184 was determined using the statistical relation by Kumar (1999); Clarke and Cook (1998). In all, 204 questionnaires were distributed with a total of 118 (57.8%) questionnaire retrieved.

Questionnaire design and data collection
Based on the theoretical framework, the first question of the survey instrument listed 31 risk factors identified during literature affecting project cost contingency for respondents to rate on a scale of 1 to 10. The second question of the instrument sought to collect data on the extent to which cost variability occurs on the various work sections of a project. In both questions respondents were to develop their basic belief assignment on the scenarios based on experience, historical antecedent and field knowledge. These hypotheses are the likelihood of occurrence (L) of a risk factor, possible severity effect (I) of risk and detectability/hideability of the risk. Each of these concepts is expressed as a concept integer between 1 to 10, with 1= low probability/severity/impact and 10= high probability/severity/impact.

Data analysis and Discussions.
Data analysis was undertaken based on the theoretical framework, using FMEA as a qualitative risk tool and evidential reasoning method as a
quantitative risk using probabilistic risk analysis. Based on the basic belief assignment of the respondents that likelihood of occurrence (L) of a risk factor, possible severity effect (I) of risk and detectability/hideability (D) of the risk, the Risk Priority Numbers (RPN) were estimated as follows and displayed in table 1 and 2:

\[ \text{RPN} = \text{severity} \times \text{hideability} \times \text{likelihood} \]

\[ \text{Example: } \text{RPN for delayed payment problem} = 7.32 \times 7.08 \times 5.2 = 269.99 \]
\[ \text{RPN for finishes} = 7.65 \times 7.64 \times 7.75 = 452.96 \]

The RPN for the risk factors and the work sections are displayed in table 2 and 3 respectively.

Quantitative risk analysis begun with the estimation of the risk of occurrence of each factor as:

\[ \text{Risk} = L \times I \]

\[ \text{Example: the risk estimate for inclement weather} = 4.06 \times 8.6 = 0.35 \]

Using the evidential reasoning method, the probabilistic estimation of risk was used to estimate the masses of the various risks:

\[ \text{The Probability of a Risk factor/work sections} = \frac{\text{Risk}}{\sum \text{Overall risk}} \]

\[ \text{Example the estimated probabilistic estimate for quality of works} = \frac{0.19}{10.51} = 0.0177 \]

Where 10.79 is the summation of all risk = 0.23 + 0.21 + 0.35 +…….+ 0.19 + 0.24

Consequent to the above an FMEA was conducted using the failure mode, failure cause, failure effect, severity class, failure detection method and compensation features of the scope factors affecting contingencies as depicted in table 2 below. Failure mode in terms of cost overruns can be deduced from changes in substructure primarily due to sudden varied eruption in substructure conditions resulting from uncertainties in geotechnical conditions. Failure mode for essential building services can be attributed to the use of prime cost sums in the contract documentations resulting from late design development. Failure mode for finishes could be resulted from scope creep and changes in taste of the client during construction works. Failure mode in substructure has a failure effect of changes in changes in substructure designs, changes in ground works with the end effect of variations in relation to substructure, changes in specifications, and etc. The failure effect of building services is introduction of many new items into the work which results in undue delays in the work and unbudgeted variations which has an end effect of inadequacy in contingency sum.
Table 1: Qualitative and Quantitative Risk Analysis-Factors Affecting Cost Contingency Factors

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Possible Risk Factor</th>
<th>QUALITATIVE ANALYSIS</th>
<th>QUANTITATIVE ANALYSIS</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>I</td>
<td>D</td>
</tr>
<tr>
<td>A</td>
<td>Natural/ Environmental Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Floods</td>
<td>3.42</td>
<td>6.87</td>
<td>8.6</td>
</tr>
<tr>
<td>2</td>
<td>Earthquakes, volcanic, landslides</td>
<td>2.83</td>
<td>7.49</td>
<td>8.87</td>
</tr>
<tr>
<td>3</td>
<td>Inclement weather</td>
<td>4.06</td>
<td>8.6</td>
<td>8.53</td>
</tr>
<tr>
<td>B</td>
<td>Technical Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Design Failure/ Defective design</td>
<td>5.46</td>
<td>7.08</td>
<td>6.88</td>
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<td>5</td>
<td>Human resource management challenges</td>
<td>4.68</td>
<td>4.72</td>
<td>4.31</td>
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<tr>
<td>C</td>
<td>Economic Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Material supply challenges</td>
<td>4.5</td>
<td>5.14</td>
<td>5.23</td>
</tr>
<tr>
<td>8</td>
<td>Labour Supply challenges</td>
<td>4.2</td>
<td>4.88</td>
<td>4.68</td>
</tr>
<tr>
<td>9</td>
<td>Equipment availability challenges</td>
<td>3.72</td>
<td>4.87</td>
<td>4.63</td>
</tr>
<tr>
<td>10</td>
<td>Equipment productivity</td>
<td>4.09</td>
<td>5.08</td>
<td>4.74</td>
</tr>
<tr>
<td>11</td>
<td>Market conditions</td>
<td>5.3</td>
<td>6.41</td>
<td>5.62</td>
</tr>
<tr>
<td>D</td>
<td>Financial Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Interest rate challenge</td>
<td>5.57</td>
<td>7.1</td>
<td>6.66</td>
</tr>
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<td>13</td>
<td>Delayed payment problems</td>
<td>7.32</td>
<td>7.08</td>
<td>5.2</td>
</tr>
<tr>
<td>14</td>
<td>Inflation/micro economic indicators</td>
<td>7.09</td>
<td>7.81</td>
<td>6.02</td>
</tr>
<tr>
<td>15</td>
<td>Global economic pressure</td>
<td>6.13</td>
<td>6.13</td>
<td>5.96</td>
</tr>
<tr>
<td>E</td>
<td>Design Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Differing site conditions</td>
<td>7.08</td>
<td>7.57</td>
<td>7.9</td>
</tr>
<tr>
<td>17</td>
<td>Design completeness or status</td>
<td>8.03</td>
<td>8.59</td>
<td>7.52</td>
</tr>
<tr>
<td>18</td>
<td>Changes scope</td>
<td>8.52</td>
<td>8.96</td>
<td>7.2</td>
</tr>
<tr>
<td>19</td>
<td>Project complexity</td>
<td>6.09</td>
<td>4.88</td>
<td>6.52</td>
</tr>
<tr>
<td>20</td>
<td>Incomplete scope definition</td>
<td>8.62</td>
<td>8.93</td>
<td>5.8</td>
</tr>
<tr>
<td>21</td>
<td>Construction technology</td>
<td>5.07</td>
<td>4.72</td>
<td>5.37</td>
</tr>
<tr>
<td>22</td>
<td>Changes in specification</td>
<td>6.55</td>
<td>6.26</td>
<td>5.57</td>
</tr>
<tr>
<td>23</td>
<td>Estimation errors/ method</td>
<td>5.81</td>
<td>5.15</td>
<td>3.87</td>
</tr>
<tr>
<td>F</td>
<td>Governmental/Social Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Contractual/procedure related</td>
<td>5.6</td>
<td>5.21</td>
<td>4.16</td>
</tr>
<tr>
<td>25</td>
<td>Governmental influence/intervention</td>
<td>.93</td>
<td>4.88</td>
<td>4.68</td>
</tr>
<tr>
<td>26</td>
<td>Legislative/ statutory</td>
<td>5.04</td>
<td>4.37</td>
<td>4.72</td>
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<tr>
<td>27</td>
<td>Customary rights and litigation</td>
<td>4.25</td>
<td>3.63</td>
<td>4.31</td>
</tr>
<tr>
<td>G</td>
<td>Construction Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Defects in supervision</td>
<td>6.67</td>
<td>3.92</td>
<td>4.52</td>
</tr>
<tr>
<td>29</td>
<td>Safety</td>
<td>4.87</td>
<td>4.58</td>
<td>3.85</td>
</tr>
<tr>
<td>30</td>
<td>Quality of work</td>
<td>4.57</td>
<td>4.06</td>
<td>3.76</td>
</tr>
<tr>
<td>31</td>
<td>Location</td>
<td>5.22</td>
<td>4.68</td>
<td>4.6</td>
</tr>
</tbody>
</table>

L= likelihood, I= impact, D= detectability, PR= Probability of risk

Data analysis using FMEA prioritised differing site condition, design completeness and status, changes in scope, incomplete scope definition, changes in specifications, delayed payment problems and micro economic indicators as the critical risk factors affecting cost contingency. From table 2, the substructure, essential building services and finishes were identified as the main work sections prone to high scope changes and scope creep.
Table 2: Qualitative and Quantitative Risk Analysis - Work Sections Prone to High Scope Changes

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Possible Risk Factor</th>
<th>QUALITATIVE ANALYSIS</th>
<th>QUANTITATIVE ANALYSIS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Substructure</td>
<td>L: 7.93</td>
<td>I: 7.94</td>
<td>D: 8.06</td>
</tr>
<tr>
<td>2</td>
<td>Floor space designation</td>
<td>5.4</td>
<td>5.4</td>
<td>5.40</td>
</tr>
<tr>
<td>3</td>
<td>Structural framework</td>
<td>6.02</td>
<td>6.98</td>
<td>6.02</td>
</tr>
<tr>
<td>4</td>
<td>Block work</td>
<td>6.85</td>
<td>6.85</td>
<td>6.85</td>
</tr>
<tr>
<td>5</td>
<td>Carpentry</td>
<td>5.02</td>
<td>5.02</td>
<td>5.02</td>
</tr>
<tr>
<td>6</td>
<td>Joinery</td>
<td>5.44</td>
<td>5.44</td>
<td>5.44</td>
</tr>
<tr>
<td>7</td>
<td>Roofing</td>
<td>6.49</td>
<td>6.49</td>
<td>6.49</td>
</tr>
<tr>
<td>8</td>
<td>Finishes</td>
<td>7.65</td>
<td>7.64</td>
<td>7.75</td>
</tr>
<tr>
<td>9</td>
<td>Electrical and IT</td>
<td>7.83</td>
<td>7.9</td>
<td>7.90</td>
</tr>
<tr>
<td>10</td>
<td>Mechanical installations</td>
<td>7.89</td>
<td>7.86</td>
<td>7.77</td>
</tr>
<tr>
<td>11</td>
<td>External works</td>
<td>6.83</td>
<td>6.82</td>
<td>6.78</td>
</tr>
<tr>
<td>12</td>
<td>Furniture/ Fenestration/ Installations</td>
<td>6.83</td>
<td>6.82</td>
<td>6.78</td>
</tr>
</tbody>
</table>

HR= highly relevant, VR= very relevant, MR= moderately relevant

Table 1.2 displays the RPN, estimated risk and likelihood of work sections yielding to scope changes

Proposed construction cost contingency model

Based on the literature review and ethnographic studies, the stages of development of the above framework are broken into formulation (conceptual), implementation and evaluation stages, with direct interconnectivity in a feedback loop. On a broad spectrum, the CCC framework went through a systematic process of identifying
significant factors for framework, establish relationship between the stages and factors, proposed framework development, testing of framework, validation reviews and, final documentation and recommendation for improvement. The conceptual model formulated conceived based on a myriad of virtual ideas were designed to consist of four parts including Ms CAD Inter-phase, Ms Master-Bill Inter-phase, Ms Project Primavera Interface and Ms Hyper text pre-processor Inter-phase. The above sections are linked together in an iterative and figuratively manner to enhance information flow as depicted in figure 4: information flow of the conceptual Model. The above process commences with project initiation through project scope planning and management, design development, cost modeling and risk management process. The risk management phase simulates risk identification, risk analysis, risk evaluation, risk response planning and review into an iterative process. The automated model is available at www.cccmodel.tk for further consideration.

Graphical user inter-phase

The graphical user interface for the above CCCM is the Hyper text pre-processor (Php). This provides several modes including a tester- where a user attempts to verify the validity of the system; a tutor- where the system provides a stock of information for a user to run through the system for acquaintance. The above interface also provides is user with a convenient medium for interaction. The basic task performed the GUI performs are to receive information from the user and interpret it to as well as provide information from the system to the user as depicted in figure 1. At the graphical user interface of the system, a user inserts a set of project parameters dubbed the cost risk contingency parameters. The proposed model would process the above data at the visualization stage to link up with other data to be processed into a mathematical function which would result in the production of tables and graphs to be returned to the user at the visual inter-phase.

Fig 2: Graphical user inter-phase

Data entry and processing

The first stage of the above model is the development of a risk register with the cooperate effort of the project team. Buertey (2012b) posits that the most important aspect of project risk management is risk identification which commences contemporaneously with risk management planning. The process of risk identification
brings to fore the need for risk categorization and the eventual development of a risk breakdown structure. During the process of risk identification, risk can be categorised as endogenous and exogenous risk, i.e. internal or external, enterprise environmental factors or organisational process asset.

Fig 3: Data entry for risk factors affecting cost contingency

Considering the predictability of the risk in relation to the project, a further subcategorization is systemic and project specific groupings. As already discussed systemic risk are related to the artifact of the system which can be predicted across projects while project specific has their impact varying by project. The essence of the risk breakdown structure is to enable further assessment of the risk based on their likelihood of occurrence, magnitude/consequence and detectability, to enable further risk response planning decision to be taken. Buertey et al (2012c) posits that risk identification results in description of risk as either systemic and project specific, endogenous and exogenous risk or known unknown risk or unknown un-known risk.

The process of qualitative risk management of the above model aims at prioritizing the risk identified above for further quantitative analysis. By the use of the theoretical framework, FMEA, the risk priority number (RPN) for each risk is calculated by the model by multiplying the values of three concepts expressed as integers as depicted in figure 2 and 3. The three concepts expressed as integers are information on the likelihood of occurrence, possible impact and detectability of risk. The above forms the basis of selecting the most important risk for further risk analysis to continue (refer to section 5.0).

Data from the qualitative risk management process is forwarded to the next stage of the model for risk quantification to commence. Quantification of risk was undertaken using probabilistic risk analysis (PRA) where effect of risk was analysed using probability estimation. The above process computes the quantitative risk values based on the theoretical framework for the research, the Evidential Reasoning Method
(Dempster Shaffer Theory). The above computations enables a user to determine the magnitude of the impact of the various risk should they occur to enable further risk modeling and risk response planning to be effected.

Fig 4: Qualitative risk analysis for risk prioritisation

The magnitude of the quantitative risk values determines the risk response strategy to be adopted for the contingency estimation process. High impact risk determined by the system through probabilistic analysis would be modeled to the next stage for the basic belief and plausibility functions to be determined.

Other less critical risk would receive the appropriate response attention. Subsequent of the risk management process, the integrated project parameters with respect to work sections are identified and entered into the model. The integrated project parameters include the critical factors that control the estimation process of the construction cost contingency. These data includes the estimated cost per work section (substructure, structural frame, masonry, carpentry, joinery, roof covering and carcasing, finishes, electrical installations, plumbing/mechanical installation, external works and other sundry installations). Other data inserted includes the total estimated cost of the project, and a factor to take care of the enterprise environmental factors and organizational process asset.

**Information flow implemented model**

At the process visualization stage, the integrated project parameters entered at the graphical user interface is now exported to the next stage for processing to begin. The proposed model processes these data at the visualisation stage and links up with other risk data sources to be processed into a matrix function which would finally result in the production of tables and graphical displays to be returned to the user at the visual interface of the model as depicted in figure 7. A thorough risk management framework for the estimation of project cost contingency estimation as depicted in the system architecture in figure 7 below. Risk identification for the process of contingency estimation must start as early as the project conception and ignition stage. This would help unveil all possible risk factors incident to the project adopting the appropriate risk categorization (exogenous and endogenous risk). Using a coherent
risk breakdown structure, all possible risk related to the project can be discovered by the project team (Buertey et al, 2012b).

Using the appropriate quantitative and qualitative risk measurement tools, the impact of systemic and project specific risk could be estimated to enable the adoption of an appropriate financial treatment. The above would be the basis for the computation of the basic belief and plausibility values for appropriate risk response planning to be undertaken in relation extent of scope changes in relation to work sections. Concurrent to the above process, a comprehensive scope definition and cost modeling process would be critical for issues related to technology, specification, procurement and contract type to be adopted for the project. The procurement process for any construction project is not sacrosanct; every system may have some flaws and challenges associated with it. Owners always strive to provide adequate contingency through their representatives to address risk related issues and to provide a safeguard for the contractor, designer and owner to complete the project on budget.

Fig 5: Sequence of data entry and processing for implemented model

Fig 6: Data processing for implemented model
Testing and validation of the model

As a means of testing the model, a pilot test was undertaken using a team of 10 cost engineers selected for an action exercise. Based on available historical data and their intrinsic basic belief assignment, each cost engineer tested the model based on their hypothetical project parameters. The pilot validation test was carried out to ascertain the validity of results generated from the model and to verify the usability and reality of the results obtained from the model. Quite imperatively, verifying the objectivity of results obtained from a model is one of the most difficult things to do. The essence of evidential reasoning theory is that the users define their own hypotheses and postulates their own basic belief assignment. The variability of data inserted with respect to the risk factors and work sections would result in variability of results depending on the source of data, pieces of evidence and hypotheses. The results revealed a contingency range of 17.5% to 28% which is consistent with what was gathered during data collection as the range of cost overruns in Ghana.

Limitation of developed model

No research-based model is unlimited and for that matter sacrosanct in usage. The research has identified the following limitations with respect to the developed model:

With the application of evidential reasoning method, it is possible to model multiple scenarios for a particular risk event for the possible introduction of Dempster-Shafer rule of combination to yield a combined basic assignment. This was however not included in the model development for the sake of simplicity. Thus the model takes
into consideration only a single basic assignment, with a single assigned evidential weight, a single assigned belief, and single deducible plausibility.

Different projects would require different risk breakdown structure and categorization. The extent to which a user can re-model the risk is to some extent limited. Due to the iterative reliance of the quantitative risk modeling on the qualitative analysis of the risk priority estimation some level of inference of Bayesian estimation cannot be ruled out of the analysis. For the sake of simplicity, the model depends on the same set of data entered at the GUI for both quantitative analysis and qualitative. For more complex modeling, the above process would require different sets of data.

The model does not depend on an inherent set of fixed set of variables. Each project would require that the user inserts different data for the modeling process making it ambiguous for users.

SUMMARY AND CONCLUSION

The development of framework for the estimation of cost contingency for construction projects, just like other models is to aid minimise if not eliminate the deterministic nature of estimation process in Ghana. From Buertey et al (2012a), it was evident that the level of knowledge and application of risk in professional work is limited. Since this research is not a panacea to the challenges in the estimation of cost contingency, the development of a simple model based on the theoretical frame would be starting point for further ethnographic studies in the construction industry. Since research work is an on-going iterative process, recommendations have been made for the improvement of these limitations in further research work. The above notwithstanding, the implementation of this research would offer the built environment professionals the opportunity to review and address the existing challenges.

Data analysis revealed that the incomplete scope definition, differing site conditions, changes in scope, changes in specification, delayed payment problems and changes in micro economic indicators were identified as the most significant risk factors affecting cost contingency. The primary work sections prone to high scope change are substructure, essential building services and finishes. These two parameters form the basis of the model developed. The framework comprises three stages - the formulation/conceptual stage, the implementation stage and the validation and testing stage. The formulation/conceptual stage is developed to inform stakeholders the abstraction of ideas culled from reviewed literature and in consultation with other experts on what can be done to develop a buoyant model. The implemented model is an extraction from the conceptual model to develop a model based on the available data and limitations of the research work. The implementation stage outlines activities which are taken to ensure that the model produces realistic results and it is accepted by all stakeholders enable an appropriate implementation. The final stage of the above model is the evaluation stage subjects the model to scrutiny and criticism to ensure its ease of adaptability to the built environment. After evaluation if the model is found to be satisfactory, it is accepted and maintained; if it is found to be unsatisfactory, recommendations by evaluators are incorporated for review. The testing and evaluation process used a focused group and structured interviews for a plot exercise. It is imperative to note that the process of evaluation is an ongoing process and further recommendations would form a basis of future research work.
The model developed is suitable for all projects building, civil engineering, heavy duty steel, etc provided the user has knowledge in risk analysis and estimation. It could be used with variability anywhere in the world after the key risk factors have been edited and other parameters incorporated. A key factor that determines the authenticity of the figures is the data source with respect to the basic belief function related to likelihood of occurrence of a factor, its impact and detectability ranges.

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RECONCILING THE PROVISIONS OF THE LAND USE ACT AND THE KWARA STATE LAND CHARGE LAW

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The need for more internally generated revenue has brought about the current paradigm shift in internal generated revenue of state government to land resources against other sources of revenue as experienced in some state in South-West Nigeria. The provisions of the Land Use Act (LUA) CAP L5 of 2004 and Kwara State Land Charge Law (No. 7) of 2009 (KSLCL) in respect of ground rent and land charge respectively was examined since it is a recurrent income. The aim of the paper is to identify the areas of conflict between the two laws. The study is a descriptive research and secondary information was used. The paper revealed that the charging of land charge on right of occupancy by the state is illegal, the basis for establishing the charge is questionable, and this might lead to litigation and subsequently abandonment of properties; land charge in Kwara State is ground rent; the state House of Assembly has acted ultra-vires by enacting the law, as the amendment of the LUA is in the Exclusive Legislative List. The paper therefore concluded that the KSLCL should be repealed because of its conflict with the LUA which is a ‘Parent Law’.

Key words: KSLCL, LUA, ground rent, land charge, Kwara State.

INTRODUCTION

In the light of the Kwara State Land Charge levy, an important issue that has engaged the attention of Estate Surveyors and Valuers in Kwara State, Nigeria, is the basis of establishing the value of land and those that are liable to the levy. Tax has been an issue that attracts opposition from the payers, for many reasons, among which is the basis of the assessment. Ordinarily, a payer should be able to know in advance how much tax is to be paid, (Onuorah, 2002). The question here is this, how possible is it for taxpayer knows this in advance? This could only be provided if the enabling laws are explicit on the basis of assessment that is, precisely defining the inputs and variables, and tightened all route of discretionary assessment of rate, as contained in section 5 of the Kwara State Land Charge Law (KSLCL).

However, NIESV Kwara/Kogi States Branch (2010) and Atilola (2011) have made a position paper in this regard, they cautioned the state Government on the imposition of land charge on all land holders and advised that the areas in the law that are nebulous should be amended, so that the state could achieve her objectives. The reason for this is that, a tax law that is not explicit on the basis of assessment, and that is discretionary on it assessment rate is bound to fail. Not only this, it will attract opposition from the payers.

The KSLCL is similar to the Land Use Charge Law of Lagos State (2001), but with slight difference in that the Lagos State Law composed of three (3) laws and the Law...
consolidated the three main property and land-based charges namely, the Land Rates Law of 1984 which covers ground rent, premium and other incidental charges payable by the property owners on government land; Neighbourhood improvement charge which concerns levies on owners of private estates for which the state government has provided infrastructures and Tenement Rates which is imposed on occupier of a property by the Local Authority for the provision of local services (Onuorah, 2002). The KSLCL can be said to have derived it origin from the Land Use Act (LUA) and this suggest that, it must be in compliance with the LUA.

Section 21 of the Kwara State Land Charge Law (No.7) of 2009 stated that “on and from the date when the land charge is levied on a property in accordance with this law, the provisions of other laws (other than provisions relating to tenement rates and the Land Use Act) relating to ground rents or other charges shall cease to apply to that property”. This implies that other provisions of the Act are still relevant/applicable. The Land Charge Law (LCL) does not repeal the Land Use Act (LUA), but something like regulation to sections that relate to rent such as sections 16 and 5(1) (c).

Also section 2 of the LCL stated properties that are liable to the levy/charge, but not in a comprehensive manner. However, section 7 of the Law identifies properties that were liable to the charge by being explicit on those exempted. Meaning that, those properties not mentioned are liable to the charge. This then suggests that the land charge is payable on properties in both urban and non-urban areas within the state. And the land charge is payable on any type of right of occupancy the owner might have.

In Nigeria, there is division of duty between the Federal Government and the State Government on law making, and which is well spelt out in second schedule of the legislative powers part I and II of the 1999 Constitution. These are called Exclusive Legislative List, (which is the list of items the Federal Legislative only can legislate on) and Concurrent Legislative List (which is the list of items the Federal Legislative and State Legislative can legislate on together). Both the federal and state governments are compelled to comply with the constitution, as this would prevent conflict between the two bodies.

The major aim of the study is to identify the area of variance between the Land Use Act and the Kwara State Land Charge Law. Other objectives include:

Examine the process of amending/reviewing the LUA;
Examine right(s)/holder(s) that are liable to payment of ground rent/land charge; and
Examine the method(s) of valuation used in determining ground rent and land charge.

Oretuyi (1982) asserted that the Federal and the State Government can make regulations to the LUA for its implementation. The LUA is a land policy and/or land reform that naturalized land in Nigeria since 1978 till date, and the State Governors of each state hold the land in their territory in trust. Hence, the questions to be answered in this paper are:

Can the regulations made by the federal and state government work in isolation of the Act?
Is it legal for the state to charge all right of occupancy? and
How are the ground rent and/or land charge determined?
In answering these questions, the two laws aforementioned will be considered in detail as regard ground rent and land charge. The focus would be on the regulations that can be made by federal and state governments as relate to the LUA; the right that ought to be liable to ground rent and land charge and method of determining the levy.

The justification for this paper can be adhered to the current paradigm shift in the internal generated revenue of state government to land resources from other sources of revenue, as it is being experienced in Lagos, Ogun, Kwara and some other States in Nigeria, and the call for land value taxation in the United States of American (Jones, 2008).

More so, Adi (2010 and 2012) has advocated for sincere property tax system for Nigeria, which will have regard for the enabling law(s) and reckon with the world best practice. It is in line with this that the paper seeks to investigate the practice of land charge in Kwara State of Nigeria.

THEORETICAL FRAMEWORK

Land administration systems are concerned with the social, legal, economic and technical framework within which land managers and administrators must operate. It also includes an extensive range of systems and processes. More so, there are some basic principles which are covered in land administration include Land Tenure, Land Value and Land Use (UNECE, 1996 reported by Atilola, 2012).

Land Tenure: the allocation and security of rights in land; the legal surveys to determine the parcel boundaries, the transfer of property or use from one party to another through sale or lease, and the management and adjudication of doubts and disputes regarding rights and parcel boundaries.

Land value: the assessment of the value of land and properties, the gathering of revenue through taxation of land, and the management and adjudication of land valuation and taxation disputes.

Land Use: the control of land use through planning policies, regulations and enforcement, the implementation of planning through granting of permit to use and develop according to the controls, and the management and adjudication of land use conflicts.

Therefore, this paper is anchored on land value with a cardinal view on ground rent or land charge which is a form of land tax in Nigeria. The payment of ground rent is mandatory and non-payment is severely sanctioned with revocation (section 16 to 20 of the LUA).

Ogedengbe (2004) averred that government intervention in Nigeria property market takes any of the following form:

Police power;

Power of eminent domain; and

Taxation.

However, the principles highlighted by Atilola (2012) and the means of government intervention as discussed by Ogedengbe (2004) can be used interchangeably as land tenure, land value and land use, for power of eminent domain, taxation and police power respectively.

Nuhu (2008) reported Denman (1962) to have classified land problems as follows:
Allocation of land resources;
Redistribution;
Restraints on absolution;
Security investment and private gain; and
Taxation.

This therefore suggests that taxation is an important tool in land administration.

Taxation of property is a veritable source of government revenue, it is as certain as death. It helps in redistribute wealth, it also helps in providing basic infrastructures. However, it is still debatable in the literature of optimal taxation to be imposed in other to enhance development without unjustly inflicting welfare cost. Economic theories of taxation approach the question of how to minimize the loss of economic welfare through taxation and also discuss how a nation can carry out redistribution of wealth in most efficient manner. Unpopular taxes have caused public protests, riots, and even revolutions (Oloyede 2010).

No matter the nomenclature given to tax on land in Kwara State, Nigeria, ground rent or land charge, it must operate in a way as it would not cause public protests or any form of unrest on the ground of the basis of liability and assessment.

Two methods of data collection were used for this study and these are; (i) extraction of provisions of the Land Use Act and Kwara State Land Charge Law, (ii) previous literatures relating to the study. The analysis of the data was based on a comparative analysis of the provisions of the two laws as relate to the regulations that can be made by the Federal and the State Government, rights/holders that are liable to payment of ground rent/ land charge, and the method of assessment recognized by the two laws.

FINDINGS AND DISCUSSION OF RESULTS

Three basic questions are to be answered in this paper. In answering the questions the Land Use Act (1978) now CAP L5 Law of the Federal Republic of Nigeria 2004 and the Kwara State Land Charge Law (2009) will be referred to mostly. Also, relevant document will be addendum to the two laws.

Can the Federal and State Government Amend the Act?

The Land Use Act is one of the four laws that were incorporated in the 1979 Constitution (Oretuyi, 1982 and section 315 (5) of 1999 Constitution); this makes the process of amending it difficult. The amendment required two-third members of the National Assembly and two-thirds of the States Assembly, (Section 274 (5) and section 9 of the 1979 Constitution). For the past 36 years of its promulgation it has not been amended.

Atilola (2008) and Tobi (1992) reported that the reason for the failure of the National Commission for Rehabilitation Act (No. 41) of 1969 set up by the federal government to see to abandonment after the Nigeria civil war, was that, individual property was not a matter on the Exclusive legislation list, but one within the domain of the States and this was why the old River State promulgated the Abandoned property ( Custody and Management) Edict (No. 8) of 1969 and the State Lands (cancellation of leases) Edict (No. 15) of 1972. But from the promulgation of Land Use Decree in 1978 and commencement of the Nigeria 1979 Constitution, there have been a paradigm shift in this principle, because the Act is included in the exclusive legislative list, whereby, the
states have been hand off from making law as regard tenure and ownership of land in Nigeria. Section 48 of the Act explains this better thus, “All existing laws relating to the registration of title to, or interest in, land or the transfer of title to or any interest in land shall have effect subject to such modifications (whether by way of addition, alteration or omission) as will bring those laws into conformity with this Act or its general intendment”.

Oretuyi (1982) stated that the Land Use Act is under the Exclusive Legislative List, and only the Federal Government of Nigeria can initiate legislative proposal on the Act for consideration by the National Assembly. He explain further that:

*The council of state can make regulations for the purpose of carrying the Act into effect with particular reference to the following;*

- the transfer by assignment or otherwise of any rights of occupancy including the conditions applicable to the transfer of rights to person who are not Nigerians;
- The terms and condition under which contracts may be made under section 8;
- The grant of certificate of occupancy under section 9;
- The grant of temporary rights of occupancy;
- The method of assessment of compensation for the purpose of section 29 of the Act;

Although the legal ownership of the land in each State is vested in the State Governor, the state Assembly has no legislative powers over the land. A State Government can make regulations with regard to the following:

- the method of application for any licence or permit and the terms and conditions under which licences may be granted;
- the procedure to be observed for revising rents;
- the fees to be paid for any matter on things done under the Act;
- the forms to be used for any document or purpose.

The above assertion of Oretuyi (1982) on power to make regulations by the Federal and State Government is in line with section 46 of the Act. Both the federal and the state government have implemented this provision. The writer of this paper is aware that, in 2006, the Federal Government of Nigeria set up a committee known as “The National Technical Development Forum on Land Administration” (NTDF) which worked on provision of section 29 of the Act, that is, the compensation rate. The committee published the new rate for compensation payable for economic trees and crops for the six geo-political zones in Nigeria. The States have equally exercise their power by inserting rent review period in the certificate of occupancy. They also charge fees on issue relating to the Act such as consent fee, registration of instrument fee among other.

What can be deduced from here is that both the federal and the state government can only make regulations in accordance with section 46 of the Act, and the regulations made must not contravene other sections of the Act for it to be valid. Also when there is a need amendment, the federal Government can initiate legislative proposal for the National Assembly's consideration.
What are the Rights that are Liable to Ground Rent and Land Charge in Kwara State?

Before examining the rights that are liable to ground rent and land charge, there is need to highlight the right identified by these Laws.

The Land Use Act Cap L5 Laws of the Federal Republic of Nigeria 2004

By virtue of the Land Use Act, the “rank” of owners of land has been reduced to a mere “tenant”. The “tenant” interest is what is now known as right of occupancy. The legal effect of section 1 read with the provisions relating to the right of occupancy is that from the commencement of the Act, it was no longer possible to own land allodially. The land itself is incapable of ownership, what is capable of ownership is the right of occupancy (Olawoye, 1982). He went further to established that the right of occupancy under the Act can be classified into four these are;

Statutory right of occupancy expressly granted by the Governor.

b. Statutory right of occupancy deemed to be granted by the Governor.

c. Customary right of occupancy expressly granted by a Local Government.

d. Customary right of occupancy deemed to be granted by a Local Government.

This was also averred in the Supreme Court of Nigeria judgment in the case of Adole verse Gwar (2008). The four rights of occupancy can further be reduced to two, that is,

Statutory Right of Occupancy, and

Customary Right of Occupancy.

Section 3 of the Act empowered the Governor to designate land in each state to urban and non-urban land. The Governor is in charge of urban land and issue statutory right of occupancy in accordance with section 5. The Governor can by extension of jurisdiction to non-urban land if the area of land required for farming and grazing are in excess of 500 hectares and 5,000 hectares respectively (Section 6 (2)). On other hand, the local governments are in charge of non-urban land in the state and issue customary right of occupancy (Section 6 (1)), these are expressly granted. On the other hand, grants under sections 34 and 36 were deemed granted.

The Kwara State Land Charge Law (No.7) of 2009

The Kwara State Land Charge Law (2009) does not mention anything about right of occupancy expressly; it discusses only owners in section 4.

"Owners” in relation to any property includes a person for the time being receiving the property in connection with which the word is used, whether on his own account or as agent or trustee for any other person who would receive the sum if such property were let to a tenant and the holder of a property direct from state whether under lease, licence or otherwise.

From the definition of “owner” given by section 22 of the Law, the deduction that can be made is ;

holders of deemed grant under statutory and customary right of occupancy ( and three set of people are recognized here; the owner of the land perse, his agent and trustee.
The agent and trustee who are always treated as representative of owner) are regarded as owner.

holder of statutory right of occupancy expressly granted by the state.

Holder of customary right of occupancy granted by the local government.

The observation from the above is that, the customary rights of occupancy expressly granted and deemed to be granted by the local government can be said to be within the definition of the owner as contained in the Law. Although, the law says persons entitled to rent if the property was let out.

From the above, it then suggest that, the State Government had extinguished the deemed grant, which should not be based on the judgment of Adole verse Gwar (2008), where it was said that, “a deemed Statutory Right of Occupancy being a vested right recognized by the Act itself, cannot be extinguished under section 5(2) of the Land Use Act by issuing a Statutory Right of Occupancy over the same plot”. If the issuance of a Statutory Right of Occupancy cannot extinguish a deemed grant, then a mere definition of ‘owner’ cannot extinguish the right of a deemed grant and therefore subjecting a deemed grant to payment of ground rent/land charge.

Having examined the types of rights and owners under the two Laws, it is then appropriate at this juncture to examine the rights and owners that are liable to ground rent and land charge respectively.

**Right Liable to Ground Rent under the Act.**

By virtue of sections 5 and 6 that empowered the State Governor and the Local Government respectively to issue certificate of occupancy, one of the common covenants in the certificate of occupancy either issued by the Governor or the Local Government is the payment of ground rent. This, some people have considered being disadvantage of obtaining certificate of occupancy. Omotola (1982) asserted that some of the disadvantage of obtaining a certificate of occupancy in sections 9(4), 10 and 15 are; a holder is bound by all the covenants in the certificate; bound by the covenant implied therein and mandatory consent of the Governor to transfer a developed land respectively. He went further that the holder of right of occupancy under sections 34 and 36 are not bound with these obligations and that the Act does not made it mandatory to obtain a certificate of occupancy, since the certificate is an evidence of title/interest in land. This argument seems to be reasonable because there is no actual grant, or what one can call contractual relationship between the owner of land and the Governor and/or Local Government.

However, there is provision for rent in part III of the Act, in particular sections 16 to 20. The sections deal with issues of rent quantum as opposed to the power to impose rent (Omotola, 1982). This view was also shared by Adigun (1982), that the sections explain the basis of computing rent payable and the penal rent imposed for breach of the covenant by the holder of right of occupancy of developed or improved land.

The reference from those provisions of the Act analyzed above is that, the governor is empowered to impose rent only when he makes a grant under sections 5(1)(a) and 6(2), and nowhere else. It is obvious that the interest that are preserved under sections 34 and 36 are not granted under sections 5(1) (a) and 6(2) and can therefore not be liable for rent under sections 5(1) (a) and 6(2). A governor who imposes rent on such interest which derives from sections 34 and 36 will be relying on any provision in the Act in doing so. Any condition stipulating rent to be paid in respect of such interest
will lack legal basis and be ultra - vires (Omotola, 1982). The above submissions are supported by the work of Obaseki (1988) as reported by Tobi (1992) that: of immense interest to every Nigerian in the Land Use Act 1978 are transitional provisions in part B1 of the Act (i.e. sections 34, 35, 36, 27 and 38 of the Act). The sections have been helping in no small way to cushion off the heavy impact the Land Use Act would have had on the life of every man and woman in Nigeria. It is doubtful whether the imposition of harsh conditions, implied and expressed, a certificate of occupancy may contain would not have excited people who cannot reconcile themselves with the idea of becoming a rent paying tenant on their own land to a cause of action which may amount to general disaffection and civil disobedience. Section 34 and 36 gave to those to whom land is vested before the coming into operation special treatment to soothe their nerves and showed consideration for their being the persons in whom the land was vested.

**Owners Liable to Land Charge under the Kwara State Land Charge Law (2009)**

From previous discussion on the right/owner recognized by the Law, it was established that the definition of “owner” given by the Law covers holders of deemed grant (statutory and customary) and holders of expressly grant of statutory or customary right occupancy. But section 7 of the Law exempted the following properties:

- a property owned and occupied by a religious body, used exclusively for public worship and having a certificate of occupancy and town planning approval to that effect;
- public and Government owned cemeteries and burial grounds;
- property used as public library;
- palaces of Emirs, Obas and Chiefs, recognized by the Government; and
- any other property specifically exempted by the Governor by notice published in the State Gazette.

The contention here is not whether the scope of the exempted properties are wide or not, but can the regulation of the governor under section 46 of the Act which is assumed the basis of the Kwara State Land Charge Law (2009) invalidate Sections 5(1) (a) (c), 34 and 36, by including the holder of deemed grant as “owner” that are liable to pay land charge in the state? The answer is straight forward, it has been established that the holder of right of occupancy expressly granted by the governor or local government are liable to payment of ground rent under the Act. This should be applicable to land charge too, only those holders of land directly from the state and those that have obtain certificate of occupancy should be charged, as ground rent is land charge in Kwara State, and as the Act supersede the KSLCK. It can therefore be concluded that the billing of holder whose rights arose out of section 34 and 36 is illegal.

What the researcher assumed might have happened to the definition of owners given in the Law and what is still on in practice in the state is the misinterpretation of section 3 of the Act by the State. After the enactment of KSLCL on 29th July, 2009, and the State sees that a lot of area in the state are non-urban area, the Governor published a gazette known as Kwara State Legal Notice (No. 8) of 2009 on 24th September, which designate certain places as urban areas in the state, so that the Law
can capture vast area. That designation order almost designate all land in the state as urban area, with this, the state government thought she can collect rent from all land owners in the state, not minding the fact that, the gazette was just for designation of land in the state for management purposes, and not that the State has acquired those areas as stipulated in section 28 of the Act, and if the State assumed that, the three basis of a valid acquisition have not been met (which are notice, assessment and payment of compensation). Therefore, it can be said that the State Government is acting ultra-vires by including customary right. The State ought to have charged express grant of statutory right holders only.

**How are Ground Rent and Land Charge Determined?**

This session discussed the basis for determining the ground rent and the land charge.

**The Ground Rent**

The lands Use Act recognize only two methods of valuation, that is, the cost and comparison method. The cost method is prescribed under section 29(4) (b) of the Act and it deals with compensation for improvement. This method is only relevant on issues of compensation for improvement and cannot be applied when determining the ground rent payable. The second, comparison method is contained in section 16 of the Act. Section 16 (a) say “shall take into consideration rent previously fixed in respect of any other like land in the immediate neigbourhood, and shall have regard to all the circumstances of the case”. Though the section does not state categorically that comparison method should be used, but in valuation that word “what is previously fixed within the immediate neighbourhood” is comparison approach. Omotola (1982) and Adigun (1982) have used the word quantum and basis of computing respectively in explaining how ground rent is determined. Their submissions are in line with the provision of the Act, and their views were fully supported by the researcher.

**The Land Charge**

Section 5(1) of the Kwara State Land Charge Law states that “ the formula set out in the schedule shall be used to determine the annual amount of the land charge payable for any property under this law” and the formula in the schedule is LC = M x (LA x LV) where:

- LC = annual amount of land charge in naria;
- M = the annual charge rate expressed as a percentage of the assessed value of the property and which may, at the State Government discretion vary between owner occupied residential property and commercial (revenue generating) property;
- LA = the Area of the land parcel in square meters;
- LV = the average value of a land parcel in the neighbourhood, per square meter in Naira.

A brief examination of the three variables that makes the annual amount of land charge will provide solution to the main question.

i. The “M” this as stated in the law is at the discretion of the state government in respect of different type of property. This is similar to rate nariage in tenement rating. Though in tenement rating, the rate nariage is fixed for all categories of property, since it is the deficit of the Local Government expenditure for the financial year that
is considered after due provision for other sources of income for the local government. Also, in tenement rating, there is no need to vary the rate nariage because the rateable value would have made the difference (Adi 2012).

ii. The “LA”: this requires the use of basic principle in surveying to determine the area of the parcel of land or this can be gotten from the survey plan.

iii. The “LV”: this suggests that there must be assessment of landed property in each neighbourhood of the State. The Law does not categorically state the method to be used in determining the value. It only refers to people or body that can be contacted for the assessment, this is contained in section 3 (2), that says, “for the purpose of subsection (1) of this section, the Director-General may appoint property identification officers, qualified assessors who shall be members of the Kwara/Kogi Branch of the Nigerian Institution of Estate Surveyors and Valuers and any other persons as he considers necessary”. The most convincing issue here is that, since the law has referred to more than one “person” that can carry out the assessment and the law failed to define who is an assessor in section 22 of the Law (NIESV Kwara/Kogi States, 2010). Also, the variable “M” is a discretion assessment which may attract opposition from the masses.

Now, since the Law did not state expressly what method to be used, it is the research option that the investment, residual and comparison method can be used to determine the land value as one of the variables in the formula.

SUMMARY OF FINDINGS

The three questions have been answered in the following way:

It has been established that the Federal and the State Government cannot amend the Land Use Act, they can only make regulations in accordance with section 46 of the Act.

The Act recognizes four right of occupancy and only those expressly granted by the governor and the local government are liable to pay ground rent or land charge as the state want the nomenclature to be. As regard the land charge, the Law covers all the four right of occupancy, and presumes that all the rights of owners are liable to the charge, and this is what is in operation in the state.

In determining the ground rent and land charge payable, the ground rent is determined by comparison method of valuation, while the investment, residual and comparison methods of valuation can be used for land charge, since the law did not spell it out.

CONCLUSION AND RECOMMENDATIONS.

It has been pointed out that, the land charge in Kwara State is the same thing as ground rent. It is the misinterpretation of section 3 with section 28 of the Act that makes the state to charge all rights of occupancy in the state.

At present one would not be able to precisely predict the policy implication of the land charge law on property owners and property market in the state, since the law became operational in 2010. This suggests that there is need for further studies of the law both in theory and practical view. However, the submission so far in this paper, the likely policy implication of the law is that, there would be a lot of litigation and disorderliness in land administration in the state. This can be liken to the submission of Obaseki (1988) in Tobi (1992) that the harsh conditions contained in the certificate
of occupancy either implied or expressed would excite people who cannot reconcile themselves with the idea of becoming a rent paying tenant on their own land to a cause of action which may amount to general disaffection and civil disobedience, and that to prevent this conflict, the transitional provision in part B1 was inserted in the Act.

In another view, when the state government enforce the provision of the receivership in section 19 (3) of the land charge law, it would also lead to litigation and this might not be too good for the state, as it would lead to property abandonment. The consequent effect might be too costly for the state to bear. Atilola (2008 and 2009) highlight the effect of abandoned property, and his works revealed that it is costly to revive abandoned property.

The state is trying by all means to make the Land Charge Law operational in the state by enacting other law(s) and regulations for the state. Example of such law apart from Kwara State Legal Notice (N0.8) that has been discussed in this paper is the Kwara State Urban and Regional Planning Board Bill (2010) in the Kwara State House of Assembly. Part of which stipulated that, before building approval would be granted the holder of such land/plot must have certificate of occupancy, this is wrong. Tobi (1992) asserted that there are five ways of proving ownership to land in Nigeria, also, the Supreme Court of Nigeria judgment in Ogunleye verse Oni (1990) affirm this. This aspect of right of ownership to land might lead to conflict even between the State and the Local Governments of the state.

Onuorah (2002), while making a remark on the need to repeal the Lagos State Land Use Charge Law (2001) said, “Also the method of assessment is uncertain and therefore prone to abuse. A tax payer ordinarily should be able to see in advance how much tax is to be paid”. On this note, this paper therefore advocates for the repeal of the Kwara State Land Charge Law (N0.7) of 2009, as the provision of the Law contravenes the ‘parent law’ that is, the Land Use Act in the following ways:

The enactment of the Law by the State House of Assembly can be said to be illegal, because the Land Use Act is in Exclusive Legislative List (see section 7 of the 1999 Constitution as amended), that means that only the National Assembly can legislate on it.

Subjecting all holders/owners of rights of occupancy in the state to payment of land charge/ground rent which are contained in sections 5 (1) (c) and 6 (2) of the Act, the Kwara State Land Charge Law has encroached on the Act.

The uncertainty in the method of assessment cannot allow tax payer to know in advance how much they are to pay, which is a ‘window’ to corruption.

The KSLCL does not make assessment of property sole responsibility of Estate Surveyor and Valuer when the property value is to be determined, this contravene the Estate Surveyors and Valuers Registration Board of Nigeria Decree 24 of 1975. Decree 24 of 1975 recognized only Estate Surveyor and Valuer as Assessor.

On a final note, since ground rent is land charge in Kwara State, it then suggested that holders of statutory right of occupancy no longer pay ground rent which ought to be one of the covenants between the state government and the holder as prescribed by the Act.
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REDESIGNING BUILDINGS FOR EFFICIENT UTILIZATION OF SOLAR ENERGY SOURCE IN KAURA NAMODA, NIGERIA

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Economic, technical, non-technical and structural constraints are among the various factors militating against efficient utilization of solar energy source for generation of electricity in buildings in Nigeria. The interplay of these factors are felt more in the rural countryside in the Northern Nigeria, where there is intense insolation all year round without the benefits of utilization for generation of electricity for household and communal uses. Factors such as space management, building form, roofing system design and building orientation contribute in constraining the use of solar energy in rural Kaura Namoda. This paper presents case studies of these constraints in four selected buildings which were not originally designed with energy consciousness but were recently installed with solar photovoltaic systems. The methodology undertaken for the case studies involves examination of the buildings in respect of their orientation, angle of insolation, and changes made to them with respect to installation of solar photovoltaic systems. Findings show that these buildings need redesign - spatial adjustments to accommodate the solar system components, roof slope and orientation adjustment, electrical installation redesign. The paper therefore suggests criteria for building redesign of these case studies and generally emphasises the imperatives of integrated design process to avoid future redesign.

Keywords: building redesign, energy consciousness, integrated design, solar energy

INTRODUCTION

Energy is one of the greatest demands of man. Since the advent of modern civilization, various forms of energy resources have been utilized by man for developmental and daily needs. These energy resources range from coal, wood, gas to electrical energy. However, the most versatile form of these energies is electrical energy which can be generated from thermal or hydropower sources to provide lighting in homes, power for industrial machineries and domestic applications (Oforeh, 1997; Lund, 2010). During the last two decades, the global electricity supply and demand chain has witnessed enormous stress due to generation supply deficits, high fuel costs, and high cost of new generating capacity, uncontrolled expansion in human settlements, urbanization and industrialization (Lund, 2010). Consequently, the call for sustainable use of dwindling energy resources gets louder by the day (Singh, 2009; Gregor, 2009). In order to mitigate the problem of dwindling energy resources, an initiative for energy conservation led to the emergence of a global campaign aimed

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at conserving power consumptions among consumers. Variously tagged, "campaign to phase out inefficient incandescent lamps" (www.en.lighteninitiative.org), and "Phase out inefficient lighting technologies" (www.energyrating.gov.au), the core plan is to phase out inefficient lighting technologies, for example, tungsten bulbs from existence as these bulbs consume much electrical power and generate more heat than efficient lighting technologies such as the compact fluorescent lamps and light emitting diode lights (Gregor, 2009). This has resulted to household energy modelling and remodelling in many developed and developing countries like South Africa, Brazil, Cuba, USA and the European Union (Limaye, et al, 2003). In these countries, a strategic approach to offset lighting overhead from the utility is the large scale utilization of compact fluorescent lights (CFL) and solar photovoltaic (PV) systems in residential, institutional and government buildings as the cumulative lighting loads of these structures accounts for more than 80% of total power supply from the national grid. Infact, in order to underscore the strategic importance of this campaign to the sustainability of the global energy supply and consumption chain, global stakeholders such as the World Bank, International Energy Agency (IEA), United Nations Environmental Programme (UNEP) amongst others have invested enormous funds and human resources to create standards and support developing economies to actualize the plan within some time span (Gregor, 2009; www.escomdsi.co.za; www.undp.org; www.usaid.org). Whole gamut of interdisciplinary strategies has been explored by stakeholders to maximize renewal energy resources. Some of these strategies include architecture-engineering design integration at the conceptual stage of building project development which can culminate to sustainable architecture, building redesigns which involves alteration of existing design integrity and solar detached options which including solar tree designs and detached platforms for mounted solar PV systems (Elzinga, 2008). Benefits of this alternative energy source include the improved capability of households or communities to overcome the problem of erratic grid-based electricity through the resilience of solar-based electricity and energy saving, reduced bill and mitigation of impact of higher tariffs (Limaye et al. 2003). Even supply utilities benefit through peak load reduction, reduced capital needs and reduced cost of supplying electricity and the Government through reduced fiscal deficits, reduced public expenditure and improved energy security (Limaye et al. 2003). Nigeria, in the West African sub-region is located between Longitude 3o and 14o east of Greenwich and Latitude 4o and 14o north of equator with about 140 million people and a total landmass of 923,768 Km2 (Sambo, 2009). Nigeria is endowed with variety of energy resources, which include crude oil, natural gas, tar sands, coal and lignite, hydropower, wind solar, biomass, geothermal and uranium. Out of these resources, oil and gas or petroleum presently constitute over 80% of the total commercial primary energy resources utilized in the country (Sambo, 2010). The solar radiation is estimated to be 4.0 - 6.5 KWh/m2/ day while the sunshine duration ranges from 9 - 11 hour/day (Bala et al, 2000; Iloeje, 2004; Sambo, 2010). The North Western region of Nigeria comprising Kaduna, Katsina, Kebbi, Sokoto, Jigawa, Kano and Zamfara respectively receives more abundant sun insolation than the rest of the regions due to its location in the Sahelian belt. Studies by the regional energy research centres, Sokoto Energy Research Centre (SERC) and the Energy Commission of Nigeria (ECN) have confirmed the region as one whose inhabitants could maximize solar energy source to the fullest if appropriate attention is paid to mitigate existing constraints mentioned above (Gulma, 1996; Garba and Bashir, 2002; Iloeje, 2004).
Generally, solar photovoltaic panels are installed on roofs based on two constructional approaches - in-roof construction, also known as building integrated photovoltaic systems (BIPV), where the panels generate electricity and also serve as a cladding or roofing materials as shown in Fig. 1 (Eiffert, 2002; Ecofys Netherland BV, 2007; Elzinga, 2008; Starrs et al (n.d)) and on-roof construction where the panels are mounted above the existing roofing materials on a steel supporting frame (see Figure 1).

Fig 1: Roof constructions for installation of solar panels (a) on-roof (b) in-roof (Photo credit: Baechler et al. 2007)

CONCEPTUAL CLARIFICATIONS

Solar energy: has been defined by the Microsoft Encarta dictionary (2009), as "energy radiated from the sun in the form of heat and light used by green plants for photosynthesis and harnessed as solar power".

Insolation: is the amount of solar energy received on a given area, usually measured in KWh/m²

Solar panel: also known as solar module or photovoltaic module is a packaged connected assembly of photovoltaic cells which converts the energy of light directly into electricity by means of photovoltaic effect.

Photovoltaic (PV) systems: also called solar electric, are systems that uses solar panels made of semiconductor materials such as Silicon and other elements to convert sunlight directly to electricity with no moving parts. The direct current (DC) power produced is subsequently converted to alternating current (AC) power with the help of inverters for powering typical household appliances. Photovoltaic systems can be autonomous or used with another source such as the power grid.

LITERATURE REVIEW

Attention has over the years been focused on different perspectives of the energy crisis in Nigeria due to its consequences on the Nigerian economy and the West African sub-region. Several energy economists and engineers have propounded on the viability or otherwise of governmental policies regulating the energy sector, the cost of investment in the generation and transmission of electricity and other investment possibilities (Iwayemi, 2008; Rabiu, 2009; Oji et al, 2012; Okafor and Joe-Uzuegbu, 2010). However, during the last few years, and in tandem with the emphasis on energy efficiency as a solution to depleting energy resources, attention has been focused on energy utilization in the built environment sub-sector due to its overbearing consequences on the global energy consumption status. It has been estimated that roughly 350-400 million households or 40% of the population of developing countries
Suleman and Umoh have no access to electricity (Sambo, 2006). While some developed countries may be comparably less affected by the problems of energy efficiency in buildings, partly because the principle of energy consciousness has been established as a code of practice in the building sectors and are religiously enforced by stakeholders, and partly due to stringent laws that have been enacted to regulate the construction of buildings, other countries including Nigeria, where such regulatory codes are weak at enforcement, have had a whole set of challenges emerging whenever the issue of energy efficiency is in focus because buildings have been constructed in urban and rural areas without energy consciousness and strict adherence to standard practices governing activities in the building sub-sector. According to Sambo (2006), only about 10% of rural households or 30-40% of Nigeria's total population have access to electricity. These statistics definitely paint a gloomy picture of overdependence of grid-based electricity in spite of abundance of alternative energy sources and thus provides a more compelling reason for a shift of focus to solar energy source for rural emancipation. As rural household energy demand is less than urban household demand and coupled with topographical and locational challenges of rural settlements, large scale utilization of solar energy is the most viable alternative due to its cost-effectiveness and reliability than grid-based electricity.

Kaura Namoda has been a focus of research since the linking of the town to the national electricity grid over a decade ago (Alaka and Umoh, 2001). Small-scale business enterprises have sprung up together with low-scale infrastructural and institutional development (Umoh, 2000). The history of power transmission and distribution in the zone has been dominated by incessant disruption of power through collapse of electricity poles, substandard system accessories and environmental dynamics (Umoh and Alaka, 2007), leading to substantial losses in funds and materials. In the building sector, structures are erected without adherence to building codes with consequences for future adjustments. Also, like many historical towns in Northern Nigeria, culture and religious ethics have considerable influence on the building forms, roofing designs and space management of buildings since time immemorial. Even with the coming of modern architecture, these cultural and religious factors still reflect substantially (Yahya, 2012). Some of these cultural influences when reflected on modern architecture have hampered the adaptability of these buildings to energy conscious changes (Umoh and Suleman, 2010). For example, in their traditional architecture and sandcrete buildings, living rooms are customarily smaller in size than the bedrooms while it is vice-versa in most modern architecture and many of these buildings were constructed without electrical installation components due to lack of foresight.

RESEARCH SETTING

Kaura Namoda lies in the North Eastern axis of Zamfara State on Latitude 12° 35′N and Longitude 6° 36′E and is approximately 56 kilometres from Gusau, the State Capital. The town is classified as a second-order settlement and owns its importance as the North West terminus of Nigerian railway system and the Federal Polytechnic, Kaura Namoda.

JUSTIFICATION FOR THE STUDY

Energy is a critical commodity in Kaura Namoda. In spite of the lack of industrial or big time consumers of electricity, the average electrical power allocation from the Gusau power substation to the North Eastern axis of the State, comprising Kaura Namoda, Zurmi, and Birnin Magaji is insufficient to serve the needs of the zone due
to supply fluctuations and losses and expansion in human settlements. In addition, the poor quality of electricity from the utility at peak and off-peak hours has severally caused damages to household equipment and lighting accessories. To mitigate these effects, residences and institutions have keyed in to the utilization of alternative energy sources through acquisition of solar panels and associated modules. Although, private use of solar technologies is still very low at the time of this study, however, the ineffective installation techniques employed by users is a major concern, hence the need for approaches for effective installation practices.

THE PROBLEM

Owing to the lack of collaboration between architects and electrical engineers at the conceptual stage of the building design task, several factors which are normally taken into consideration in the plan to utilize solar technologies were not integrated into the design processes of the case studies. Such factors, as shown in Figure 2, include building form (e.g. height, roof projection etc), orientation (e.g. approach), space management (e.g. room sizes) and roofing system designs. This oversight was due primarily to the fact that emerging technologies like the solar panels, were not in vogue in Nigeria some 15 to 20 years ago when some of these building were constructed, and secondarily due the lack of foresight on the part of the architects on the dynamic changes that buildings would pass through in the near future. Consequently, these buildings are not solar ready and this renders solar installation technically difficult or adds cost of making infrastructural changes to accommodate it. Consumers have therefore resorted to fixing solar panels loosely on the roof and this makes the panels to be vulnerable to wind loads which displaces them from their fixed positions and orientations during the wet seasons that comes with heavy downpour and wind loads.

Fig 2: Building factors in alternative energy use

METHODOLOGY

The case study method was used in this research. Four cases, all situated in Kaura Namoda town, Nigeria, were studied. The four buildings are those housing STEP-B educational project, National Information Technology Development Agency (NITDA) project, Department of Electrical Engineering Technology, all situated in the Federal
Polytechnic campus, Kaura Namoda and a residential property located at the Government Low-Cost housing Estate. These buildings were selected because they share the characteristics the typical building types found in the research setting. All the selected buildings were designed without provision for future integration of alternative energy sources. The methodology undertaken for the case studies consists of close-up examination of the buildings in respect of their orientation, angle of insolation and changes made to accommodate the solar photovoltaic systems.

**DESCRIPTION OF CASE STUDIES**

**Electrical Engineering Technology (EET) Complex**

This is a rectangular-shaped one-storey structure housing the Department of Electrical Engineering Technology of the Polytechnic. One wing of office block which utilizes alternative energy from the solar panels is located on the first floor. The solar panels were mounted on steel frames which were not rigidly tied to the long span galvanized iron roofing sheet and properly oriented to face east (Figure 3(c)). The roof is sloped at 15° to the horizontal. Investigations revealed that the two portrait-oriented panels are highly vulnerable to wind load due to the wide opening between the roofing sheet and the tilted steel supporting frames as shown in Figure 3. There is no trunking system for concealing electrical cables or a separate compartment for housing other system components such as the charge controller, inverter, storage batteries and wiring systems. As a result, they are kept unprotected in an open space in one of the offices as shown in Figure 3(b).

![Fig 3: EET Complex](a) (b) (c)

**STEP-B Project building**

This is a facility containing two computer rooms and offices. The building is a rectangular form, with hipped roof at an angle of 18° to the horizontal (Fig 4(a)). The roofing materials consists of long-span galvanized aluminium sheets placed on hardwood trusses. The windows are of glass hung on metallic frames while the doors are metallic types. The building is oriented North-South with the approach and the solar panels on roof facing east. The solar panels are tightly-mounted on steel frames and screwed to the roof materials in portrait formation with no tilt angle away from the roof slope. However, there is no trunking system for cables or a separate
compartment for solar system components. As a result, they are kept unprotected in an open space as shown in Figure 4(b).

Figure 4: STEP-B Project building (a) Solar panel installation on rooftop (b) PV system components laid in an open space (Photo credit: Authors field work, 2012)

**NITDA Project Building**

This building consists of a computer centre, word processing laboratory and some offices and classrooms. The solar panels which are installed on the rooftop (Figure 5(a)) and facing north are loosely tied to their steel supporting frame making them vulnerable to wind load. A close-up visual inspection revealed that the panels were not rigidly tied to the support frames and there is no separate compartment to house the associated PV system components. Thus, they were laid unprotected in an open space as shown in Fig 5(b). However, plastic trunking for cables were installed to conceal the cables as shown in Figure 5(b).

**Residential Property at Government Low-cost Housing Estate**

A summary of the case studies is given in Table 1 below.

<table>
<thead>
<tr>
<th>Table 1: Characteristics of Case studies</th>
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<tr>
<td>Case study</td>
</tr>
<tr>
<td>Electrical Engineering Technology Complex</td>
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<tr>
<td>STEP-B Project Office</td>
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<tr>
<td>NITDA Project Office</td>
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<tr>
<td>Residential Property</td>
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</table>
The property is typical of most residential buildings in the study area in terms of roofing style and compartmentalization. It is a small sized two-bedroom apartment with east-west orientation. The solar panels are arranged on the bare ground in a north-south orientation with cables interconnections left on the bare floor of the courtyard (Figure 6(b)). There is no separate compartment to house the PV system components, thus, they are left in an open and unprotected space as shown in Fig 6(c) with no trunking for the cables.

(a)  (b)
Fig 5: NITDA Project building (a) PV system components in an open space (b) Solar panel installations on rooftop showing some displaced panels (Photo credit: Authors field work, 2012)

(a)  (b)  (c)
Fig 6: Government Lowcost Housing Estate (a) Front view of the building (b) Solar panels arranged on the ground (c) PV system components in open space (Photo credit: Authors field work, 2013)

**IMPLICATIONS OF CASE STUDIES**

Findings show that all the buildings in the case studies shares the same problems of roof slope inadequate inclinations and inadequate orientation, lack of separate compartments for system components, lack of trunking systems for cables (except for the NITDA building). Therefore, any proposal for reconditioning the buildings for adaptation to use of solar energy should be focused on these deficiencies. These deficiencies are discussed as follows:
Roof Slope and orientation

Roof slope and orientation affects the amount of solar radiation falling on the panels. Ideally, the sun radiation should strike the panel at an angle perpendicular to it in order to maximize it. While installed systems in all cases could source sufficient power to service few installed loads, the EET complex solar PV system works at sub-optimal level as arbitrary increase in installed loads often lead to system breakdown. Only the STEP-B solar systems is working at optimal level as technical factors such as tilting angle adjustment of supporting frames, number of solar panels and roofing orientation were properly evaluated and realigned during the installation stage. The NITDA installation is currently dysfunctional due to poor installations leading to displacement of solar panels on the roof. In redesigning buildings in Kaura Namoda, care should be taken to choose a south or east facing roof to install the solar panels.

Solar panels on rooftops should be oriented southward in order to maximise amount of insolation on the panels. Although east and west orientations could source solar power for some predetermined electrical loads, however, the solar panels will be performing at sub-optimal levels. To get an average output over the year, the solar panels should be inclined at an angle not less than the site’s latitude from the horizontal (Roaf et al., 2007). Kaura Namoda as already mentioned has a latitude of 12° 35’. However for maximum impact of solar radiation, it is recommended that an additional angle of 15° should be added to the latitude. This implies that an angle of about 30° would be best for Kaura Namoda. It is noteworthy that none of the cases studied has a roof slope up to 30°.

Compartment for system components

System components such as the charge controller, inverter, storage batteries are always installed in a room free from interference from the public. This is called the control room. In all the cases studied the control room was absent leaving the system components exposed. In redesigning buildings for solar energy installation, care should be taken to create a control room by partitioning of a small space from a large room or conversion of use of an existing small space or building an attachment. The need for a control room for the safety of people and equipment cannot be overemphasised.

Trunking

Trunking is a casing used to conceal electric cables for easy serviceability and protection. Wiring provides interconnectivity for the components that constitutes the solar photovoltaic systems and is therefore one of the most vulnerable components of the system. Improper wiring method can pose a serious hazard to the building and occupants. With the exception of the NITDA building, all other cases studied have no trunking in place to conceal the cablings. There is also no cable strapping of any form in the residential property while buckle clips are used to hold together some few length of cables in the EET complex case.

CONCLUSION AND RECOMMENDATIONS

Case studies of some factors constraining the efficient utilization of solar energy in four selected buildings in Kaura Namoda, Nigeria have been presented in this paper. The study has shown that it is often necessary to install renewable energy such as solar energy to buildings which were initially designed without consideration of future energy need. The study has revealed that roof slope and orientation, lack of separate
compartments for subsystem components and trunking materials are the basic provisions needed to be focused upon during the process of adapting the buildings to be solar ready. In view of these findings, the following recommendations are made:

Integrated design process should be adopted as best practice by stakeholders in the built environment so that the problem of redesign will be eliminated. Architects and engineers should always collaborate to design buildings that could be easily adapted to future dynamics.

In redesigning buildings in Kaura Namoda, care should be taken to choose a south or east facing roof to install the solar panels.

In redesigning buildings for solar energy installation, it is recommended that a 30° roof slopes be considered. Where the roof slope is not adequate solar panels should be mounted on carriers at the right slope.

During the design or redesign of buildings for solar energy readiness, compartments should be included in the architectural design to house solar subsystems.

As trunking provides effective cost-effective shielding of associated cables and equally easy access to the bundled cables during troubleshooting and fault diagnosis, it is necessary to use metal or plastic trunking to shield wiring.

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REDUCING VARIABILITY IN CONCRETE ACTIVITY LABOUR PRODUCTIVITY TO IMPROVE LABOUR PERFORMANCE

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The management of daily labour productivity variability on site is an important aspect of construction management thinking. The lean technique suggests that reducing variability gives better labour performance. Therefore this paper examines the analysis of labour productivity data of concrete activity from sixty one construction sites of single storey buildings in Abuja metropolis. The objective was to determine the relationship between labour productivity variability and labour performance in concrete activity. The data used were collected from sixty one live projects within the study area. The daily method of data collection was adopted in this research. A total of 778 data points were observed for all concrete activities from these sites. The analysis of the performance index that is Project Waste index (PWI) revealed that some the projects studied were poorly managed because the projects had low productivity rating. While some other projects performed well. The PWI values computed for the project studied ranged from 0.12 to 0.67. It was observed that low outputs were accomplished with high labour inputs. The values for coefficient of variation in labour productivity range from 0.09 to 0.48. These values and the performance indexes calculated for all projects were tested for correlation analysis. The coefficient of correlation for the two variables was found to be 0.601**, which is significant at 0.01 confidence level. The result showed that the variability in daily labour productivity is more highly correlated to project performance than workflow output variability which means that reducing variability in labour productivity appears to have a significant effect on performance. Also the performance gap value for concrete work was found to be 3.62 man hrs/m³. It was recommended that the site managers should determine to get more output with a reduction in input.

Key Words; variability, labour, management, performance, productivity, input, output.

INTRODUCTION:

Labour productivity has been identified as an index for measuring efficiency because labour is acknowledged as the most important factor of production since it is one of the major factors that creates value and sets the general level of productivity (Ameh and Odusami, 2002). Enshassi, Mohammed, Mustafa and Mayer (2007) identified labour productivity as the key factor contributing to the inability of many indigenous construction contractors to achieve their project goals which include most importantly, the profit margin amongst others. They suggested the need to investigate and

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understand the key variables of labour productivity and to keep accurate records of productivity levels across projects.

Andersen and Petterson (1995) suggested the application of benchmarking technique to accelerate change in attitude and behaviour in an organisation. In view of the fact that it is a mechanism for “improvement and change”, it will further help an organisation to search for industry best practices that will bring about superior performance by examining the performance and practices of other firms. Therefore to complement government efforts to promote and develop building industry (Olugboyega, 1995 and Olugboyega, 1998) there is the need to investigate variability in terms of output and input resources for indigenous building firms in Nigeria with a view to increasing performance. In literature the application of modern production concept like reducing variability to increase labour performance in the local industry in Nigeria is very sparse. In this research work, with the application the lean technique concept, labour productivity data was obtained from concrete activity on a number of projects sites to test relationships between output variability and performance.

Therefore this paper covers review of related works, method of data collection, determination of research variables, analysis of data and discussion, research findings and conclusion.

**Review of Literature**

A survey of the literature revealed several primary contributions to the theory and practice of lean production principles. Some of the research works provided support for this study. In construction the application of lean production model stems from the discussion of koskela’s research work (1992), which emphasized the importance of the production processes flow, as well as aspects related to converting inputs into finished products as an important element to the creation of value over the life of the project. Many other researchers (Ballard and Howell, 1998; Alarcon and Calderon 2003; Bertelsen 2004; Salem et al., 2005) have expanded this concept and provided evidence of its applicability in the construction industry. The pioneering work of koskela opened up streams of researches into lean construction principles. The core lean concepts were identified and translated from the manufacturing production management into construction language (Shingo 1984; Koskela 1992, 1993; Ballard and Howell 1994a). To operate these core concepts in the construction industry a new set of management techniques were developed (Paez et al., 2005). The last planner system of production control was introduced in 1992 but developed by Ballard, and Howell (Ballard and 1994b). In the application of these tools, previous researches revealed substantial improvement in productivity for those who improved plan reliability to the 70% level, Howell and Ballard (1994) in their study on the last planner technique showed that the use of formal and flexible production planning procedures is the first step to keep the production environment stable. The technique emphasizes the use of daily production plans, constrains analyses, Lock ahead and percentage of planned and completed items. Thomas et al. (2002) asserted that, with the last planning technique, the percentage of planned tasks (PPC) is measured to show changes in planning reliability. However, they argued the extent to which a larger PPC improves project performance. According to them, there is limited evidence showing that productivity performance for crews with a PPC above 50% is 35% better than that of crews with a PPC below 50%. This remains unclear. Also while these techniques have proven useful, El Mashaleh et al., 2001 believed that their
Labour performance

application has no methodology that could relate the activity and project level accomplishment to firm’s accomplishment.

Abdel – Razek et al. (2007) suggested that better labour and cost performance can be achieved by reducing variability and measuring benchmarking. However, all the previous studies on benchmarking were done on non homogenous projects (Thomas and Zavrski 1999; Abdel – Razek et al., 2007; Enshassi et al., 2007). Thomas and Zavrski (1999a),1999b) developed the framework for international labour productivity benchmarks of selected construction activities.

The application of these benchmarks can lead to evaluating the labour productivity and identifying the best and worst performing projects. Therefore, from these series of inferences it could be said that the exploration of improving construction labour performance in Nigeria by applying some lean construction principles, namely benchmarking and reducing variability is a possibility.

RESEARCH METHODS

Collection of Data

The data collection for on-site productivity study was conducted on concrete building activity. The research procedures involved the engagement of ten research assistants, who were trained on how to observe the workmen and record observations in terms of input and output. Data collection covers concreting work in 61 live projects from building contractors within the study area (Abuja). Daily visit method of observation of labour productivity was adopted. This involved personal observation of Labour activities on the selected work on live projects. The strategy here was to visit the site daily and interact with the foreman and workers in order to record the dates, number of workers, starting time, closing time and measurement of length/breadth of work done (quantities) of each worker. Entries were made on research instrument collection sheet designed for this purpose. The figures collected were analysed using lean benchmarking approach of calculating performance using Thomas et al (1990) mathematical model.

Determination of Research Variables

Thomas and Zavrski (1999a), 1999b) expressed the projects attributes in the following forms.

\[
\text{Total work hours} = \sum \text{Daily work hours} \tag{1.1}
\]

\[
\text{Total quantities} = \sum \text{Daily quantities} \tag{1.2}
\]

\[
\text{Cumulative Productivity} = \frac{\text{Total work done (wh)}}{\text{Total quantity (m}^2\text{)}} \tag{1.3}
\]

Baseline Productivity: This is defined as the paramount performance a contractor can get from a particular model or design. To compute the baseline productivity values certain laid down steps were applied to the daily productivity figures for each project (Abel Hamid et al., 2004 and Enshassi et al., 2007).

Establish the figures for workdays that consist 10% of the workdays studied.
The number established in one above should be rounded off to the next highest odd number which should not be less than (5) five. This number, n, explains the size of the baseline division.

The contents of the baseline division are the n workdays that have the highest daily production or output.

The next step is to compute the summation of the work hours and quantities for these n workdays.

The baseline productivity can now be expressed as the ratio of work hours and the quantities contained in the baseline division.

Project Management index (PMI) or Project Waste Index (PWI) According to Abdel-Hamid et al. (2004); Thomas and Zavrski, (1999a), 1999b) it is expressed as follows:

\[
\text{Project Waste Index (PWI)} = \frac{\text{Cumulative Productivity} - \text{Baseline Productivity}}{\text{Expected Baseline Productivity}}
\]  

(1.4)

Project Waste Index (PWI) has been identified in previous studies as a useful tool to measure performance (Thomas and Zavrski 1998, 1999).

\[
\text{Coefficient of productivity variation (CPV)} = \frac{\text{PV}_j \times 100}{\text{Baseline Productivity}_j}
\]  

(1.5)

Where CPV = coefficient of productivity variation for project, j. Alternatively it can be computed as a ratio of the standard deviation to the mean.

Population of the Study and Sampling Technique

The population of the study was drawn from contractors handling building projects in the study area. The builders were involved in different types of construction activities such as mass housing projects of bungalow category, storey building housing projects and infrastructures. In order to meet the objectives of the study, the research samples were drawn from contractors constructing single storey buildings for the purpose of homogeneity. The research team was able to collect data from sixty one (61) construction sites, randomly drawn from the available list of builders. A total of 778 data points were obtained for all concrete activities from these sites. At the time of data gathering, it was observed that most of the firms were executing projects at various levels of completion.

Data Analysis and Evaluation was conducted using the following statistical tools;

1. Descriptive Statistics
2. Inferential Statistics
   - Box and Whisker analysis
   - Regression analysis


Conversion Factor for Concrete Elements

There are certain factors that affect concrete work on site in terms of transporting, placing and compacting. This means that productivity rates for each concrete element will differ from one another depending on where the concrete element is located in the
structure. Also methods employed in the construction process, such as method of placing, transporting and compacting concrete will affect the labour output. Therefore, the assumption here is that the methods are same for all studied projects. The predetermined standard unit is established using statistical median. Based on this assumption the labour outputs for transporting, placing and compacting concrete for all concrete elements per one labourer expressed in man hours over output were obtained as follows for foundations, concrete beds, suspended slabs, columns, beams, walls and staircases as 3.50, 4.00, 7.50, 13.50, 13.50 and 15.5 man-hrs/m³ respectively. The corresponding conversion factors are 0.259, 0.296, 0.556, 1.00, 1.00, 1.00 and 1.148 for foundations, concrete beds, suspended slabs, columns, beams, walls and staircases respectively (Ross et al., 2007).

ANALYSIS AND DISCUSSION OF RESULTS

Concreting: The concrete work labour productivity data was tested for normality and was found to be slightly normally distributed for concrete. The normal probability plot for the labour productivity data for concrete activity is shown in figure 1, with slight deviation from the straight line of fit. A sample size of 353 was computed to be adequate but a data set of 778 was used for the study. The purpose for large data set gathering was for improvement of results. The mean of the sample was found to be 13.326 whr/m³ and the median was determined to be 13.807 whr/m³. It was observed that the mean of the estimate was less than the median. This

![Normal Q-Q Plot of Labour Productivity for Concrete Work](image)

Fig 1. Line of Fit Probability Plot of Labour Productivity Data for Concrete Activity indicates that the frequency distribution is not symmetrical. Also observation of the line of fit graph for concrete work in figure 1 does not show any clear fit to the normal distribution. It is a skewed distribution as shown in figure 2. Also the distribution is negatively skewed having a skewness value of -0.247 and standard deviation of 3.776.

The distribution of the sample variable was assumed to be slightly normally distributed. The measure of variability was determined from the normal probability statistics computed. The range was found to be 15.71 which is the difference between the highest and the lowest scores in the distribution. The average coefficient of
variation for all the projects which is a function of the standard deviation and the mean was calculated as 28.26%.

The labour productivity values calculated or synthesized from the raw data were used to compute the cumulative productivity. Which is the overall attempt required to accomplish a concrete task. This is a key element in assessing crew performance from project management index perspective. Statistical analysis of data showed that the mean and standard deviation of cumulative productivity were found to be 13.326 whr / m$^3$ and of 3.776 respectively.

Figure 2. Normal Distribution Curve of Labour Productivity Data for Concreting Trade

**Box and Whisker’s Test**

The productivity data were tested for any extreme outliers. The box and whiskers technique was adopted to examine the level of possible extreme outliers present in the data. Extreme outliers were found and dealt with which made the data for the concrete site activities to be free from extreme outliers. Figure 3 shows the box and whiser’s plot for concrete work. A graphical observation of the plot for concrete activity points out that the line of symmetry in the box was tilted towards the upper arm. This reveals that the data were not symmetrical hence the skewness. The plot shows that the concrete work data set was negatively skewed to the left. The large range value would have been responsible for the negative skewness.

Fig 3. Box and Whisker’s Test for Concrete Activity Labour Productivity Data.

**VARIABILITY IN DAILY LABOUR PRODUCTIVITY FOR THE SELECTED SITE CONCRETE ACTIVITY**

**Concreting activity:** Figure 4 shows the variability in daily labour productivity of concrete task for project 28. The variability computation was done for each of the projects examined. It was determined from input and output relationship. The computed values of coefficient of variation for concreting activity range from 0.09 to 0.48. These values are the products of the standard deviation divided by the mean of the estimate.

The instrument used illustrates the days observed for concreting activity, the gang size, work hours, daily quantity, daily labour productivity, baseline days and abnormal
days. The concreting task observed in the project was done for twenty days. The total team size employed to construct 203 metre cube of concrete work was 327 work men with a total work hours of 2818hrs. This indicates that the construction firm used one site worker to achieve approximately 0.621m$^3$ of concrete. The daily productivities ranged from 6.838 to 19.200whr/m$^3$. The concrete work has a cumulative productivity of 10.33whr/m$^3$.This indicates that labour input was fairly normal since this cumulative productivity is less than unity. The following days 7, 8, 10, 12, and 13 were identified as baseline days for concreting task. These are the highest productivity scores that were considered to define the baseline subset and the average of these five figures (6.897, 6.838, 7.742, 8.496 and 7.176whr/m$^3$) represents the baseline productivity or benchmark for the project which is calculated to be 7.430whr/m$^3$. The concrete task witnessed no abnormal days.

The project waste index which provides a measure of labour performance was found to be 0.666 which is the worst pwi of all projects investigated. This index facilitates the comparison of labour performance to a baseline criterion. The higher the pwi figure the poorer the labour performance. An examination of figure 4 showed some level of gap between daily labour productivities and the baseline productivity which was found to be 36.50% coefficient of variation. This level of variation shows some level of opportunity for improving labour performance. The wider the values of daily labour productivity are from the baseline productivity the poorer the labour performance. Project 60 in figure 5 for concreting activity shows a better performance with daily productivity closer to the baseline productivity value. The baseline productivity for the project was computed to be 13.113whr/m3. Also it was observed that the gap between the daily productivities and the baseline productivity provided a coefficient of variation of 9.2% which produced a better labour performance (pwi) index of 0.160 compared to 0.666 obtained for project 28. To achieve greater performance, the same output is maintained with fewer inputs to reduce output variability. This supports the theory that states reducing variability in labour productivity improves labour performance on site.

![Figure 4. Variation in Daily Labour Productivity for Project 28 Concrete work with the Worst Project Waste Index Value](image-url)
Figure 5. Variation in Daily Labour Productivity for Project 60 Concrete work with the Least Project Waste Index Value

Fig 6. Performance Gap for Concrete Site Works.

**Performance Improvement Gap in Labour Productivity**

The target performance improvement gap of the site activity under examination in this study is shown in figures 6 for block laying activity. The distributions define the productivity variability which provides opportunity for improvement.

The performance gap, which is as a result of variability is assessed or quantified by determining the different between expected mean productivity (EMP) (which is the mean baseline productivity) and present mean productivity (PMP). The wider the gap
between PMP and EMP, the bigger the opportunity for labour performance improvement.

The performance improvement gap value for concrete work was found to be 3.62 man hrs/m³. The process performance improvement can be achieved by adjusting the group of variables that mainly influence the performance indicator. Therefore reducing this performance gap value could mean a significant improvement in performance, profit and productivity for builders and contractors.

**THE RELATIONSHIP BETWEEN COEFFICIENT OF VARIABILITY AND PERFORMANCE (PWI)**

**Construction Output**

The values of coefficient of variation for construction output are shown in appendix 1. These values and that of performance (PWI) were tested for any significant relationship. The correlation between the two variables was computed as -0.229 which was not significant. The implication of this analysis with this coefficient of variation is that the variability in daily construction output has no correlation relationship with the project performance. Therefore the correlation coefficient obtained from this analysis confirms the earlier study that daily construction output and performance have minimal or no relationship. Furthermore, it appears from the test result that reducing variability in production output in order to improve performance has an insignificant or no effect on performance.

**Labour Productivity**

The figures calculated for coefficient of variation for labour productivity are shown in appendix 1. The values for coefficient of variation in labour productivity range from 0.09 to 0.48. These values and the performance indexes calculated for all projects were tested for correlation analysis. The coefficient of correlation for the two variables was found to be 0.601**, which is significant at 0.01 confidence level. The inference from this test result is that the variability in daily labour productivity is more highly correlated to project performance than
construction output earlier determined. In addition, the result of the analysis shows that reducing variability in labour productivity appears to have a significant effect on performance. Linear regression analysis of the two variables showed a coefficient of determination for a linear relationship of about 0.37 which means that 37% variation in crew performance is accounted for by variability in labour productivity.

The linear equation is
\[ P_{wi} = 0.08424 + 0.9732x \]  
(1.6)

The equation has a model probability value (P-value) = 0.02

From the linear model shown in figure 7 it has an intercept of 0.08148 and for every increase of one unit of variability in labour productivity there is an increase of about 0.6802 in performance.

Polynomial regression analysis was carried out to ascertain the best predictive curve fit for the model, it was found out that the second order polynomial gave an improved coefficient of determination R² of 0.40 with an equation model

\[ P_{wi} = -0.081 + 2.096x - 2.578x^2 \]  
(1.7)

The equation has a model probability value (P-value) = 0.001
Figure 8. Best Curve Fit Polynomial Model for Concreting Activity Performance

From the equation model in figure 8, the intercept on Y axis is -0.081 and for every increase of one unit of variability in labour productivity there is an increase of about 2.096 in Performance. But it was observed that for every unit increase in variability in labour productivity raised to the power of two, there is a decrease of about –2.578 in Performance. The model revealed that most of the data points fell within the 95% prediction interval point.

FINDINGS

(1) Correlation between project waste index (performance) and coefficient of variability for construction output for concrete work = 0.229

(2) Correlation results show that there are strong associations between project waste index (performance) and coefficient of variability for labour productivity of concrete work = 0.601**

(3) It was found that 40% variation in crew performance in concrete activity is accounted for by variability in labour productivity.

(4) The effect of labour productivity variability alone on performance was observed to be greater than the combined effects of construction outputs and labour productivity variability on performance for the activity under consideration.

(5) Labour productivity gap of 3.62 man hrs/m³ was observed for concreting.

CONCLUSION

This research work investigated the effects of workflow variability and labour productivity variability on the job site performance. Using productivity data from
concreting activities on multiple projects, various parameters of output variability were tested against construction performance. The labour workflow productivity data analyzed were found to be slightly skewed. Data from concrete work was skewed negatively perhaps due to large range of values encountered from the data. All values of skewness were greater than zero but less than one. This showed the level of reliability of data used in the analysis.

The correlation relationship between work flow variability and performance was found to be low for concrete activities. Similarly, the correlation between labour productivity and performance was discovered to be highly significant for the studied site activities therefore it is suggested that in measuring the impacts of variability on performance, emphasis should be placed on labour productivity variability instead of work flow or construction output variability. The values of variability in labour productivity were compared with the project performance (PWI) it was found out that the higher the values of labour productivity variability the poorer the performance. Also the baseline productivity computed for the studied activity was compared with the mean labour productivity.

It was discovered that a level of performance gap exist for the concrete site work. This is an indication of improvement opportunity for performance in labour utilization for the activity investigated. The present productivity distribution was higher than the expected productivity distribution, this represents a gap in performance.

The effect of variability on jobsite performance was determined using regression analysis. A level of effect was established for the concrete site activity which is 40%. This suggests that reducing variability will bring about improvement in labour performance.

**RECOMMENDATIONS ON PERFORMANCE IMPROVEMENT STRATEGIES TO BE ADOPTED BY SITE MANAGERS AND OPERATIVES.**

1. The correlation relationship between work flow variability and performance was found to be low for concrete activities therefore it is recommended that in measuring the impacts of variability on performance, emphasis should be placed on labour productivity variability instead of work flow or construction output variability.

2. The correlation between labour productivity and performance was discovered to be highly significant for all measured site activities therefore it is suggested that labour productivity variability be used to measure the impacts of variability on performance.

3. The variations in crew performance in the activity investigated was found to be as a result of variations in labour productivity therefore the following are suggested,

4. Multiple variables effect of work flow and labour productivity variability on labour performance was found to be lower than the single variable effect of labour productivity variability thus single variable effect is proposed for the assessment of variability effect on performance.

5. It is proposed that site managers should close up performance gaps in project execution by reducing the disparity in values between baseline productivity and the mean labour productivity for the project.
REFERENCES


### Appendix 1 Computation of Research Variables

<table>
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<th>Coefficient of Variation LP</th>
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<th>Baseline Productivity</th>
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REVERSING THE BUSINESS FAILURE RATE AMONG SMALL AND MEDIUM SIZE CONSTRUCTION FIRMS IN SOUTH AFRICA: A PROGRESSIVE STUDY

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The construction industry development board (CIDB) register of contractors shows that small and medium sized enterprises (SMEs) outnumber established firms in South Africa. The failure rate of SME businesses, which has increased in recent years, however constitutes a source of concern in the industry. This situation is reflected in the limited number of successful construction SMEs as a percentage of the total registered firms in the industry. The research design for the study reported on entails semi-structured and unstructured interviews, which will be conducted over an extensive period of time to gather sufficient information from the research participants. However, the preliminary findings that form the nexus of this paper are based on the reviewed literature and a pilot study that was conducted among a purposive sample of construction SMEs - Grades 3 to 6 on the CIDB register. It is notable that the initial findings suggest that construction SMEs often encounter difficulty in securing projects, fail to realize core organizational objectives and goals, and are unable to gain cost advantages over their immediate rivals, which affects their business performance. Thus it appears that more effort is required to improve the business performance of construction SMEs in South Africa.

Keywords: construction industry, historically disadvantaged individuals (HDIs), small and medium size enterprises (SMEs), South Africa

INTRODUCTION

It can be observed that the South African construction industry is in the process of transformation (Martin, 2010). The requirement for this transformation stems from the need to address the effects of apartheid (Martin, 2010). Since 1994, South Africa has been re-integrated into the international market, and has been positioning itself to realise the high expectations of its populace regarding a successful transition towards a more democratic society (Berry et al., 2002). Berry et al. (2002) further posit that to achieve the objectives of economic growth and employment generation and income redistribution, SMEs must be actively promoted in South Africa.

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SMEs encompass a broad range of firms, from established traditional family businesses that employ over a hundred people to survivalist self-employed from the poorest layers of the population (Berry et al., 2002). According to Shakantu (2012), there are several difficulties related to attempts to define a SME business enterprise. The yardstick for delineating enterprises by size is usually one or more of the following: total number of employees; value of fixed assets; paid-up capital; annual turnover, and annual volume of physical production. The nature of activity determines the viable and normal economic operating size. Therefore, there is no single definition.

Ofori, Ali Lin and Tjandra (2012) mention that the development and growth of construction businesses within the lower grades of the CIDB is a fundamental element for all countries as a strong SME base has the capacity to produce quality infrastructure. However, in South African construction, SMEs are repeatedly experiencing certain difficulties that are not limited to lack of capital due to difficulty in accessing finance, and lack of experience; but more so the lack of general business and managing training and exposure to achieve business sustainability in their market share (Murray and Appiah-Baiden, 2002). Many authors have stated the reasons behind business failure among construction SMEs. With this failure, a number of proposed solutions have been identified. Given the fact that the failure rate among construction SMEs is so significant, there is a need to address this problem by providing a clear theoretical understanding of the basic constructs amongst construction SME businesses.

Based upon the aforementioned introduction, the problem statement evolved for the study is: Business failure occurs within the infancy years or simply stated, less than 10 years of existence, of most construction SMEs in South Africa. Furthermore, the primary objective of the study is: to obtain proficient judgement on the various statements and possible causes which influence the business failure rate among SMEs in South African construction.

LITERATURE REVIEW

The existence of a vibrant small business sector often indicates the presence of an entrepreneurial spirit and an economically healthy society. Although facing many structural difficulties, the small business sector is a significant contributor to the South African economy. According to the Department of Trade and Industry (2003), small businesses represent 98% of the total number of firms in South Africa. They employ 55% of the country’s labour force and contribute 35% towards the GDP of South Africa. They also contribute more than 40% of the GDP in four of the eight major economic sectors; construction being one of them. These are good figures in terms of SME involvement, but sadly, it was revealed that 40% of these SMEs who start new business ventures fail in the first year, 60% in their second year and 90% in their first ten years of existence (Van Scheers, 2011). These figures speak not only to SMEs in general, but also to construction SMEs that form part of this business sector. However, the CIDB and Construction Education Training Authority (CETA) estimate that 70% of construction SMEs fails in their first year of existence (Martin, 2010).

The challenges that contribute to the high business failure rate among construction SMEs are many and varied, and impact significantly on their development and sustainability. According to Barron (2000), one of the major challenges that most construction SMEs experience is that they generate good ideas and are generally competent in the physical work they deliver, but unfortunately “they do not have a
clue on how to run a business and have no underlying appreciation of business fundamentals.” Chilipunde (2010) in addition observed that poor strategic leadership and insufficient control of essential aspects of financial management formed the key issues behind their business decline and eventual failure. Ranjit, Mwanaumo and Nkado (2011) also identify deficiencies in managerial skills and business know-how among construction SMEs in South Africa. Brink and Cant (2003) further mention that business problems experienced by construction SMEs can be categorised based on their origin in the external and internal environment. Within the external environment, construction SMEs is faced with problems such as: the state of the economy, compliance with legislation, resource scarcity, HIV and AIDS, crime and corruption and rapidly changing technology (Luo, 2003; Chen, 2006). As for the internal environment, construction SMEs’ major cause of business failure revolves around management skills, financial knowledge, and lack of expertise in functional areas such as marketing and human resource management (Ligthelm and Cant, 2002).

Some of the problems emanating from these factors include specific management issues such as lack of business management training and skills as well as a limited family business culture in South Africa (Ranjit, Mwanaumo and Nkado 2011). Other reasons for failure include the inability to act as entrepreneurs, to control business growth and undue emphasis on financial rewards. In addition, management actions and behaviour that were found to be lacking in construction SMEs include: the inability to set strategic goals; plan forward actions; reluctance to seek advice; lack of management commitment, and unwillingness to adapt to change (Ligthelm and Cant, 2002). Proposed solutions have been identified to address the factors contribute to the failure rate among construction SMEs in South Africa. These solutions include the need for entrepreneurship, for expertise, access to finance and a supportive regulatory environment (Shakantu, 2012). Other critical success factors for construction SME development include: the ability of contractors to market their services among the industry role players; the experience and management expertise of the owner; the ability to maintain a good relationship with clients, suppliers and other relevant role players, as well as to develop adequate project management capabilities (Shakantu, 2012).

As indicated in mainstream management literature, some of these difficulties can be surmounted. Hence, Hough et al. (2011) postulate that business strategy is management’s action plan for running the business and conducting operations. Hough et al. (2011) add that core competencies and competitive capabilities are vital areas, which could assist construction SMEs in the execution of good business strategies. They are equally important areas that could be utilized in securing a competitive advantage over rivals in situations where it is relatively easy for rivals to copy smart strategies. Hough et al. (2011) further add that the best way to achieve a lasting competitive advantage is to out-execute competitors. For example, by performing certain value-chain activities in a superior fashion, SMEs could out smart their competitors. The core concept of this is that building competencies and capabilities that are very difficult or costly for rivals to emulate has a huge payoff for construction SMEs. This generally results in an improved strategy execution and the potential for a competitive advantage. However, for most construction SMEs, the words ‘business strategy’ and ‘competitive advantage’ could be uncommon / or unknown as they tend to rather focus on survival, from project to project, instead of business growth.

Based on Porter’s concepts (1980), a key fundamental in business growth, however, requires construction SMEs to understand trends within the industry, and to fully
understand the market. Hough et al. (2011) opine that due to the emerging market being in its infancy, there is usually much speculation about how it will function, how it will grow and how big it will get. For construction SMEs that are hampered by repeated shortcomings, it is very complicated in order to make profits due to limited historical information available to them (Hough et al., 2011). Porter (1980) comments that a market signal is any action by a competitor that provides a direct or indirect indication of its intentions, moves, goals or internal situations. The behavioural pattern of competitors provides signals in a myriad of ways. Porter (1980) further mentions that some signals are deceptive, some are warnings and some are earnest commitments to a course of action. Therefore, if construction SMEs are able to recognise and accurately read these market signals, it would be of major significance for developing a competitive strategy and would be the key driver to competitor analysis (Porter, 1980).

In an attempt to assist construction SMEs to adapt to the abovementioned skills, a number of contractor development programmes were established. These programmes are managed by the National and Provincial Departments of Public Works (CIDB, 2010a). These programmes have gained huge successes in relation to participation, but have not addressed the fundamental concern, which is the growth and development of construction SMEs into established contractors (Ranjit, Mwanaumo and Nkado, 2011). In addition, Ranjit, Mwanaumo and Nkado (2011) mentions that the results of these contractor development programmes have been largely insignificant. This raises doubt surrounding the CDPs and their models for producing ‘serious industry players’ and developing sustainable construction SMEs. According to Ehlers and Lazenby (2004), research has revealed that firms who practice strategic management techniques usually outperform those that do not.

**METHODOLOGY**

An exploratory survey was used to obtain insights related to the issues impacting on the business failure rate among SMEs in South African construction. The survey was made up of two principal questions which were 5 point likert scale type. The first question required the respondents to rate certain statements that describe the characteristics of SMEs in South African construction and the second question elicited responses to notable causes of business failure among such SMEs. A non-random sampling method was used to select respondents within the Western Cape Province. A purposive sampling method consists of identifying and selecting respondents that a researcher perceives to have prior knowledge in the subject area. Respondents were owners of established construction firms, construction managers and quantity surveyors involved in the South African construction industry and who are affiliated to professional bodies such as the South African Council for the Project and Construction Management Professions (SACPCMP), the Association of South African Quantity Surveyors (ASAQS) as well as the Master Builders and Allied Trades Association, Western Cape (MBAWC). These respondents were chosen because of their active involvement in the development of construction SMEs in South Africa. Table 1 presents the research participants. In the context of this particular study, SME refers to firms that are graded between grades 3-6 on the CIDB register. All the respondents that were approached completed the questionnaire. This equates to a 100% response rate.

<table>
<thead>
<tr>
<th>Respondent Participants</th>
<th>Response Number</th>
<th>%</th>
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Table 1 Research Participants
The respondents were of the opinion that the lack of management competencies (MS = 3.96), strategic planning (MS = 3.68) and...
marketing competencies (MS = 3.64) are the three key areas that construction SMEs need to develop before they can realize core organisational objectives and goals that should enable them to expand their businesses. Lack of finance achieved an MS of 3.50. A likely reason for this is that finance is still a major concern in terms of start-up capital, which the majority of the SMEs require. However, in terms of MSs, finance is followed closely by lack of skilled workers, estimating competencies, tendering competencies, and forecasting and trend monitoring that are needed for successful enterprise management.

The poor prioritization of value systems achieved a low MS of 3.18. A likely reason for this score is that most SMEs are still early developers in terms of market position and would more than likely battle in terms of developing sufficient value systems. It is however notable that lack of entrepreneurial skills also achieved a rather low MS despite the fact that the lack may be detrimental to the development of construction SMEs. The lowest MS suggests that contractor development programmes (CDP) do not adequately address the business of construction. In essence they hamper the development of new construction SMEs in terms of equipping them with the various competencies required to sustain and grow their businesses.

Table 3: Causes of business failure among SMEs within the South African construction industry

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<th>Response (%)</th>
<th>MS</th>
<th>Rank</th>
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<td>monitoring</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lack of skilled workers</td>
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DISCUSSION

Many authors (Hodgetts and Kuratko, 2008; Van Scheers, 2011; Bikitsha and Root, 2011; Toor and Dhir, 2011; Hormozi, Sutton, McMinn and Lucio, 2002; and Ranjit, Mwanaumo and Nkado, 2011) identify the various causes of business failure among SMEs in construction. However, it is made evident by the findings of this explorative study that respondents generally agreed with the examined statements and causes. The study suggests that managerial and marketing competencies and strategic planning can be construed as notable causes of business failure among SMEs in South African construction.

Beaver (2007) postulates that despite the contributions and significance of SMEs to economic growth and job creation, every year tens of thousands of these small
enterprises often cease to trade. Temtime and Pansiri (2006) observe that one of the major causes of small business failure is poor management. Hodgetts and Kuratko (2008) concurred with this view as they said that one of the major reasons behind small business failure is the lack of managerial competencies.

Van Scheers (2011) mentions that marketing is one of the most important tasks for SMEs in South Africa. It is a key determinant as to whether the construction SME businesses will succeed or cease to trade. According to Fuller (1994) cited by Reijonen (2010), it is argued that through marketing, a firm aims to achieve competitive advantage by satisfying its customers more effectively and efficiently than its competitors, thus ensuring long-term profitability. In addition, it is stated that marketing places customers at the centre of the firm’s activities. Marketing can therefore be regarded as a process that brings the firm in constant and direct contact with its customers.

In addition, Hormozi, Sutton, McMinn and Lucio (2002) suggest that another key determinant of business success lies in the absence or presence of strategic planning, which most SMEs do not embrace according to Beaver (2003). The concern is that by neglecting strategic planning, SMEs may not achieve their full performance and growth potentials, and their survival could be placed at risk (Wang, Walker and Redmond, 2011). Wang, Walker and Redmond (2011) further mention that in terms of business performance and growth, strategic planning is generally utilized most often in better performing SMEs. They contend that SMEs that engage in strategic planning are more likely to achieve higher sales growth, higher returns on assets, and higher margins on profit, and higher employee growth, than those that do not.

CONCLUSIONS AND RECOMMENDATIONS

The study was conducted to obtain proficient judgement on the various statements and possible causes that influence the business failure rate among SMEs in South African construction. The overall aim of this study was to improve the business performance of construction SMEs in South Africa. An exploratory survey was used as the method to collect data, which generated insights related to the issues impacting on the business failure rate among SMEs in South African construction.

The survey was made up of three principal questions, two of which were 5 point likert scale type and the third question was open-ended. The first question required the respondents to rate certain statements that describe the characteristics of SMEs in South African construction, and the second question elicited responses to notable causes of business failure among such SMEs. The open-ended question then requested general comments pertaining to the subject area.

An empirical concern in terms of directing the overall research was that the findings confirmed the importance of managerial and marketing competencies as well as strategic planning that SMEs in South African construction should possess if they are to improve their business performance. The study was geographically limited to the Western Cape Province. In addition, limitations also existed in terms of the choice of respondents, which did not include owners of construction SMEs. It is therefore acknowledged that the input of construction SMEs would have been more credible and that further empirical studies should be conducted.

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SHARING, COOPERATION AND CONFLICTS: MULTIHABITATION AS AN URBAN LOW INCOME HOUSING STRATEGY IN ACCRA

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Multihabitation in housing is a social situation within a specific space in which people who consider themselves or do not consider themselves as one household share a living space. The high frequency of interaction and contact with other members in a multihhabited house increases the likelihood of conflicts but also allows for a greater deal of cooperation between households. Regardless of all the conflicts associated with multihabitation, it has been recognized as an efficient and economical means of addressing urban low income housing needs in developing countries. This paper presents the living arrangements of households under multihabitation. It further examines the perception of the households with regards to multihabitation as an urban low income housing strategy. Using both quantitative and qualitative methods of data collection, four low income communities in the Greater Accra Metropolitan Area is studied. It was observed that even though conflict was rife in multihabitation, respondents concluded that the benefits derived from existing and new social ties under multihabitation far outweigh the disadvantages of conflicts associated with multihabitation. However, there were suggestions for the modification of the housing design.

Keywords: multihabitation, low income, housing, compound housing, Accra, Ghana

INTRODUCTION

Multihabitation in housing is a social situation within a specific space in which people who consider themselves or do not consider themselves as one household share a living space (Tipple et al., 1999; Schlyter, 2003). Schlyter (2003) drawing from the perspective of the African traditional house in Chitungwisa in Zimbabwe, identified sharing as an integral part of multihabitation. Facilities such as toilets, bathrooms, kitchens and utility services including electricity and pipe borne water are shared among the multihhabited households. Sharing in housing has been viewed as a cost cutting measure which increases affordability and the judicious use of urban land (Tipple et al.; 1999 Schlyter, 2003; Andreasen et al., 2005). Ikejiofor (1998) studying sharing as a housing strategy in Abuja, Nigeria, observed that sharing among persons in single family dwellings reduce rent cost.

Multihabitation can be categorised into three groups, namely; sole occupation by members of the extended family as in ‘family houses’, mixed habitation of both family members and non-family members and lastly, multihhabited houses exclusively occupied by non-related tenants as in migrant houses. The compound house in Ghana typifies multihabitation with enclosed rooms around a central courtyard. Other
arrangements of multihabitation show single-room dwellings that are free-standing on
a plot of land. Various levels of interaction extending into the neighbourhood occurs
among households living under multihabitation. In coping with urban challenges and
managing everyday living, multihabited households rely on the existing social
interactions within the compound and outside the compound. Living under
multihabitation requires the bargaining of resources at some point in time. According
to Agarwal (1996), intra-household interaction contains elements of both cooperation
and conflict. However, Agarwal (1996:p4) contends that many different cooperative
outcomes are possible in relation to “who does what, who gets what goods and
services”. However, many issues arise from these interactions which often result in
conflicts. Inherent in multihabitation is conflict as a result of sharing and frequent
interactions among households.

Assimeng (2006) observed that social interactions under multihabitation are
characterized with conflicts, competition and cooperation. Facilities shared under
multihabitation are usually inadequate to cater for the occupants of a house leading to
conflict over use. Datta (1995) in a study on Gaborone observed that social interaction
between resident landlords and tenants often breed conflicts and tension as a result of
the close relationships existing within the house. In situations where the landlords
were absent, fewer tensions were present. According to Songsore and McGranahan
(1996), arrangements regarding roles, responsibility and power relations form the
basis of both cooperation and conflict within the household. The composition of
households in terms of age, gender, ethnicity, religious affiliation and social status are
all sources of conflict and competition among multihabited households. This situation
is usually managed through cooperation developed among households based on the
norms instituted by the landlord, head of the family or elected leader of the compound.

Regardless of all the conflicts associated with multihabitation, it has been recognized
as an efficient and economical means of addressing urban low income housing needs
in developing countries (Amole et al., 1993; Korboe, 1992; Tipple et al., 1998;
Pellow, 2002; Lekule, 2004; Andreasen et al., 2005; Wellington, 2008; Afram and
Korboe, 2009; Afram, 2009). The housing backlog in Ghana is estimated to be
750,000 housing units with an estimated annual demand of 150,000 (Sarfoh, 2010).
However, currently the annual housing supply stands at about 40,000 housing units.
The 2010 population and housing census indicate that about 51.1% of the total
population lives in compound houses. Rental unit from multihabited housing is still
the prime method of accommodating urban low income households in Ghana (Peil,
1994). This paper, using both qualitative and quantitative methods of data collection,
examines multihabitation as a housing strategy for urban low income households in
Ghana.

**STUDY AREA**

The study area, Greater Accra Metropolitan Area (GAMA), lies within the Greater
Accra Region of Ghana as shown in Figure 1. GAMA, being the capital city, is the
hub of political, economic and migrant activities of the country. Politically, the
activities of government is decentralised into districts, municipalities and metropolitan
areas. Each administrative zone is managed by a chief executive who is the head of
the local government.
The cosmopolitan nature and economic importance of GAMA have made it a destination for both inter-regional and intra-regional migration. GAMA has a total population of 3,756,423 out of the total regional population of 4,010,054 (GSS, 2012). Approximately 16.3% of the national population lives in GAMA (GSS, 2012). The population density for the Greater Accra Region is 1,236 persons per square kilometre (GSS, 2012). Bordered by the Gulf of Guinea at the southern side, the spatial expansion of the city is limited to only three directions, which are the north, east and west. GAMA displays diverse residential settlements ranging from low income settlements to middle-high income residential areas. Each residential settlement is a mix of migrants and indigenous people living in single and multifamily dwellings.

Multihabited houses comprise of indigenous family houses and compound houses in GAMA. The family houses are typically composed of a more indigenous population core of considerable homogeneity that is the Gas, while the compound houses are predominantly occupied by migrant households. However, some unrelated households tend to rent rooms from the family houses. Such households are expected to conform to the norms of conduct prevailing in the houses. Generally, the patterns of social relationships in family houses are closer than in compound houses. Again, the family head acts as the symbol of authority in family houses ensuring that there is some continuity to the mutual obligation of giving and receiving assistance from extended family members. The family head is saddled with the responsibility of efficiently managing all social affairs pertaining to the extended family members.

On the other hand, compound houses, predominantly occupied by migrants, are more heterogeneous in nature. In such houses one can certainly not choose his/her neighbours since only available rooms are given out to prospective tenants. Consequently, most neighbours are seldom related and display a mix of different ethnic background or social status. A relationship is developed out of keeping ‘good terms’ with each other. The migrant household experiences a social system which is characterised by conflicts and the absence of traditional forms of security. However, mutual assistance is provided to members of the house with each member recognising...
that their positions can alternate between a helper and needing help. This relationship is primarily directed towards achieving households’ livelihood outcome. In migrant compound houses, the landlord or landlady is usually the head of the compound exercising the power of administration and overseeing to the smooth running of activities in the house to ensure good cooperation among the households by instituting norms to govern the operations in the house. However, social activities within each household are conducted by the household head. If social activities need to take place within the compound, then permission is sought from the landlord/landlady. This is contrary to what pertains in the predominantly indigenous family houses where the family head has more control over the social activities held in the house.

SURVEY APPROACH

Using a cross sectional approach, a multistage cluster random sampling method was used in the sampling design (UNSD, 2005). The survey collected information from respondents in four communities namely James Town, Tema Manhean, Madina and Ashaiman. James Town and Tema Manhean are predominantly high density indigenous settlements with mainly family houses while the inner cities of Madina and Ashaiman are predominantly high density low class migrant settlements with overcrowded multihabited houses. The average household size is about 4 persons per household with one house surveyed in James Town having as many as 36 members sharing about six rooms.

The administered questionnaire captured information on the social and economic profiles of households by purposefully selecting the household head. In their absence, an adult representative was selected as the respondent. The household head was defined based on the spatial, functional and structural terms of a household (Yaro, 2004). Although the selected communities were generally classified as low class residential areas before 1999 (Songsore et al., 2006), some areas within Madina and Ashaiman are now well developed into middle to high class residential areas. However, the old settlements had mainly multihabited dwellings where the questionnaire was administered by trained assistant researchers. The survey was conducted in the selected communities from November 2009 to September 2010. In instances where the respondents could not understand the English language the questions were translated into two predominant Ghanaian languages (Ga or Twi) spoken in GAMA. Of the total sample, 34 households each were sampled from James Town and Tema Manhean, while 74 households each were also sampled from Madina and Ashaiman. In all a total of 216 households responded to the questionnaire.

In addition to the quantitative survey, a qualitative data collection method was conducted to gather information to confirm, disprove, support, ascertain, and explain trends and results obtained from the household questionnaires. In-depth interview guides and focus group discussions were employed during the data collection. These interviews were conducted outside the homes to give the respondents the free will to express themselves without any fear of being overhead by the landlord and ejected from the house. The perceptions and acceptability of multihabitation in urban low income housing provision was considered by looking at the interactions and informal social networks under multihabitation, sharing of space and conflicts under multihabitation, the level of satisfaction of households living in multihabited dwelling and the acceptability of multihabitation as a housing provision strategy in the twenty first century.

The survey approach and the number of respondents is summarized in Table 1 below.
Table 1: Summary of Data Collection Methods and the Number of Respondents

<table>
<thead>
<tr>
<th></th>
<th>Household questionnaire</th>
<th>Focus group discussions</th>
<th>In-depth interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons</td>
<td>216</td>
<td>15 and 18 persons for the groups</td>
<td>15</td>
</tr>
<tr>
<td>Number of groups</td>
<td>N/a</td>
<td>2</td>
<td>N/a</td>
</tr>
<tr>
<td>Number of residential areas</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Data processing began on the field while the survey was ongoing to check for completeness of data and perform quality control checks. The data collected from the household questionnaire was processed by first editing for consistency, completeness of all questions, and accuracy in answering questions correctly and finally edited for uniformity to check whether all questions were interpreted in the same sense by all informants. Next, coding was done by assigning a number to each answer which falls in a predetermined class and common characteristics. This was followed by the tabulation of the data in the Statistics Package for Social Sciences (SPSS). After the processing of data, they were summarised by organising them for analysis and interpretation. Microsoft EXCEL was used to graphically summarise and present the data for quick interpretation.

Using both inductive and deductive analysis, the qualitative data collected was transcribed and used as vignettes to explain real life situations. The qualitative data served as a method of validating some of the observed trends from the quantitative data analysis. In other cases, the vignettes were used to describe the current situation and perceptions about issues. These were validated through evidence drawn from secondary and primary sources by cross checking interview responses.

**RESULTS**

**Shared facilities**

From Table 1, bathrooms (62.8%) and electricity supply (62.5%) are the most shared facilities followed by toilet facilities (39.2%), waste collection (33.6%) and pipe borne water (32.9%). Kitchen (29.2%) and lobby (24.8%) are the least facilities shared in the house because most of these spaces have been converted into sleeping areas. As many as 46.8% of the respondents did not have pipe borne water flowing in their houses which means that households fetch water from community stand pipes or from wells from other houses. This research confirms what was observed by Arku et al. (2011) in four middle-low income residential areas in GAMA. The survey also revealed that about 38% of the respondents do not have toilets in their houses and they also use public latrines. Hence households use public baths and public latrines. In line with this, the AMA is building more public facilities to support what exist. About 35% of the respondents did not have access to lobbies or verandas in front of their houses.
The space hierarchy in multihabited dwellings indicates spaces that are public such as the compounds and courtyards, semi-private space such as the verandas in front of the rooms and private spaces within the rooms. According to Korboe (1992), the hierarchy of spaces introduces some minimal privacy for multihabited households. In some instances, some of the semi-private and public spaces have been enclosed and converted into additional rooms either by the landlord or by the occupants with permission from the landlord. About 33% of the respondents did not have access to kitchen facilities and in cases where there are kitchen, most of them have been converted to rooms. A question was asked about the sharing of kitchen in a compound house and the response received was;

“There are no kitchens, toilets and verandas in our house and many other houses in James Town because all of them have been converted to sleeping rooms. The issue is the land we occupy is insufficient for us to build kitchens and toilets. How can we have these facilities if the rooms in the family house are not adequate to cater for the expanding family members?”

Even if they are not occupied by family members, they are rented out by the family head so that they can make extra income to maintain the family house. Very few houses did not have bathrooms or shower places. There were no bathrooms specifically built for only males or females. They shared these facilities together.
Sometimes the heads of the house or family heads have their own locked facilities which they do not share with the rest of the household.

Sharing of household items is usually reciprocal in nature. Where the reciprocity is lost, conflicts occur and the person at the receiving end is described as a beggar. This creates a sour relationship among the households. Within the community, open spaces, alleys, community standpipes and toilets are shared as in Plate 2. Virtually every external facility outside the house is shared. The level of sharing also determines the level of interaction between households. This interaction could be positive if there are not many conflicts experienced through sharing.

Plate 2: Activities of multihabitation extends into the open spaces and alley ways

**Cleaning and Maintenance of shared facilities**

The female members clean the toilet, bathroom, courtyard and standpipe in the house and the male members supply the cleaning materials especially if they are bachelors. However, if a bachelor is courting and the girlfriend often comes to sleep over, then the girl is expected to take part in the cleaning of the house. Cleaning is done in turns by households or collectively. In a compound house, households are expected to clean up their debris immediately after food preparation and that no member should leave the rubbish to be collected by another household member. The male members take up the responsibility of maintaining the house.

The study found out that about 66% of the households rotated daily in cleaning the multihabited house as shown in Figure 2. Mothers and children are the main people who clean the house. About 29% of the households collectively clean the house and this sort of arrangement is prevalent in family houses. Others (5%) employed other means of the cleaning the house through hired labour and professional cleaners. Waste disposal in both the family houses and other multihabited houses are done through the hiring of the services of waste management companies.
Sharing, cooperation and conflicts

Figure 2: System of cleaning shared facilities in the house

From Figure 3, about 42% shared the responsibility of maintaining the house with other tenants and their landlord/landlady. About 30% of the respondents claimed that the maintenance of the house is done by a resident landlord and about 7% responded that it is done by a non-residing landlord. Just about 14% of the respondents claimed that maintenance of the house is done solely by the tenants. The results indicate that landlords were the major players in maintaining the shared facilities with tenants being co-players.

Figure 3: Maintenance of multihabited house by respondents

Contributions are made towards maintenance projects in the house as and when demanded. This takes various forms, the first is a monthly contribution which is saved and used for any maintenance that may arise in the use of the shared facilities and the second form is the collection of monies for a particular maintenance that is required. In this case, the cost of maintenance or repair of the item is estimated and shared among the households including the landlord. Another option of repairing and maintaining the house is through volunteerism. This form of maintenance usually takes place in family houses where most of the occupants are related. A working member could volunteer to repair the spoilt item. However, this will not be a major maintenance work.

About 6% of the respondents claimed that the houses they live in have not been renovated, repaired or maintained since they rented rooms from the house. These houses are mostly occupied by only tenants who do not consider themselves as responsible enough to maintain the house. Maintenance of the shared housing is mainly done during certain times of the year and they are tied to special occasions. Examples are the painting of the house during the ‘Homowo’ festivals, funerals and festive occasions. Sometimes social activities spill over into the open spaces within
the community. These communal spaces are collectively maintained by the members of the community through communal labour or contributions from individual households.

**Conflict in Multihabitation**

Conflict is a common occurrence within any human institution and as such conflict is inevitable and conventional in our everyday life (Kumar and van Dissel, 1996). Conflicts become pronounced when households have to share common facilities within a house and interact with other households. Although there are laid down norms and regulations guiding the living together of households in multihabitation, conflict is unavoidable. Conflict can occur over every activity or ‘action’ or ‘inaction’ that takes place in the house, for example from the way a person eats, cooks and even the time of waking up and playing music in the house.

There are different sources of conflicts in multihabitation, and these conflicts occur over various issues and at different times of the day. Conflicts can occur over what co-tenants have said or the mannerisms of households living together. However, it was deduced that conflict occurrence was prevalent in the mornings and evenings when shared toilets and bathrooms are in use and at the end of the month when utility bills need to be shared for payment. This subsection presents the sources of conflicts in a multihabited housing situation and how these conflicts were resolved.

When questions were asked about conflicts in a household survey, a majority of the households responded that they were not experiencing any form of conflict in living together and sharing facilities in the house. This was contrary to the response received during focus group discussions and in-depth interviews held with respondents outside their homes. Although the household questionnaire showed that there was very little conflict among households, the qualitative data collection with individual households revealed that the major challenge associated with multihabitation was the issue of conflict. This contradiction in the two forms of data collection was as a result of the uncomfortable location that respondents in the household survey found themselves. They were interviewed within their compounds with other co-tenants nearby or the landlord or caretaker present. Fear of being ejected made most of the respondents reply ‘no conflict’. However, when the respondents were interviewed outside their houses and at their work places and on neutral grounds, they freely confided that they were contending with conflicts within their various homes. It was also observed that the nature of conflicts within family houses and migrant houses were almost the same with very slight variations.

In multihabitation, conflict was two dimensional; between tenants and other co-tenants and between tenants and landlords. When it becomes unbearable the tenant moves out of the house to rent another place, otherwise the landlord or caretaker will ask the tenant to move out of the house for the sake of peace in the house, especially when it is perceived that he/she might be the cause of a regular conflict in the house. In other instances, some tenants and landlords have been compelled to take either the landlords or the tenant to the rent control department in Accra for a fair judgment to be passed on rent payment issues and the tenancy rights of the tenant or the ownership rights of the landlord.

During the in-depth interviews, both the male and female respondents agreed that women were the main source and channel of conflict in the house. This was because most men leave early to work and return late in the evening so there is hardly any
opportunity for them to pick a quarrel with a co-member of the house. On the other hand, women spend most of their day at home either getting the children ready for school, operating home-based businesses from the home or community or preparing evening meals. All these lead to more interactions between the women folk and other co-members of the house which easily bring about confrontation.

Conflict Resolution

Conflicts in multihabitation are resolved in four levels; at the household level, at the compound house level between the tenants and the landlord, at the community level and beyond the community level to the national level. The level at which a conflict is resolved depends on the nature and seriousness of the conflict. More domestic conflicts are resolved either at the household level, house (compound) level or at the community level. Domestic conflicts are defined as conflicts that occur over shared facilities within the compound and conflicts that occur through interactions at the house level. Sometimes when domestic conflicts involve inheritance problems then the legal courts are sought to resolve the conflict.

Female-headed households who are tenants tend to resolve their conflict through the landlords while more male-headed households who are tenants tend to resolve the internal conflicts among themselves. In very few cases tenants resolved their conflicts through other means such as refusing to talk to each other, resorting to legal actions, or seeking arbitration from the community leader or church elders. While a greater proportion of the female-headed lower quintile households resolved conflicts through their landlords, a greater percentage of the male-headed higher quintile households resolved conflicts also through their landlords.

Various avenues of conflict resolution were identified from the survey and the interviews. These include landlord-tenant arbitration, among tenants alone, involvement of community leaders, religious leaders and traditional authorities such as chiefs and elders and the legal courts. The avenue adopted depended on the nature and category of conflict described above. However, most of the conflicts in multihabitation are resolved through the landlord and among the co-tenants.

Perceptions of households

Conflicts in Multihabitation

Households were not enthused about the sharing of facilities such as toilets, bathrooms and kitchen on the same compound. They were of the opinion that the regular conflicts that occur among households were as a result of the use of shared facilities. They were also concerned about their health and cleanliness stating in a focus group discussion that,

“Many problems associated with compound house living is that other members do not clean the house very well especially the toilets. You have to do the cleaning always because you are particular about the cleanliness of the bathroom and toilet and that you do not want to get sick”.

This opinion was buttressed by a housing specialist in an interview, who claimed that, “Shared toilets and baths are not ideal in the face of public health issues. Culturally, younger children need their space and so do adults”.

Preferably, each household should have unshared facilities for its personal use and maintain them individually.
The survey found out that most of the compounds did not have pipe-borne water connection to the houses and some houses had separate electricity meters for each dwelling unit. However, most of the multihabited houses surveyed were sharing electricity and this was also another bone of contention between the landlord and the tenants. Commenting on the shared facilities in multihabitation, a member of a focus group said,

“Every household should have its own toilet facilities. The problem is that a co-tenant might not have a wife. I have a wife who has been doing all the cleaning in the house. This breeds quarrels among us”.

Another commented,

“Each family should have its own toilet, bathroom and kitchen. This is the only way to solve the problem (of conflicts). This is because every human interaction from different families having a wife and children in addition to sharing facilities would definitely lead to conflicts. You will want to live peacefully but another person might want to pick a quarrel with you”.

Citing his personal experience, a focus group discussant emphatically supported the notion that sharing facilities in multihabited houses was not desirable.

Dislodging of septic tank was also a source of conflict since it involved the contribution of money. In this case, the contribution was to be done per person including all children in the house and not at the household level. A woman bitterly recounted her experience. In her case, they were ten persons in her household and each person had to contribute an amount of ten Ghana Cedis. To her, it was cheating since her household alone was going to contribute one hundred Ghana Cedis while only one hundred and fifty Ghana Cedis was the amount needed to dislodge the septic tank.

While a lot of households had closed their toilet to tenants use, the few houses that allowed their use did not have adequate toilet facilities. This had led to indiscriminate dumping of faeces in big gutters, on undeveloped land and within the community. As an alternative solution to shared toilets, one household head in a focus group discussion suggested that well maintained and efficient public toilets should be built in the vicinity to supplement the inadequate toilet facilities in the multihabited houses which would be accessible at most times of the day. Other members of the focus group discussion maintained their argument that toilets should be available in the houses otherwise people would be tempted to indiscriminately dispose of faeces within the community and in waste dumps. Water was not an issue among the households because most do not have access to pipe-borne water.

Most of the female respondents emphasised owning their personal kitchen for privacy sake. Putting it explicitly, one female discussant said,

“In my opinion, each household should have its own kitchen. For example, if one day I do not have money and I am cooking or preparing soup, my neighbours would be spying on the kind of food or soup I am preparing and they will gossip about me. If you have your own kitchen, you can have privacy, cook whatever you want and eat whatever you want without being gossiped about”.

Interviews with policy makers and stakeholders clearly showed the divided opinions on the sharing of facilities under multihabitation. While some viewed the shared facilities as cost cutting measures, others contended that shared facilities were sources
of conflict in multihabited houses. Hence personal facilities such as toilets, bathrooms and kitchens should not be shared or at least there should be minimal sharing by fewer households.

Level of Satisfaction and Acceptability of Multihabited House

While households living in predominantly family houses were ordinarily satisfied with multihabitation living arrangement, households living in predominantly tenant houses with no blood relations expressed greater level of dissatisfaction especially with the sharing of facilities in the house. The complaint from one discussant was;

“There are many problems associated with compound house living arrangement. They do not want to clean the house and they leave the cleaning for only some particular households with children and women”.

Households kept on referring to ‘landlord-tenant” relationship as a source of conflict;

“The children of our landlord refuse to take part in the cleaning of the house expecting our children to always be doing the cleaning”.

The urban low income households perceived multihabitation as an affordable means of accommodating them. If households are given their own facilities with minimal sharing then they would prefer to live in multihabited houses because of the existing informal social networks and the support systems present. However, policy makers, housing experts and other stakeholders were divided in their opinions.

For those in support of multihabitation as an urban low income housing form in the 21st Century, they argued that these dwelling type have higher densities especially when they are constructed multilevel. Again the idea of multihabitation can bring about efficient usage of urban land, efficient provision of services and infrastructure, provision of more affordable housing and residential areas could be well planned to improve sanitation and provide supporting facilities such as schools and market. The chairman of the Architects’ Registration Council (ARC) supported the idea of multihabitation stating the benefits of the social support systems present in such multihabited houses being of great help to the households when coping with the challenges of urban life. Afram (2009) has argued that compound houses have a lot of social benefits and they are affordable to build. A policy maker however cautioned that,

“The development must ensure that households in a unit are homogenous and well sensitised through public education and community participation in the formulation of the policy”.

Housing experts and policy makers who were not in support of multihabitation in urban low income housing provision argued from the acceptability and sharing of space perspective highlighting the absence of privacy and existence of conflicts in such housing units. The executive secretary of the Ghana Real Estate Developers Association (GREDA) was of the opinion that multihabited houses were impractical and unmarketable. According to him the target group for buildings constructed by GREDA was the middle to higher income households who desire to have their privacy. This point was buttressed by one housing expert,

“I think it will be less attractive to the rich who often benefit from schemes targeting the poor. I see it as viable once it has the basic services including toilet, water and electricity for each household and it also fits somehow into our cultural setting”.

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An architect/housing advocate was of the view that land, planning laws and housing finance will be some of the challenges associated with the provision of multihabited housing in the 21st Century.

**DISCUSSION**

Housing design based on western building styles may not be the only solution to housing the urban poor (Asojo, 2010: 93). According to Asojo (2010), a successful design must respond to the form and function of the occupants’ housing needs. The social and cultural lives of the occupants need to be incorporated in the housing designs. Riemar and Demerath (1954) in earlier years noticed the relationship between housing standards and housing designs and the physical and human attributes of housing. A number of researches have shown the relationship between housing and quality of life and housing and socioeconomic status (Garcia-Mira et al., 2005; Arias and De Vos, 1996). It has been proven that good quality housing has a significant impact on the emotional and physical health of the occupants. Again, the kind of housing one occupies determines the social status of the person in a society.

Afram and Korboe (2009) quoting Sutherland (1981) reported of the “…considerable degree of cooperation ... and a higher (level of) social harmony within the neighbourhood than in other housing sectors” (pp.7) in spite of the high levels of crowding and the potential difficulties associated with multihabitation. However, in designing housing for the urban low income household, affordability supersedes all other requirements though these requirements are not relegated into the background. Riemar and Demerath (1954) have sounded a caution that, “Good housing is no one thing: it is a composite entity. Bundles of action and objectives become linked to bundles of housing conditions. One can investigate the effects of standards or design practices, but not their ‘ultimate’ desirability. There will never be a fixed point on any continuum of desirable effects that is not basically arbitrary”. This means that no housing design will be ‘perfect’ enough to address all the housing needs and challenges of the urban low income household.

Although the research highlighted issues regarding challenges in sharing, stakeholders were of the opinion that multihabitation may be an appropriate strategy that could help provide more housing units to solve the housing needs of most low income households. Generally, the low income households whole heartedly accepted the notion of multihabitation in urban low income housing provision because that would provide affordable housing. However, they were emphatic that drastic changes are needed in the design of such a dwelling space. To them, adequate space in terms of an average of three rooms was the first requirement while the second requirement was an unshared kitchen and bath for the female respondents and adequate community toilets for the male respondents. Ideally, each unit should have its own toilet, bath, kitchen and electricity supply. However, the major challenge was the cost of building such units.

This stance adopted by the users was supported by the policy makers, and housing designers who were also of the opinion that sharing should be minimal but courtyards and, veranda could be shared. The housing advocates contended that the cost of constructing such housing units would be high and that sharing of the toilets, baths, and kitchen cannot be avoided. However, the private housing developers were emphatic about the unprofitability of such housing units asserting that it should be the responsibility of the government and not private developers. Provision of low income houses should be considered as social housing.
Concerning the design of such buildings, the ARC felt that terraced houses, apartments, condominiums, will accommodate more people and judiciously use urban land. Again, the designs of the multihabited houses should be culturally sustainable taking into consideration the cultures and cooking habits of the occupants. A report by the UN Habitat (2011) highlights some challenges in living in condominium housing in Ethiopia. The condominiums built were not serving the cultural needs of the households and this led to high levels of dissatisfaction among occupants. Most households held the opinion that even if you build your own house, it eventually became a family house considering the traditional cultural practices of extended family system.

Where households had to share facilities, households advocated that there should be a clearly defined maintenance schedule. They were also of the opinion that if fewer households were sharing facilities, the level of conflict associated with it will be reduced. However, there were suggestions that community toilets, baths and standpipes should be provided to supplement what is in the houses.

This notwithstanding, the construction of multihabited housing with shared toilets, bathrooms and utility services is decreasing in GAMA. The reasons for the shift away from the traditional multihabited houses in the housing fabric has to do with the liberalisation policy of Ghana government playing the facilitative and regulative role and allowing the private sector and individuals to construct houses. Again, detached and semi-detached bungalows are increasing because people living in such facilities are bestowed the highest status in society. Acculturation and its influence on spatial organisation cannot be left out. Compounds are viewed as old fashioned and traditional by the younger generation and housing preferences and tastes have changed in Accra due to changing cultural attitudes. A shift away from compound houses is also attributed to their limited economic value. For example, they cannot be sold out, and a family house is owned in common indicating multiplicity of co-ownership (Grant, 2009). Many of these houses are concentrated in the inner and older parts of the city making them unattractive to investors. Unfortunately, national urban housing policies aim to increase the number of single household dwelling units rather than multihabited housing.

**CONCLUSION**

In conclusion, sharing of facilities in multihabitation and regular interaction among households in multihabitation can result in conflicts. However, all the respondents of the focus groups concluded that the benefits derived from the cooperation and the interactions associated with multihabitation far outweighs the disadvantages of conflicts associated with multihabitation.

Multihabited dwellings including indigenous family houses and tenant compound houses are mainly found in the built up areas of the city centres. Very limited land or virtually no free land is available for ancillary development such as toilets and bathrooms. It is thus a huge challenge for owners and housing developers to make any improvement to such houses. It is recommended that urban infilling approach should be used to address the issue of expansion through vertical development. Suburban development of urban low income housing will also increase the supply and decrease the cost of production since suburban lands are usually lower in cost. It was also observed that urban low income housing units lacked proper arrangement of rooms and basic design principles leading to low quality dwellings. It is suggested that professional bodies such as the Ghana Institute of Architects, Ghana Institution of
Engineers, Ghana institute of Planners and other professional bodies should offer free design advice as part of their corporate social responsibility which will go a long way to improve the housing and livelihoods of the urban low income households.

REFERENCES


Grant


SICK BUILDINGS SYNDROME, HEALTH ISSUES AND LIFE EXPECTANCY OF RESIDENTS IN NIGERIAN CITIES

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Sick building syndrome (SBS) is a building phenomenon in research which is a building related concern today. Amongst the repercussion of the building related concerns are health issues such as Building Related Illness (BRI) on the occupants of such ill-constructed buildings. Where not detected and treated early enough would ultimately lead to reduction in the life expectancy ratio of residents in cities and metropolis. Therefore the focus of the study was to examine sick building syndrome (SBS) with all its health implications in order to recognize and document it as one of the causes of reduction in life expectancy ratio in Nigerian cities. The paper has attempted to provide some form of remedy to the growing phenomenon. Hence, the research was conducted using descriptive documentation and experimental/qualitative approaches to explain observations in the research. Conversely, the knowledge and awareness generated on the danger in building material for different climate and environment documented in the paper will improve consumers, manufacturers and property developer choices.

Keywords: sick building syndrome, health issues, life expectancy ratio and Nigerian cities

INTRODUCTION

In recent years, a large number of incidents have been reported where occupants' health and comfort problems have been associated with their homes or with the buildings where they spend part of their time. These problem cases have normally been attributed to one of two different situations: Sick-Building-Syndrome (SBS) or Building-Related-Illness (BRI) (WHO, 1989). Research has shown that building materials play a significant role in causing these problems (Gustafsson, 1992). In the case of BRI, it is possible to find the cause of illness or a problematic situation linked directly to the building and in many instances, even to the material causing the effect. In the case of SBS, it is difficult to find a direct connection between a single cause and the problems associated with health or discomfort. It is observed that air pollution originating from building materials, is at least one of the causes of health issues/discomfort amongst several others. Thus, indoor air pollution (IAP) and its sources, caused by building materials, and other factors in the indoor space can be

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considered as possible causes of both BRI and SBS. The way building materials are handled is a major determinant of people health and the health of the natural environment, therefore the study focuses on how sick building and building related illness affects and reduces life expectancy (longevity).

**STUDY OBJECTIVES**

The study focused to emissions (chemical contaminants) from building material usage like volatile organic compounds (VOCs) and Indoor air pollutant (IAP) which is one causes of SBS and has potentials to affect health, well-being and therefore reduces life-span. But in order to examine SBS consequences on life expectancy of residents in Nigerian urban centres, the paper has identify all the illnesses associated with a sick building, the factors causing SBS and health implications of such illness, determine its preventions and possible remedy to such ailments that increase the life expectance in Nigerian cities. Most building materials emit VOCs and IAP such as acetone, heptane and many other metabolic products like formaldehyde, paints and lacquers and toxins. VOCs emission is five times more likely to be found inside the home than outside, the proposed procedure will enable building professionals, manufacturers, consumers and other decisions makers to develop and select better products with lower and safer emission levels. This will improve indoor air quality and reduced energy wastage, promote sustainable development and improve health and comfort thereby increase longevity.

**CLASSIFICATION OF EFFECTS OF SICK BUILDING SYNDROME**

Sick Building Syndrome (SBS) explains a situation in which the occupants of a building experience acute health or comfort-related effects that seem to be linked directly to the time spent in the building. The occupant may be in a particular room/section/spread throughout the building. SBS defines a range of health challenge that can occur through exposure to pollutants inside a home, office or other building. It usually related to poor Indoor Air Quality (IAQ) and can be caused by mold, radon, smoke or any number of chemical, biological and environmental pollutants. The SBS can be classified into major groups (Purushottam, 2001). According to life wellness (2004), the health conditions associated with buildings can be classified into three;

**Sick Building Syndrome (SBS):** this is the first type of classification. The symptoms of SBS includes headache, ear, nose or throat irritations, nausea, dry cough, fever, dry and itchy skin (skin irritations), fatigue, dizziness and sensitivity to odours, difficulty in concentration, hoarseness of voice, allergies, cold, flu-like symptoms, increase incidence of asthma attacks and personality changes. It reduces work efficiency and increases absenteeism. Most times occupants report relief soon after leaving the building, although lingering effects of neurotoxins occur (Shoaf, 1991). The second classification is **Building Related Illness/Disease (BRI)** is used when the symptoms of the diagnosable illness are identified and traced directly to airborne building contaminants (Levy and Lunau, 1990). The symptoms are cough, chest pain, shortness of breath on mild exertion, edema, palpitations, nosebleeds, cancer, pregnancy challenges and miscarriages. The extrinsic allergies alveolitis, legionnaire’s disease, humidifier fever, pneumonia and occupational asthma do also occur. These symptoms have clearly identifiable causes and can be clinically defined (Wolverton, 1990). The recovery time after leaving the building may be prolonged and the third type of classification is **Building Associated Symptoms (BAS).**
However, the symptoms of SBS are common amongst the urban poor rather than the rich, people doing clerical jobs rather than people in managerial jobs because of better working conditions. It is common in females rather than in males probably because females are more in secretarial jobs and more susceptible to the effects (Phoon, 1988). The symptoms are ramped in air-conditions buildings rather than in naturally ventilated buildings and are common in a public building rather than in a private building.

**FACTORS CAUSING SICK BUILDING SYNDROME**

There are diverse contributing factors primarily responsible for SBS which includes design of built environment, disregard of building laws and regulation, haphazard informal settlements, non-functional building design (i.e. inappropriate lighting/limited access to natural daylight, inadequate ventilation, bad acoustics, poor furniture and equipment and poor ergonomics), biological contaminants and chemical contaminants. One the main cause of SBS is chemical contaminants resulting from VOCs, and other chemical compounds emissions from building materials and environmental pollutions (Sick Building Syndrome, 1997).

**Design of Built Environment** When an environment is not properly laid out, planning becomes inappropriate resulting in sprawling building and eventually slums. The effects of such settlements are SBS, BRI and Building Associated Symptoms (BAS), because the kind of buildings found here are poorly designed, policies on building laws and regulation ignored and the built environment is haphazard and unfit for living. This is typical of most Nigerian cities (like Lagos, Ibadan, Port Harcourt, Benin, Warri and so on) and African cities in general. Such environments are threat to life.

**Psychological Factors and Neglect of Building Laws and Regulation** It has been observed over the years that poor interpersonal relationship, excessive work stress or dissatisfaction and poor communication are often associated with SBS. Most land and house owners in Nigerian cities, due to “Omo-onile” syndrome, ignorance and greed, disregard building laws and regulations during the sales and construction of landed properties, the space for set-backs, building line and part of the access road are sold. Successively, there are congested built environment resulting in poor ventilation, inadequate daylight, poor road network and dirty and bad drainage. Therefore occupants suffer from SBS, BRI and BAS which are threat to life expectancy ratio in Nigerian cities.

**Haphazard Informal Settlements** The issue of urban poverty and shortage of housing stock in Nigerian cities due to rural-urban migration amongst other factors has resulted in indiscriminate spring-up of informal settlement in our cities. The challenge is having its toll on the housing quality in cities. However it is impossible to comment on SBS, BRI and BAS without mentioning the way houses are designed. Meanwhile the design and construction of houses determines the housing feature of a city’s settlement. Therefore, the effect is a haphazard informal settlement with ill-designed houses which is one cause of SBS, BRI and BAS threatening life expectancy ratio in Nigerian cities.

**Non-Functional Building Design** In Nigeria, there are several factors that contributes to non-functional building designs, like lack of profession consultation, poverty, lack of awareness, poor orientation and many more. However the courses of non-functional design are limited access to natural daylight, inadequate ventilation, bad acoustics, ill-designed furnishing, furniture and equipment, poor ergonomics and wrong use of
building materials. An example of a non-functional architectural plan is “the central corridor design” otherwise known as “face me I face you”. This house type litters the residential landscape of Nigeria major cities. It is preferred by occupants (urban poor) on the short run because it contains more bedrooms and cheaper to rent. While for the commercial home owners it is easy to build, cheaper to maintain and easily yield return on investment (ROI). On the long run for occupants non-functional design causes SBS, BRI and BAS which are threats to life in Nigerian cities.

**Fig1a &1b: A Typical Floor Plan of a Central Corridor House (“Face Me I Face You”)** Source: Ekhaese, 2011

**Biological Contaminants** The biological contaminants includes pollens, bacteria, viruses, fungus, molds, etc. these contaminants can breed in stagnant water that has accumulated in humidifiers, drainpipes and ducts or where water has collected on the ceiling tiles, insulations, carpets and upholstery. Insects and birds droppings can also be a source of biological contamination. Biological contamination causes fever, chills, cough, chest tightness, muscle aches and allergic reactions. In offices with high density of occupants, airborne diseases can spread rapidly from one worker to another. Air-conditioning systems can recirculate pathogens and spread them throughout the building e.g. legionnaire’s disease due to legionella organisms. (Redlich, et al, 1997)

**Chemical Contaminants from Building materials**

Exposure to emission from building materials affects the skin, the mucous membranes in the eyes, nose and throat, and sensory system. These effects may be caused by formaldehyde compounds and VOCs such as acetone; benzene; toluene; cyclohexane; nhexane; styrene; chlorinated and other solvents, that are emitted by many indoor building materials (e.g. paints, stains, adhesives, walling materials, flooring materials, ceiling materials, binders, door and window materials). Chemicals may affect the mucous membranes directly by their sensitizing and irritating effects or by increasing the effects of allergens, infectious agents or other irritating substance. Such as interactions of fiber glass and styrene on airway irritations (Molhave et al., 1986, 1991) and between bacterial and viral infections (Kjaergaard et al., 1989, 1991). Effects on the nervous system can be produced by several organic chemicals present
as pollutants in the indoor environment. Several of such chemicals are neurotoxic, but their general effects have only been shown at exposure levels in occupational settings (Harving et al., 1991). Most available information is derived from observations, studies on human or experiments from the range below which “No-Observed Effect Level” (NOEL) up to exposure that have cause death within minutes. Most contemporary “Occupational Exposure Limits” (OELS) are health based and sets from the NOELs with safety factors or from other similar source of information on human effects. Paint as a building material is hazardous to health because it contains lead. All categories of paints are leaded, Lead-based and Lead-containing. Lead as a toxic metal cause extensive environmental contamination and health problems in many parts of the world. Human exposure to lead is estimated to account for over 143 000 annual deaths and 0.6% of the global burden of disease (IAQ Publications, 2009). Lead is a cumulative toxicant that affects multiple body systems, including the neurological, haematological, gastrointestinal, cardiovascular and renal systems. Children are particularly vulnerable to the neurotoxic effects of lead, and even low levels of exposure can cause serious and, in some cases, irreversible neurological damage. Childhood lead exposure is estimated to contribute to about 600 000 new cases of children with intellectual disabilities every year (ECA, 1997). Lead can cause a variety of serious adverse health effects. In children, even low levels of lead increase a child’s risk of developing permanent learning disabilities, reduced concentration and attentiveness spans, and behavior problems. Adverse health effects may occur before the appearance of any symptoms. Symptoms include loss of appetite, difficulty sleeping, irritability, fatigue, headache, moodiness, joint and muscle aches, and metallic taste in the mouth. High levels of lead concentrations can result in severe damage to the blood forming, nervous, urinary, and reproductive systems of the body. Lead poisoning from leaded paint typically occurs due to the ingestion of leaded paint or lead-contaminated dust into the body through the digestive system or inhalation. Immediate symptoms of exposure to polluted air can include throat irritation, dizziness and headaches. Long-term health risks may include respiratory disease, heart disease and even cancer. From the classroom to the cubicle, students in schools with healthy air are more proficient at retaining information and teachers have fewer sick days. For employers, improving indoor air quality directly correlates with higher productivity and a more satisfied workforce. VOCs poor air quality for occupants and reduce utility costs for building owners, causes Temperature and Odor in Indoor of Building. Other effects include: Environmental Issues, Occupational Safety Issues and Residential Structures.

**STUDY METHODOLOGY**

After outlining various causes of SBS, the study identifies internal spaces in residential houses, office spaces, institutional building in order to measures the effects Building contents/materials on occupant health. The paper has adopted the evaluation method to detect the chemical contaminants in building materials. For the purposes of this discussion, residential buildings are government owned or rented family housing, child development centers, family child care homes, schools, playgrounds and similar facilities. Non-residential structures include office buildings, warehouses, water towers, etc. The area for evaluation and chemical analysis includes: Walling Materials, Flooring Material, Surface Preparation and Finishes like: Paint, Hazardous Air Pollutants, Binders, Heavy Metal-Containing Pigments and Additives, Plumbing and solder, etc.
STEPS FOR EVALUATION OF BUILDING MATERIALS

According European Collaborative Action (1997) the evaluation of VOC emissions from building materials with respect to their effects on health and comfort may be broken down into five main steps. An inexpensive procedure for the chemical analysis of VOC emissions has to be established for emission factors of individual VOCs and of TVOC (Total Volatile Organic Compounds).

**Step 1:** Small test chamber measurements of chemical emissions from solid materials have shown acceptable results for some purposes, measurements of emissions from pasty or liquid materials still show unacceptably large disparities.

**Step 2:** The evaluation process requires the definition of an exposure scenario which is relevant for the purposes of the evaluation. For indoor spaces where people spend part of their time, the scenario should provide standard values for all exposure related environmental parameters, such as room area and volume, type and amount of materials and/or activities in the spaces, ventilation and temperature. Based on the selected scenario, on the emission rates determined in step (1) above, and on time activity patterns, models may be used to estimate exposures of occupants to chemicals. Although exposure models for relatively complex scenarios have been proposed, only models for very simple scenarios have been validated.

**Step 3:** Chemical exposures estimated in step (2) have to be evaluated with respect to their potential health effects. For this purpose, relevant toxicological data have to be collected. Currently, only limited data exist on the effects of individual compounds, on effects of mixtures of compounds, and on validated methods for their estimation. This situation requires there be a number of approximations and the introduction of safety margins. Currently, the proposed evaluation procedure is for building materials, because the availability of chemical emission data for these materials creates the possibility of testing the consequences of the proposed toxicological evaluation. However, it can be applied to other building materials with minor modifications. VOCs may have effects on the human senses even at concentrations that are not detectable using the current chemical measurement techniques utilized in step (1) above. With present knowledge, sensory effects of many VOCs and to a greater extent those of their mixtures cannot be predicted from concentration measurements. It is known that such effects play an important role in the reaction of humans to indoor VOC pollution (Mprlhave, 1991).

**Step 4:** Sensory evaluation by test sections is required in order to assess the perceived quality of VOC emissions. Whereas the chemical characterization is widely applied, and generally accepted (although not completely validated) methods are available, sensory evaluation of emissions from building materials is still a matter of discussion and for the time being, no generally accepted methods exist. In particular, modeling of perceived air pollution in real environments based on sensory emission measurements is an unresolved problem. Difference in quantity of available knowledge becomes also visible in the study where sensory evaluation has been treated in a section whereas by contrast, chemical evaluation can be found in different studies related to emission measurement, modeling and evaluation.

**Step 5:** A rule or a scheme has to be developed on how to use the information obtained in steps 1-4 to characterize or label building materials with respect to the potential impact of their VOC emissions on human health and comfort. ECA, 1991)
EVALUATION OF THE EFFECTS OF VOC EMISSIONS ON HUMAN HEALTH

Analysis has shown that Indoor air pollution (IAP) in buildings such as residences, offices and schools, is widely recognized as an environmental risk to human health. IAP may consist of a complex mixture, volatile organic chemicals (VOCs), Environmental Tobacco Smoke (ETS) and other combustion products that may affect human health and comfort in many ways. Exposure may affect the respiratory system, the immune systems (NKB, 1993), affect reproduction, affect the skin and mucous membranes, affect the nervous system and increase the risk of cardiovascular diseases (ETS and GO) (ECA, 1991). Thus Very few of the VOCs emanating from building materials have been evaluated for toxic effects when appearing in mixtures. Available information is derived from observations and studies on humans or experimental animals exposed to single chemicals at concentrations ranging from those below which “No-Observed Adverse Effects Level” are observed (NOEL or NOAEL), up to exposures that have caused death within minutes. It should be noted that even for single substances, very few toxicological data are available for the vast range of VOCs likely to be emanating from building materials. The toxicological evaluation of chemicals requires that dose-effect and dose-response relationships are established. These are used to identify the thresholds of toxic action or 'No Observed Effect Levels' (NOELS). Together with exposure estimates and assumptions on the sensitivity of the exposed population, these thresholds are then used for defining “Occupational Exposure Limits” (OELs), “Air Quality Guidelines” (AQGs) or other regulatory or guideline values for individual chemical compounds. Exposure limits are usually expressed as concentration thresholds, whereby concentrations are mainly averaged over daily exposure duration (8 hours for OELs, 24 hours for AQGs) and where the days of exposure per week (5 days for OELs, 7 days for AQGs) are taken into account. Most contemporary OELs are health based and set from the NOELS with safety factors or from other similar sources of information on human effects. Non-occupational air quality guidelines are available for only a few indoor pollutants (WHO, 1987). The setting of such guidelines is a tedious process which will take years. Until then, OELs are the best available starting point for deriving substitutes of indoor guideline values for VOCs. However, because in indoor situations exposure may last 24 hrs./day, 7 days/week and the exposed population includes infants, the elderly and sick as well as healthy adults, the application of additional safety factors is required (WHO, 1987; Shoaf, 1991; Nielsen et al., 1995, 1996).

When dealing with emissions from building materials, multiple chemical exposures is the rule rather than the exception. Therefore, interactions must be considered. There are very few available data on toxicological interactions obtained from controlled multiple exposures, although in early toxicological studies additive joint toxicity was found for most combinations of commercial organic chemicals (Smyth et al., 1969). As a result, several organizations including the (American Conference of Governmental Industrial Hygienists (ACGIH) have adopted the additive approach for deriving occupational exposure limits for mixtures as a "rule of thumb" (ACGIH, 1996). Recently, scientific arguments have been brought forward in favour of additivity for respiratory tract effects of non-carcinogenic pollutants at the low concentration found indoors (Nielsen et al., 1995). Therefore, in the absence of other specific information, it is reasonable to adopt such an "additive" approach for complex low level exposures. It is practical and probably affords a reasonable degree of protection (Levy and Lunau, 1990). Applying this approach for determining the toxic potential of a mixture of...
compounds, the concentrations of individual compounds divided by their respective air quality guideline values or their replacements are added. Typically indoor air contains many VOCs each at a low concentration (few micrograms/m³). In view of the limited number of VOCs for which experimental toxicological data exist and for which OELs have been established, various models have been proposed for predicting toxicological data. These include Quantitative Structure-Activity Relationship (QSAR) models and "guesstimates" based on the similarity of chemical structures. When exposure limits are not available for a chemical substance, it seems to be reasonable to use as a provisional proxy-estimate of the exposure limit, the one established for the most similar chemical compound. Among the methods suggested to predict toxic properties of chemicals, a mouse assay has been used for detecting upper respiratory tract irritation (Alarie, 1984). However, this approach has limited use for the purpose of predicting more general toxicological properties. A practical way to assess exposure to VOCs consists of measuring the total concentration of VOCs. TVOC have been measured for various purposes using different techniques which give different results. A new definition of TVOC is presently being developed by an ECA “European Collaborative Actions” expert group; this definition will be substituted for the one existing as soon as it becomes available. There is a consensus that it is not possible to define an effects based threshold for TVOC. However, there is an agreed need for improved source control to reduce the pollution load on the indoor environment from health, comfort, energy efficiency and sustainability viewpoints. Therefore, TVOC levels in indoor air should be kept “As Low As Reasonably Achievable” (ALARA) and should not exceed the typical levels currently found in non-industrial buildings, i.e. 0.1 - 0.5 mg m⁻³ (Krause et al., 1987, 1991). In order to maintain levels at the lower end of this range, the contribution from a single material should be limited. In the test, 5 mg m⁻³ after 3 days and should have fallen to 0.2 mg mm³ after 28 days. Such limits are intended to encourage the production of low-emitting materials.

When assessing health risks from chemical exposures, the duration of the exposure (whether short term or long term) has to be taken into consideration. In the case of emissions from building materials, consideration has to be given to both exposures resulting immediately after the application (which has traditionally given rise to complaints by the exposed occupants), as well as to exposures occurring weeks or months later, which is representative of the long term emission that may continue for the lifetime of a material. Many health effects are not related to single exposures triggering an acute response, but are chronic and induced either by bioaccumulation of a toxicant reaching a critical level in the target organ or tissue, or by repeated exposure causing acute episodes which ultimately lead to a chronic response. For the purpose of developing the evaluation procedure proposed here, the following groups of VOCs have been distinguished: (a) Known or suspected human carcinogens - The carcinogenicity of chemicals to humans can be derived either from human studies or extrapolated from animal studies. As a result of such assessments, the chemical substances have been classified by different organizations into various groups expressing different potential risks for man. The criteria for such classifications are not universally agreed upon, and this has resulted in the development of different classification schemes by, for example, the E.U., the IARC and the U.S. EPA. The cancer risk linked to exposure to carcinogens can be quantified by using the "unit risk" concept
applied by the U.S. EPA and (WHO, 1987). Unit risks are defined as the excess risk caused by exposure to the unit concentration (LPG m$^{-3}$) of a substance over a lifetime. Although there are uncertainties in the accuracy of “Lifetime Unit Risk” (LUR) estimates, the LURs can be helpful in public health as they allow at least a relative quantitative assessment of risks. For the purpose of the evaluation procedure proposed here, it was considered appropriate to use the EU scheme which classifies the carcinogenic substances in three categories (EU, 1994). For the substances belonging to categories 1 and 2, the unit risk concept will be applied. Substances of categories 1 and 2 considered to be relevant to this work are those potentially present in VOC emissions.

**SENSORY EVALUATION OF EMISSIONS FROM BUILDING MATERIALS**

The use of human observers is an indispensable tool for the measurement of sensory effects of indoor air quality because chemical analysis cannot be used to predict how chemicals will be perceived. Moreover, chemical methods of characterization are usually unsuitable or insufficient for integrating different types of sensory exposures and effects. Therefore, sensory methods are the only tools available for evaluating perceived air quality. Ideally, the final goal of the sensory evaluation of emissions from building materials would be to predict from laboratory evaluations or guidelines would provide the criterion for labeling or classification of the material. However, models are required for predicting human reactions to real life exposures from the results of laboratory tests of individual materials. These models are required to transform sensory source characterizations in small scale settings into sensory characterizations of indoor air quality in full scale, to predict the relation between sensory responses and air pollutant concentrations. To predict the sensory perception of emissions from a combination of sources using measurements made individually for each contributing source; and to predict occupant responses in buildings using test panel responses in the laboratory. At present no widely accepted and validated models for all of these purposes exist. Therefore, only in exceptional cases will laboratory evaluations be useful for an estimate of the consequences of a building material emission for the perceived air quality in actual environments. For these reasons, there are no guideline or target values for the sensory effects of material emissions. A further complicating factor is that several approaches are described in the literature and used in practice to study the perceived air quality of building material emissions (Berglund and Lindvall, 1979; VDI, 1986; Fanger, 1988; Gunnarsen et al., 1994, Knudsen et al., 1996). Some are based on old factory measurements whereas others are intended to measure a broader range of perceptions; furthermore the approaches are not inter-calibrated. Discomfort (or acceptability) attributed to air quality reflects not only perceptual information but also depends on psychological and social values. Therefore, reliable measures of discomfort (or acceptability) are not easily achieved since the outcome, to a large extent, depends on context factors and calibration is difficult. However, a reasonable assumption is that the perceived intensity of odours plays the major role in the generation of odour discomfort. Considering the problems outlined above and in view of the fact that not all relevant open questions can yet be answered, the European Collaborative Action (ECA) Steering Committee has decided to establish a separate Working Group to address and hopefully answer these questions. Consequently, for the purpose of the procedure proposed in this paper, a simplified, provisional approach to the evaluation of sensory emissions from building materials is presented in the following.
**TESTING OF SENSORY IRRITATION AND ODOUR OR PERCEIVED AIR QUALITY**

The general requirements for sensory emission tests include: Size and supply of material specimens, Minimum airflow and test specimen area: Test chamber cleanliness and Exposure equipment. The purpose of the evaluation procedure proposed in the paper is to identify "healthy" building materials. The emissions into indoor air of these materials should not induce sensory irritation. However, due to the large variations of sensitivity in the population (also including hypersensitive subjects), the requirement cannot be satisfied in absolute terms but needs to be specified in terms of a defined maximum percentage of the population that perceive sensory irritation from the material emission. In view of the lack of sensory emission standards and related standard measurement methods, it has been deemed appropriate to base the evaluation criterion proposed here on the recommendation World Health Organization (WHO, 1989) that indoor air pollution sources should not cause more than a maximum of 10 % of building occupants to perceive sensory irritation. Accordingly, a material will only be eligible for receiving a label based on the proposed procedure if not more than 10 % of the test panel members (i.e. not more than one out of 10-15 panel members) assessing the material emission perceive sensory irritation. Chemical emissions are usually highest for new materials and decay with time, but because people installing materials should be protected from irritation, the sensory irritation test should be made as early as possible in the test procedure. Nevertheless, the members of the test panel members should be protected from inhaling carcinogenic compounds. Therefore, the test has to be performed on the third day of testing (3rd day after the introduction of the test specimen in the test chamber). Further the material has to be tested with clean air flow through the test chamber corresponding to an area specific ventilation rate q, [m³ h⁻¹ m⁻²] and the same as selected for the evaluation of chemical emissions. The test conditions are intended to reflect low-medium ventilation rates. The perception of sensory irritation, contrary to perceived odour, may increase with exposure time. The increase will not be detected by only exposed for a short time. There is no standard method for characterized odour and/or perceived air qualities caused by material emissions nor are there guideline or limit values for the sensory effects of these emissions. Moreover, in contrast with sensory irritation, odour and air quality whilst causing discomfort for some people may be perceived as indifferent or even pleasant by others. Hence, it was not deemed appropriate to exclude materials from labeling based on the mere detection of these sensory characteristics. On the other hand, strong and longer lasting odours may not be tolerable to most people and the presence and/or strength of odorous emissions may be an important argument for the choice of building materials by consumers. Therefore, the evaluation procedure of material emissions described here has to include, on the 28th day of testing (28th day after the introduction of the test specimen in the test chamber), a sensory test of odour or perceived air quality. The result of the test should enable consumers to compare the emissions from different materials, or to rank the materials, with respect to odour detectability, perceived odour intensity, percentage of test panel members dissatisfied with the perceived air quality or equivalent quantities. However, at present, it is up to the authority or body establishing and/or granting a label to select and prescribe an appropriate test method among those described in the literature and used in practice to study odour and/or the perceived air quality of building material emissions.
REMEDY OF SICK BUILDING SYNDROME

The study examined remedy in two ways, firstly the solution to SBS, BRI and BAS and secondly the prevention and control of the causes of the building related sickness. The paper though focused on how to evaluate building materials in order to determine the chemical emissions and contaminants. This is intended to help consumers of building materials to make informed choices. But there are other causes of SBS, BRI and BAS that needs attentions, therefore occupants, home owners, building professional and policy makers need the right information about the remedies of the causes of building related sicknesses and discomfort. Hence they are documented for future references and further studies.

a. SOLUTION

Ensure access to natural daylight and opening of windows for ventilation (if there are any) can help give the occupants a feeling of control over internal environment.

Wherever possible, source of pollution should be eliminated or relocated and if the pollutant source is easily identified, removal or modification is required.

Policy must be formulated to control haphazard informal settlement and machineries must be established to drive compliance and implementation of the policy.

Task force should be prepared to drive strict compliance to Building Laws and Regulation informal settlements.

Ensure the use of non-sustainable and non-ecofriendly materials and the need to develop community consumer initiatives and regulatory processes to support these reforms. (Bluyssen, et al 1997)

b. PREVENTION AND CONTROL

Education and communication: are key aspects of any air quality management programme, in order to work more effectively and efficiently to prevent and resolve the health challenges faced by sufferers of SBS, BRI and BAS, educational and awareness programmes should be organized frequently by the agencies concern to enlighten occupants, home-owners, building professionals and land-owners.

Legislation: Habits and sources of pollutions that cause distortion of airflows and ventilations in in-door spaces should be ban and removed respectively. Laws prohibiting use of pollutant substances, chemicals and building materials in internal spaces should be implemented.

Research: Field/fields of study should be evolved in built and human environment studies to manage issues evolving from building related illnesses.

Increase the Ventilation Rate and Air Distribution: Buildings in tropics (e.g. Nigeria) require designing with opening for cross and true ventilation to allow maximum natural inflow. Where it near impossible owing to the immediate environment, heat ventilation and air-condition (HVAC) system should be operated and maintained to ensure that the desired ventilation rates are attained. If there are strong pollutants in the internal spaces in homes, offices etc., and the air may be directly vented to the outside. The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) recommend a minimum of 8.4 air exchange per 24hours.
Air cleaning and control air pollutants: Air cleaning can be executed by ensuring uncongested interiors with open office designs, use of glass and skylights that gives access to natural light, terrace garden, community spaces and indoor plants that absorbs carbon monoxide and formaldehyde from that air. Air filters are also effective in removing some if not all pollutants.

Removal or modification of pollutant source: This is done through routine maintenance, replacement of damage/affected building materials (floor, ceiling, roofing and walling), avoiding use of wrong building materials and unplugging idle devices, venting contaminants to the outside and using pollutants sources in periods of low or no occupancy and allow time for building materials in new houses to be off-gas pollutants before occupancy.

Beautification of the environment by planting clean air plants: With technological advancement and energy efficient attitudes, building are becoming airtight culvert of germs and toxins. Building occupants are experiencing symptoms of SBS, BRI and BAS. The environmental protection agency has reported that sick building causes an estimated loss of over $61 billion a year due to reduced productivity, medical costs. Plants have been proven to be important life supporters in the removal carbon dioxide from the air and release oxygen through the process of photosynthesis. National Aeronautics and Space Administration, (1999) studies found that plants also work in a symbiotic relationship to remove air pollutants produced by people, industries etc. in fact, virtually every tropical foliage and flowering plants works to remove pollutants from the interior environment and some plants are better at removing certain toxins (Wolverton, 1990). Therefore the environment should beautify with air cleaning plant both inside and outside to prevent and control air pollution.

CONCLUSION

The paper has shown that BRIs SBS and BAS are consequence of building indoor air pollutants which are threat to health and eventually a threat to life expectancy ratio. Since all building materials are product of chemical compounds and reactions, it becomes imperative to have a working knowledge of materials used for construction of building in order to make informed choices on building materials to be used. The paper has itemized and evaluates the causes and effects of SBS and BRIs as emissions from building materials. In course of the research, a generally applicable, validated procedure for the evaluation of all types of building materials for all purposes could not be established. Hence, development of such procedures will still take some time. Meanwhile, several new and even older materials are brought in for buildings construction without evaluation regarding their impact on health and comfort. This situation informed the Steering Committee of the European Collaborative Action (ECAIAQ) to assemble evaluation procedure employed in this study. Although incomplete, it allowed an evaluation to be made in some cases. As the required information becomes available, the procedure will evolve into a generally applicable evaluation scheme. The intended use of the evaluation scheme is to compare, classify and/or label building materials with respect to their VOC emissions, which should serve to inform the consumer about building materials that are not likely to interfere with health and sensory comfort as far as chemical emissions are concerned. This information will be communicated by a label attached to products that successfully pass the evaluation procedure. Thus reduce the risk to health and threat to life caused by hazard and poor choice of building material in most Nigerian cities. It is primarily
expected to inform occupants, home owners, government, environmental health personnel and policy-makers who are not laboratory specialists

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The study examines the socio-economic characteristics of the users of wetlands, the relationship between their status and their resources with a view to land reform in the region. The study employed primary and secondary data. Primary data explored 566 structured questionnaires administered on wetland users using the snow-ball method soliciting information on; respondents’ indicators of livelihood assets, resources, human capital, socio-economic characteristics, quality of dwelling, sanitation and ownership of land. Secondary data was sourced from conventional sources. Data was analysed using descriptive and inferential statistics. Results show that over 70% of respondents were above 41 years of age and were predominantly small scale food-farmers. Furthermore, 59.4% of respondents lived in Brazilian type of houses “face me I face you” with 49.0% of the houses in fare state that need maintenance, 60.3% had bare ground floors while 44.3% were personal houses and 31.7% family houses.

Similarly, it was established that the depth of poverty in relation to landed assets showed that 58.6% of the rich compared to 20.7% of the moderate poor and 20.7% of the poorest ranked households owned more than 10 ha of land. The implications of this is that a greater proportion of productive assets (Land) in Ede region were in the hands of the non-poor ranked households which has continued to widen the gap between the rich and the poor and if poverty has to be tackled, then there must be a way forward through “land reform” to make this very important livelihood asset available to the extreme poor.

Key words: land reform, poverty, housing conditions, livelihood assets, wetlands.

INTRODUCTION

It has generally been established that, 60-70% of rural dwellers in Nigeria and other developing countries in the Global South who depend on agriculture as their source of sustenance are living in absolute poverty (Ekong, 1999; Kolawole and Torimiro, 2006; Gysue, 2009). To be precise 70.2 % of Nigerians live below the poverty line (World Bank and FOS, 1997). However, despite this, it was observed by Oyesiku (2009), that the share of people living in poverty is larger in African cities than any other region in the world (UNICEF, 2009; Kessides, 2006 and Booth et al, 2000). Furthermore, Oyesiku (2009) while quoting Mekomen (1994) emphasized that 52% of sub-Saharan Africa’s population was poor in 1985, which rose to 63% in 1990 and was estimated at 63.5% in 2009 (UNICEF, 2006). However, according to World Bank (2001) and Fields (2000) poverty is a rural phenomena.

Ekong (1999) observed that rural communities especially, in Nigeria are seriously marginalized in terms of most basic elements of development and the inhabitants tend...
Wetlands users

to live at the margin of subsistence and opportunities. These rural communities lack potable water, electricity, health care, educational and recreational facilities. They also experience high population growth rates, high infant and maternal mortality, low life expectancy and a peasant population that lacks modern equipment that can guarantee sustainable exploitation of the natural resources on which they live (Oyeranti and Olayiwola, 2005).

Land seems to be the most valuable asset at the disposal of the rural dwellers to meet their developmental needs for housing as well as agriculture. Over 60 percent of the population of West and Central Africa is dependent on land for subsistence or commercial agricultural production. The remaining 40% of the population though not directly require land for residences and places of employment in cities, towns and villages (Gyuse 2009). In a study by FOS (1999) poverty in rural Nigeria was identified to manifest in land holding ability of the rural dwellers in relation to farm size, use of improved inputs and farm credit facilities. The land use decree of 1978 which has gone into history as the most controversial and ambiguous legislations has disposed the rural poor of the rights to their land (CRP, 1999).

In Nigeria, wetlands cover over 24,009 km$^2$ (Kio and Ola-Adams, 1990). Meanwhile in Ede region it’s estimated at 2587.93 ha in 1986 and was reduced to 889.66 ha in 2002. Wetlands are under serious threats from population pressure, urbansisation, agriculture, road construction as well as deforestation. Conscious of all these, the Federal Government of Nigeria embarked on a series of measures since the 70’s to reduce the impact of poverty on Nigerians but very little or no success has been made in that direction. Some of these measures amongst others include; Operation Feed the Nation (OFN), Agricultural Development Programmes (ADPs), River Basin and Development Authorities (RBDAs) and the Green Revolution programme (see Table: 1). The failure of these measures and policies within the wetlands, to address the plight of the poor despite its enormous potentials has motivated this study. Given the multifaceted nature of poverty, any solution towards its eradication must be multi dimensional in nature. It was at this backdrop that the study was conceived to assess the socio-economic characteristics of the users of wetlands, the relationship between their status and their resources with a view to land reform in the region. This, if achieved, will provide a framework for improving the socio-economic conditions of the residents in wetlands areas.

THEORETICAL FRAMEWORK

Poverty

Theoretically, there are three prominent views as far as the definition of poverty is concerned. The first view looks at poverty as material deprivation that can be assessed in monetary terms but fails to recognize non-material forms of deprivation such as illiteracy and social discrimination among others (Oyeranti and Olayiwola, 2005; Townsend, 2006). The second conceptual view is directly linked with the work of Sen (1999) and has been used by the Human Development Index (HDI) and Human Poverty Index (HPI), which defines poverty as the failure to achieve basic capabilities such as being adequately nourished, living a healthy life, possession of skills to participate in economic and social life, permission to take part in community activities just to mention but a few. This opinion therefore recognizes multidimensional nature of poverty. The third conceptual view came to the limelight in the 1990s and looks at poverty from the subjective point of view. The strong point of this view is that poverty must be defined by the poor themselves or by the communities where the poor live.
The subjective view of poverty opines that poverty has both physical and psychological dimensions. The poor people themselves strongly emphasize violence and crime, discrimination, insecurity and political repression, biased or brutal policing, and victimization, neglectful or corrupt public agencies (Narayan et al., 1999 and Chambers, 2006). According to Tomlison (2002) the former country director of World Bank, one out every five persons “are critically poor” and one in every four persons in Nigeria never get a clean glass of water and live on less than $1 US a day.

The scope of poverty alleviation has evolved over the years and in the 1970s the scope changed from lack of income and recognized the need for education, health and other essential services (DFID and ILO). In the 1980s the scope of poverty was further broadened to encompass non monetary aspects, such as vulnerability to shocks, food security, assets and inequity. Whereas poverty refers to different forms of deprivation that can be explained in a variety of terms (income, basic needs, human capabilities), equity is concerned with distribution within a population group under real egalitarian conditions. Vulnerability is the measure of insecurity; defenselessness and the risk of falling into poverty. These include effects of discrimination on the grounds of gender, class, disability, race, age or ill health, which may make it more difficult for people to earn a living. They also include natural and man made shocks such as economic collapse, drought or floods which have more impact on the poorest as they have fewer assets to cushion their effect (DFID, 2005; John and Regaly, 1997). Food security refers to the ability of individuals and households to meet their staple food needs all year round.

Karlsson (2001) observed that given the present understanding, poverty goes beyond material and capabilities deprivation and therefore business as usual will not reduce poverty. The World Bank Report (World Bank, 2001) extends the concept of poverty beyond income and consumption plus education and health, to include risk and vulnerability as well as voicelessness and powerlessness. However, it may not necessarily be the case that shocks affect the poor disproportionately, but it is clearly the case that they are more vulnerable, since their economic margin is slim. Therefore the poor are often exposed to highly fluctuating incomes, and, particularly, in rural areas and it is common for households to move in and out of poverty (Dercon, 2000; and World Bank, 2001). The main issue that comes here in relation to poverty is social exclusion. Social exclusion within the concept of poverty focuses on those aspects of social deprivation that impede people from participating fully in their society and its development. It further recognizes the root problem of lack of material resources but also help us to understand the processes, including social and political processes that lead to poverty. For instance, people who are poor may be excluded from land or employment and therefore a livelihood, meaning that they are effectively politically powerless to change their situation.

To further illustrate the multi-dimensional nature of poverty, poor people are often illiterate or have little education, making it much difficult for them to find employment and much more likely to suffer from ill health. Social exclusion draws attention to the viscous cycle of poverty whereby a breadwinner becomes sick, the family income falls and child malnutrition ends in early death. It is difficult to separate the economic, social and political factors contributing to poverty or to say where one influence ends and another begins. The term exclusion recognizes this overlap and synergy between the processes that cause poverty. For instance, decisions made in an urban centre may effectively exclude rural people from control over resources. Women’s exclusion from decision making within the household and the
community, or from ownership of land and assets, partly explains why women are likely to be poor. Other areas of exclusion include; markets, welfare provision, family, community rights, practical participation, resources and relationships (David, 1994; Igawa 2001; DFID, 2005).

The poverty situation in Nigeria today, presents a contradictory paradox considering the country’s immense wealth and the fact that the poverty situation has worsened despite the enormous human and material resources that have been devoted by successive governments for its eradication with no substantial success (Oyeranti and Olayiwola, 2005; Gasu, 2011). The World Bank (1996) attempted a classification of poverty alleviation programmes in Nigeria between the years 1975-2001 as shown in table 1 below.

Table 1: Classification of Poverty Alleviation Programmes in Nigeria from 1975-2001.

<table>
<thead>
<tr>
<th>Programme/Scheme</th>
<th>Focus/Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agriculture</td>
<td></td>
</tr>
<tr>
<td>(a) Operation Feed The Nation (OFN)</td>
<td>Food Security</td>
</tr>
<tr>
<td>(b) Green Revolution</td>
<td>Food Security</td>
</tr>
<tr>
<td>(c) River Basin Rural Development Authority (RBRDA)</td>
<td>Water resources management and Irrigation for Agriculture</td>
</tr>
<tr>
<td>(d) Directorate of Food Roads and Rural Infrastructure (DFRI)</td>
<td>Multi-sectoral approach (Urban and Rural)</td>
</tr>
<tr>
<td>(e) National Agricultural Land Development Authority (NALDA)</td>
<td>Commercial agriculture</td>
</tr>
<tr>
<td>(f) Agriculture Development Programme (ADP)</td>
<td>Support to rural farmer/food security</td>
</tr>
<tr>
<td>2. Health</td>
<td></td>
</tr>
<tr>
<td>(a) Guinea Worm Eradication Task Force (GWETF)</td>
<td>Guinea worm/water and sanitation</td>
</tr>
<tr>
<td>(b) Primary Healthcare (PHC)</td>
<td>Children’s Health</td>
</tr>
<tr>
<td>(c) Roll Back Malaria (RBM)</td>
<td>Improved Health for all</td>
</tr>
<tr>
<td>3. Education and Employment</td>
<td></td>
</tr>
<tr>
<td>(a) Nomadic Education Programme (NEP)</td>
<td>Education for nomads</td>
</tr>
<tr>
<td>4. Economic and Social</td>
<td></td>
</tr>
<tr>
<td>(b) National Housing Fund Scheme (NHFS)</td>
<td>Housing for the employed</td>
</tr>
<tr>
<td>(c) National Directorate of Employment (NDE)</td>
<td>Skills formation and employment</td>
</tr>
<tr>
<td>(d) Petroleum (Special) Trust Fund (PTF)</td>
<td>Multi-sectoral financing</td>
</tr>
<tr>
<td>(e) Federal Assisted Mass Transit programme (FAMTP)</td>
<td>Assistance to the private sector in financing transportation</td>
</tr>
<tr>
<td>(f) National Economic Reconstruction Fund (NERFUND)</td>
<td>Fund for reconstruction</td>
</tr>
<tr>
<td>(g) Family Economic Advancement Fund (FEAF)</td>
<td>Economic support for family improvement</td>
</tr>
<tr>
<td>(h) National Poverty Eradication Programme (NAPEP)</td>
<td>Economic support for family improvement</td>
</tr>
<tr>
<td>(i) Family Support Programme (FSP)</td>
<td>Economic support for family improvement</td>
</tr>
<tr>
<td>(j) Better Life Programme</td>
<td>Economic support for improvement</td>
</tr>
<tr>
<td>(k) People Bank of Nigeria (PBN)</td>
<td>Community based financial programme</td>
</tr>
</tbody>
</table>

Source: Adapted from the World Bank, 2001

Kolawole and Torimiro (2006) observed that the World Bank reported that all these programmes failed because they were unsustainable and ad-hoc in approach, as they
were borne out of the traditional “Top down” strategy and that for any programme to succeed it must receive the blessings of the beneficiaries. Furthermore Tomlinson (2000) noted that the engagement of the beneficiaries is a catalyst which will help the Government to tailor interventions more closely to the needs of the poor, who will drive coordinated solutions as the key to sustainable development. It was further documented that these past efforts to rid the country of poverty have produce very little results for the following reasons;

Policy inconsistency and bad governance
Ineffective targeting of the poor (leading to leakage of benefits to unintended beneficiaries).
Unwieldy scope of the programmes resulting in resources being spread among projects.
Overlapping of functions which ultimately led to institutional rivalry.
Lack of mechanism in various programmes and projects to ensure sustainability.
Lack of complementarities from the beneficiaries.
Uncoordinated sectorial policy initiative
Lack of involvement of social partners in planning and evaluation
Poor human capital development and inadequate funding.
Lack of involvement of the people at grass root.
Absence of agreed poverty reduction agenda that can be used by all concerned (Ajakaiye and Olomola, 2003; Oyeranti and olaiyiwola, 2005; Kolawole and Torimiro 2006, Gasu, 2011).

**Land Reform models**

Land reform is not new to the African continent since the era preceeding independence from various European colonial rule especially in the West African Subregion (Gyuse, 2009). What is new is the toll it has taken on the African masses especially in Nigeria. Ouedraogo *et al* (2006) observed that without exception, the reforms have been in the direction of abolition of customary ownership and replacement with a statutory form where ownership of land were vested in some cases exclusively in the State with citizens holding users rights. For instance, Benin Republic in 1972, Burkina Faso in 1984 and The Nigerian Land use decree of 1978 in all these cases the land was acquired compulsorily. Amongst the cases that of Nigeria was a complete robbery attempt by the authorities in power to dispossess the Nigerian masses of their most valuable asset and means of livelihood.

According to the land use decree, all lands except the Federal lands were vested in the Governor of the State who is to hold it in trust for the people of the state and for all Nigerians (Land Use Act, 1978, Section 1). In practice the decree is supposed to make it easier to acquire land for both public and individual purposes. This was not the case, for only those with socio-political connections were able to acquire land in rural areas for agricultural purposes even though we are yet to see the impact in this area (Gyuse, 2009). Under the act, tenure was not secure for tenure was granted only for a period of 99 years in the case of state allocation and 33 years in the case of Local Government allocation. Gyuse (2009) noted that this meant that the land and its development could not be passed on to the descendents.
The Land use decree is plagued with many controversies amongst which include the fact that many indigenous land owners still lay claim to their land. The decree expropriates land from the original owners (compound/families) and confer the ownership on the executive governor of each of the states of the federation. The act favours Government as well as those in Government and therefore creates serious difficulties for the common man to acquire land (Akinola, 2007). The practice therefore, is that if anyone acquires a piece of land from government one still has to sign an agreement with the indigenous owners which is usually backdated before 1978 leading to double payment. In retrospect, the law is of colonial inspiration and feudal inclination for the purpose of exploiting, expropriating and oppressing the citizens (Akinola, 2007). Another controversy which was equally described as oppressive by Akinola (2007) was in the area of compensation which was confirmed in a study in 1991 by Akinola and Awotona (1997) to be ridiculously lower than the actual or real market value of the property by 33.0% for rural areas and 57.6% for urban land.

Omotola quoted in “Shelter Watch” 1996 observed that the act is no doubt infested with many ambiguities, contradictions and confusion which have made those concerned with its administration (civil servants) uncomfortable with its provisions (Akinola, 2007). Many of the controversies generated by the decree have proved difficult to be resolved by the judiciary as “judicial interpretations of the different sections, words and phrases used in the land use act have resulted in long drawn and bitter legal battles” often going as far as the supreme court (CRP, 1999).

Another model of land reform which was very original to Africa was that of Tanzania under the distinguish leadership of Dr. Julius Nyerere which was based on the principle of rural villages conceived as communal organization (collectivization). The Tanzanian model was made public by Nyerere in 1962 in his publication Ujamaa “the Basis of African socialism” in which Ujamaa was described as the socialist attitude of mind which in the tribal days gave to every individual the security of belonging to a widely extended family. The Tanzanian model became a policy in 1967 during which Nyerere rejected rural capitalism and turned the Ujamaa of 1962 into a national policy. Ujamaa was implemented in three phases (1967-69), (1969-73), and (1973-76). The villagization scheme had remarkable impact on population redistribution in Tanzania whereby in 1968 about 60,000 people were resettled in 180 villages and by 1973 about two million people were regrouped in 57,2000 Ujamaa villages (Adepoju, 1983; Okafor and Onorkerhoray, 1994). It has equally been documented that by 1974 about 4 million people have been resettled. The policy ended up with very mixed results as Ujama villages still had a long way to go in raising rural welfare and narrowing the gap between town and village life.

The Chinese Land Reform

Incidentally China has only about 10% of world’s cultivable land with about one-fifth of the world’s population (1.3 billion people) and yet they are self food sufficient with excess for export. China today presents one of the leading worlds’ economies with an average growth rate of over 10.7% between 1980s and 2006. Industrial activities (manufacturing, mining, and construction) contribute the largest percentage of the country’s G.D.P amounting to 48 percent while agriculture contributes to about 18% GDP (Clunas, et al, 2009). China has succeeded in eliminating absolute poverty and solving the problems of unemployment and inflation, the three most serious problems facing developing nations (Aziz, 1978).
The most striking feature of Chinese agriculture has been the relative scarcity of cultivable land with the total arable land per person living in the rural areas estimated at 0.25 ha. As observed by Aziz (1978) the Chinese farmers’ precarious situation was compounded by natural calamities with constant threat of climatic uncertainty in the South and persistent drought in the semi arid North and North West. It was at the backdrop of all these that the Chinese revolution evolved its own approach to socialism based on agriculture and rural development. A very important feature of the Chinese model is the land reform which came as a response to challenges such as; series of socio-economic problems of rural areas, scarcity of land and traditional land holding. Before the land reform in China, the poor who constitute 70% of the population owned less that 10% of the land while the rich who constitute about 10% owned 2/3 of the arable land (Okafor and Onokerhoray, 1994). As observed by Aziz, (1978) the total liquidation of the traditional system of land ownership and social stratification could not be completed until the establishment of the People’s Republic of China in 1949. The Agrarian Law of 1947 provided the policy framework for the implementation of the land reform programme which resulted in the redistribution of land and property among the poor and middle peasant including the landlords and rich peasants who were prepared to reform themselves and live on allotted holdings (Okafor and Onokerhoraye, 1986). Official figures revealed that 46.6 million ha of land was distributed among 300 million landless and land poor peasants with each receiving an average of 0.15 ha. The Chinese land reform was therefore poised to create a new communal order (collective ownership of land) where all would work together unselfishly for common goals, for the Communists first redistributed property (Aziz, 1978, Clunas, et al, 2009).

Agricultural collectivization followed land reform in several stages. First, farmers were encouraged to join mutual-aid teams of usually less than 10 families. Next, they were instructed to set up cooperatives, consisting of 40 or 50 families. From 1954 to 1956 the Communists created higher-level collectives (also called production teams) that united cooperatives. At this point, economic inequality within villages had been virtually eliminated. The state took over the grain market, and peasants were no longer allowed to market their crops (Clunas, et al, 2009).

The institutional framework for the success of the Chinese land reform was made possible by a system of production teams, production brigades, communes, provinces and the central planning commission. Olanrewaju (1980) described a production team to be a historic hamlet or cluster of houses with 20-40 families or 100-200 members. Production teams make up production brigades and brigades combine to make up the people’s communes. Counties are multi-commune government units while counties combine to form provinces and at the national level the central planning commission coordinates the national production plans and targets. In this bureaucratic set up, the basic unit for rural transformation in China is the people’s communes. A Chinese commune is a composite unit of local government that encompasses the whole range of economic, social, administrative and political functions for the rural community (Aziz, 1978). The essential purpose of this bureaucratic structure is to organize and mobilize the rural population to develop their land and other resources in order to meet their essential needs on the principles of self-reliance, while at the same time reducing social inequalities and creating a rural society based on justice and equality. The system of commune provides a very effective mechanism of local planning in accordance with the simple philosophy: from bottom up and from the top down.
Wetlands users

fondly referred to as planning from below (Olanrewaju, 1980; Okafor and Onokerhoraye, 1986; Clunas, et al, 2009).

STUDY AREA

The study was conducted in Ede Region Osun State, Nigeria. It is located between latitude 7º 31' and 7 º 55' North and longitude 4 º 15' and 4 ° 40' East. Ede region accommodates the wetland areas of Ede South and Ede North LGAs. Ede is bounded to the South by Ayedade, to the East by Atakumusa and Osogbo, to the North by Egbedore and to the West by Ejigbo and Ayedire Local Governments Areas of Osun State. The region is drained by Rivers Shasha and Osun along with their tributaries. The soils are associated with Iwo and Egbeda associations. They have been mapped out as montmorillonite soils with inherent poor drainage because of the presence of 2:1 clay minerals (Okusami, 2011). The low-lying nature of the area makes possible the deposition of alluvial soils rich for agriculture and digging of shallow wells.

The two LGAs had a population of 159, 866 at the 2006 census (NPC, 2007). Even though the area is in the tropical rainforest belt natural-vegetation is depleted largely for crop cultivation which is the dominant economic activity. It is characterised by tufted savannah grasses and dotted with trees especially oil palms (Symth and Mongomery, 1962). The main crops are foods such as cassava, maize, beans and yam. Cash crops such as cotton, cocoa and palms serve the local cottage industries such as cotton weaving, cottonseed milling, cocoa and palm processing.

RESEARCH METHOD

The study adopted the Snow-ball technique where pre-tested and validated structured interview schedule was developed and administered to solicit information from the respondents covering a wide range of spatial-economic activities on livelihood assets and household relative poverty as it relates to resources (human capital), Socio-economic characteristics of respondents, quality of dwelling including water and sanitation, ownership of land and other valuable assets amongst other social and environmental issues. This approach resulted to a total of 566 questionnaires for the study administered on 40 settlements but 451 were actually returned for data analysis representing a response of 79.6%. In a typical snow-ball fashion, one wetland user was identified and who in turn identify the next user(s) and it continued in that same manner until all the users required were identified. Information on wetlands, farms locations, infrastructure like roads and social facilities like solid waste disposal, water sources, health and schools were gotten through direct observation, direct measurement, and oral interview by the researcher during visits. Statistical analysis made use of descriptive and inferetial statistics. The Principal Component Analysis (PCA) used to establish a relative poverty household classes of (extreme poor, moderate poor and non-poor income levels) based on $1US a day earning. The classification was now used for the inferential statistics (cross tabulation).

RESULTS AND DISCUSSIONS

Results in Table 2 show that 43.8% of respondents were above 51 years of age. Furhtermore, result shows that of 43.9% of the respondents have 5-10 children while 40.1% have less than five children in the family which is a typical rural African
characteristic where large families are usually desired because they are seen as a major source of farm labour. Similarly, the results show that 71.2% of respondents were predominantly small scale food-farmers which is in consonance with earlier studies by Ekong, (1999); Kolawole and Torimiro (2006); Gasu et al., (2007), while trading was (10.4%), mixed occupation (8.2%) and civil servants 10%. The result also reveals that 39.0% of the respondents earned below 60,000 naira annually, 29.7% earned between 60,100 and 100,000 annually while 26.4% earned between 101,000 and 200,000 naira annually. Furthermore, 59.4% of respondents lived in Brazilian type of houses “face me I face you” with 49.0% of the houses in faire state that needed urgent maintenance while 60.3% live in houses that had bare ground as floors.

Table 2: Socio Economic Characteristics of Respondents

<table>
<thead>
<tr>
<th>Age of Respondent</th>
<th>Frequency</th>
<th>Percent</th>
<th>Household Size</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-30</td>
<td>74</td>
<td>16.2</td>
<td>&lt;5 person</td>
<td>118</td>
<td>40.1</td>
</tr>
<tr>
<td>31-40</td>
<td>73</td>
<td>16.1</td>
<td>5-10 persons</td>
<td>198</td>
<td>43.9</td>
</tr>
<tr>
<td>41-50</td>
<td>108</td>
<td>23.9</td>
<td>10-15 persons</td>
<td>54</td>
<td>12.0</td>
</tr>
<tr>
<td>51-60</td>
<td>95</td>
<td>21.1</td>
<td>&gt;15 persons</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Above 61</td>
<td>101</td>
<td>22.7</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>451</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Frequency</th>
<th>Percent</th>
<th>Owner of Building</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>332</td>
<td>73.6</td>
<td>Family</td>
<td>148</td>
<td>32.9</td>
</tr>
<tr>
<td>Female</td>
<td>119</td>
<td>26.4</td>
<td>Self</td>
<td>200</td>
<td>76.1</td>
</tr>
<tr>
<td>Total</td>
<td>451</td>
<td>100</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Type of Housing</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>41</td>
<td>9.1</td>
<td>Brazilian (face to face)</td>
<td>268</td>
<td>59.4</td>
</tr>
<tr>
<td>Married</td>
<td>384</td>
<td>85.1</td>
<td>Modern Villa</td>
<td>27</td>
<td>6.0</td>
</tr>
<tr>
<td>Divorce</td>
<td>4</td>
<td>4.6</td>
<td>Single Family</td>
<td>75</td>
<td>16.6</td>
</tr>
<tr>
<td>Total</td>
<td>451</td>
<td>100</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Floor Material</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Formal</td>
<td>178</td>
<td>39.5</td>
<td>Bare ground</td>
<td>272</td>
<td>60.3</td>
</tr>
<tr>
<td>Primary School Cert.</td>
<td>119</td>
<td>26.4</td>
<td>Cemented</td>
<td>140</td>
<td>31.0</td>
</tr>
<tr>
<td>SecondarySchoolCert.</td>
<td>82</td>
<td>18.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND/NCE</td>
<td>25</td>
<td>5.5</td>
<td>Concret</td>
<td>18</td>
<td>4.1</td>
</tr>
<tr>
<td>First Degree</td>
<td>7</td>
<td>1.6</td>
<td>Tiles</td>
<td>5</td>
<td>1.1</td>
</tr>
<tr>
<td>Others</td>
<td>49</td>
<td>8.9</td>
<td>Others</td>
<td>16</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>451</td>
<td>100</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percent</th>
<th>Housing Conditions</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
<td>317</td>
<td>71.2</td>
<td>Fair</td>
<td>221</td>
<td>49.0</td>
</tr>
<tr>
<td>Trading</td>
<td>47</td>
<td>10.4</td>
<td>Good</td>
<td>139</td>
<td>30.8</td>
</tr>
<tr>
<td>Mixed</td>
<td>37</td>
<td>8.2</td>
<td>Poor</td>
<td>82</td>
<td>18.2</td>
</tr>
<tr>
<td>Civil Servants</td>
<td>45</td>
<td>10</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>0.2</td>
<td>Annual income</td>
<td>451</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>451</td>
<td>100</td>
<td>Below N50,000</td>
<td>133</td>
<td>29.5</td>
</tr>
<tr>
<td>Water Sources</td>
<td>Frequency</td>
<td>Percent</td>
<td>N51,000-N60,000</td>
<td>38</td>
<td>8.4</td>
</tr>
<tr>
<td>Private well/Tap</td>
<td>47</td>
<td>10.4</td>
<td>N61,000-N70,000</td>
<td>29</td>
<td>6.4</td>
</tr>
<tr>
<td>Shared Well</td>
<td>211</td>
<td>46.8</td>
<td>N71,000-N80,000</td>
<td>19</td>
<td>4.2</td>
</tr>
<tr>
<td>Bore hole</td>
<td>41</td>
<td>9.1</td>
<td>N81,000-N90,000</td>
<td>34</td>
<td>7.5</td>
</tr>
<tr>
<td>Public Tap</td>
<td>69</td>
<td>15.3</td>
<td>N91,000-N100,000</td>
<td>47</td>
<td>10.4</td>
</tr>
<tr>
<td>Rain</td>
<td>11</td>
<td>2.4</td>
<td>Above N100,000</td>
<td>135</td>
<td>29.5</td>
</tr>
<tr>
<td>Spring</td>
<td>40</td>
<td>6.2</td>
<td>No Response</td>
<td>16</td>
<td>3.5</td>
</tr>
<tr>
<td>River/Stream</td>
<td>32</td>
<td>7.1</td>
<td>Total</td>
<td>451</td>
<td>100</td>
</tr>
</tbody>
</table>

Authors’ Field Survey September, 2012
Table: 3 shows that 58.6% of the non-poor ranked households owned more than 10 hectares of land compared to 20.7% of the moderate poor and 20.7% for the extreme poor ranked households in the same category. Similarly, the result shows that 42.2% of households ranked as moderate poor income compared to 34.7% and 23.1% ranked as extreme poor and non-poor households respectively owned less than 2 hectares of land. In a study by FOS (1999), poverty in rural Nigeria was identified to manifest in land holding ability of the rural dwellers. The implication of this was that a greater proportion of livelihood assets (land) in the Ede region were in the hands of non-poor ranked households. This scenario was equally observed in an earlier study by FOS (1999) which could continue to widen the gap between the rich and poor. Therefore, if poverty has to be tackled, then there must be a way forward through land reform to make available this very important livelihood asset to the extreme poor as we have witnessed in China and Ujamaa in Tanzania.

![Table 3: Cross Tabulation of Farm Size and Poverty in Ede Region.](image)

The results in Table 4 show that 38.6% of the moderate poor ranked households compared to 38.0% and 23.4% of extreme poor and non-poor ranked households respectively were farmers. Similarly, 80.8% of the highest ranked households compared to 12.8% and 6.4% of the moderate and extreme poor ranked households respectively were traders. It could also be deduced from the results that, 48.9% of the non-poor ranked households compared to 28.9% and 22.2% of the moderate and extreme poor ranked households respectively were civil servants. The results were as expected since most of the rural dwellers in the region were farmers as observed in earlier studies by Ekong, 1999; Kolawole and Torimiro, 2006 and Gasu, 2011 and also, the fact that most of those who live above the poverty-line must do something extra than farming, as indicated by most traders who live on a higher income level than farmers. The chi-square test in Table 5 also reveals the differences to be highly significant which goes to reinforce relative poverty amongst the households in the region.

![Table 4: The Cross tabulation of Various Households Occupation and Poverty in Ede Region](image)

Source: Field Survey, 2010
Table 4: Chi-square test of Cross Tabulation

<table>
<thead>
<tr>
<th>Chi-Square Tests</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>72.281a</td>
<td>10</td>
<td>.000</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>70.904</td>
<td>10</td>
<td>.000</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>11.951</td>
<td>1</td>
<td>.001</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>451</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. 6 cells (33.3%) have expected count less than 5. The minimum expected count is .33.

Source: Field Survey 2010

Results in Table 6: illustrate that 50.0% of the non-poor ranked households compared to 38.9% and 11.1% of the moderate and extreme poor ranked households respectively live in houses with concrete floors. On the other hand, 40.1% of the extreme poor ranked compared to 35.0% and 24.3% of the moderate poor and non-poor ranked households respectively live in houses with bare ground while 38.9 % extreme poor ranked households compared to 35.7% of non-poor and 33.0% of moderate poor ranked households respectively live in houses with cemented floors. These results were as expected as they conformed to the three distinct poverty groups and reaffirmed the relative nature of poverty amongst the households in the region.

Table 6: Cross Tabulation of Materials for Floor and Poverty in Ede.

<table>
<thead>
<tr>
<th>Poverty Group</th>
<th>Materials for Floor</th>
<th>Extreme poor</th>
<th>Moderate poor</th>
<th>Non Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare ground</td>
<td>40.7%</td>
<td>35.0%</td>
<td>24.3%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Cement/Sand</td>
<td>31.3%</td>
<td>33.0%</td>
<td>35.7%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>11.1%</td>
<td>38.9%</td>
<td>50.0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Tiles</td>
<td>20.0%</td>
<td>40.0%</td>
<td>40.0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Others (wood,</td>
<td>75.0%</td>
<td>25.0%</td>
<td>.00%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Terrazzo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2010

**SUMMARY AND CONCLUSION**

Poverty was highly epitomized in the study area in relation to livelihood assets ownership especially the most valuable asset is land. Land is everything to the rural dwellers and the study shows that 58.6% of the non-poor ranked household owned more than 10 hectares of land compared to 20.7% of the moderate poor and 20.7% of the extreme poor ranked households in the same category. Similarly, the result shows that 42.2% of households ranked as moderate poor income compared to 34.7% and 23.1% ranked as extreme poor and non-poor households respectively owned less than 2 hectares of land. The planning implications of this is that a greater proportion of productive asset (land) in the Ede region is in the hands of non-poor ranked households which were equally observed in an earlier study by FOS (1999) which
could continue to widen the gap between the rich and poor. If poverty has to be tackled, then there must be a way forward (land reform) to make available this very important livelihood asset to the extreme poor as has been observed in earlier studies in China and Ujamaa in Tanzania.

In conclusion, over 70% of respondents were above 41 years of age and were mostly involved in small scale food-farming. The housing conditions particularly the walls, roofs and floors need a complete overhaul. The general sanitation of the environment equally need an urgent attention. For wetlands to yield the required results by contributing to the transformation of the rural areas, agricultural activities need to move away from; farm fragmentations, the use of rudimentary tools and manual labour to mechanisation and value addition to farm produce through processing and the use of improved irrigation methods like river channelization. There is also need to carry out land reforms which should involve the total restructuring of institutions and agencies that deal with land matters and organization of the rural dwellers into farming organizations or cooperatives. This will ensure that they could attract funds from funding organizations or banks since most of them in the rural areas do not have “title on land” in the form of land certificates or certificates of occupancy (C of O), hence could not afford collateral security to collect loans for rural agricultural developmental activities.

There is therefore, an urgent need to amend the Land Use Decree of 1978 in order to give it a human face, to be people focused and with their active participation by them. Land reform is like giving back to the neglected rural majority access to their most important livelihood asset, which will also give them the opportunity to own a title on land (C of O), the basis for their existence, the foundation of their life and the agent with which to transform their economy, life and status.

REFERENCES


Land Use Act 1978.


SPATIAL ANALYSIS OF FIRE DISASTER AND EMERGENCY SERVICE LOCATION IN JOS METROPOLIS

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1Dept of Strategic Space Applications. National Space Research and Development Agency
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The effect of fire outbreak in any built up environment is known to be very disastrous if proper measures for emergency response service is not properly put in place. In Jos metropolis evidence from research has clearly shown that emergency response service providers are ill-equipped to cope with the rising problem of urban fire disasters from various causes. This partly is as a result of the improper distribution of fire stations within and around the city to arrest any inferno through a reduced drive time. This research aims at using geospatial intelligence to identify and assess the settlement at risk of urban fire disaster around the various gas stations in Jos Metropolis. Spatial data of the city were extracted from the satellite image with specific reference to buildings/settlement, roads, infrastructure and service location within the study area. The geospatial analysis of the acquired image and the datasets obtained using Geographic Information System (GIS) techniques shows that only three major fire stations are in the whole of Jos metropolis. Further analysis did however reveal that most of the adjoining buildings to these gas stations do not conform to the international and urban planning building codes, which infers that most of such buildings in any event of an uncontrolled inferno or explosion in the gas stations are at the risk of being consumed and the result could be very disastrous. This study made useful recommendations to the relevant bodies to plan and provide for more fire service stations at some strategic location in the city to reduce the ‘drive time’ of fire fighters to gas stations in an emergency situation. And also the provision of hydrant facilities within the metropolis for the emergency need of all residences and gas stations.

Key words: risk assessment, fire disaster, emergency response service, spatial analysis.

INTRODUCTION

The rate of urban fire incidents and inferno has reached an alarming rate in recent time, with the recent publication of the National Fire Service during the 2011 safety week pegging the total count of various fire incidences across the country at 10,160. The cause of this rapid rise is not farfetched as most major urban cities in the world today are confronted with similar challenges. Rapid urbanization, overcrowded

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building, lack of proper fire prevention education, gross household negligence, lack of early fire combating equipments are among an endless list to be blamed for the incessant fire disasters. More also, the continued loss of valuable lives and properties worth billions of naira is partially due to the lack of early response from the appropriate fire fighting departments to carry out a timely rescue operation and combat such incidence to minimize damages. Factors such as the inappropriate distribution of fire service station within the urban metropolis to reduce the drive time to a location of interest and the utilization of strategic and emergency response systems are very paramount to the operations of the fire service department. Furthermore, the use of GIS technology within the emergency management sector has seen a sharp increase in the last decade and this is because of the enormous advantage it has in providing planning support systems, preparedness, mitigation, response, and incident management (ESRI, 2007). Research in this regard has clearly demonstrated that certain sector of the city and populations are more vulnerable to fire than others. Areas with high population and spatial density present a high risk of fire due to the increased exposure and probability. Those same areas also pose a threat of high casualty rate for the same reasons, hence undue precedence and attention through appropriate planning; infrastructural development and utilization of emergency response system must be given to such areas.

In Jos metropolis, many lives and properties worth millions of naira has been lost to various fire disaster. The most notable of all is the fire disaster that engulfed the popular seven multi-storey main market building at the heart of the central business district on 11th, September, 2002 in which properties worth over 200million naira ($1,492,537.31) were lost (sediq, 2012). This still lingers in the heart of many Josites. More also the city also suffered a similar incidence when the office of the defunct Nigerian Telecommunication (Nitel) was also engulfed by fire on the 26th may, 2010 (NBS, 2011). Similarly, it was also revealed that the city had a total number of 341 fire incidence in 2010 alone (NBS, 2011). These among other notable incidence are a cause of concern for stakeholder in the Jos Metropolis together with all its inhabitants.

The city of Jos itself is located on a very high altitude which portends a serious challenge to the spatial orderliness and a problem for the fire agency to cope with. It has a total density of 1,010/sq mi (391/km²) with a good fraction of 45% being urban slum with little or no access to good roads and absence of hydrant facilities within the city scape. This in its entire ramification makes a good spatial proportion of the metropolis vulnerable to indiscriminate fire disasters.

**AIM**

This study is aimed at assessing the spatial dimensions of Jos metropolis and its vulnerability to fire disasters from gas stations.

**OBJECTIVES**

The following objectives were pursued in the course of this study:

To extract and map the positions of all urban spatial features, that is, roads, settlements, existing infrastructures, utility and services.

To identify the position of all functional fire and gas stations within the study area.

To assess through proximity analysis the settlements and gas stations most vulnerable to fire disaster.

To recommend mitigation strategies to reduce concomitant fire disasters.
STUDY AREA

Jos is the administrative capital of Plateau State. It is situated approximately on 9°56′N, 8°53′E and 9.933°N 8.883°E. The city lies close to the geographical center of Nigeria. It has an area of 291km², a population of about 736,016 people based on the 2006 census (NPC, 2006) and located on the Jos Plateau at an elevation of about 1,238 meters / 4,062 feet high above sea level. The climate of the state is milder than that of the rest of the country and the nearest equivalent to a temperate climate in this tropical zone. Temperatures on the Plateau are several degrees lower than those in the rest of the country. Recorded mean temperature is 81.7F (27.6C) Maximum and 51.7F (10.9C) Minimum. There are neither extreme dual temperatures nor too much difference between the rainy and dry season. The state has over forty ethno-linguistic groups. Some of the indigenous tribes in the state are the Berom, Afizere, Amo, Anaguta, Aten, Bogghom, Buji, Challa, Chip, Fier, Gashish, Goemai, Irigwe, Jarawa, Jukun, Kofyar (comprising Doemak, Kwalla, and Mernyang), Montol, Mushere, Mupun, Mwaghavul, Ngas, Piapung, Pyem, Ron-Kulere, Bache, Talet, Tarok, Youm and Fulani/Kanuri. These ethnic groups are predominantly farmers and have similar cultural and traditional ways of life. People from other parts of country have come to settle in Plateau State; these include the Igbo, Yoruba, Ibibio, Annang, Efik, Ijaw, and Bini (Blench, et al, 2003).

DATA AND METHOD

Settlement Map

The settlement map of the study which is one of the most important dataset in the course of this research was obtained from the national centre for remote sensing Jos. The settlement map was carried out at a scale 1:50,000 and covers the whole of
plateau state in which the study area was exquisitely extracted and used to create the spatial density maps (Medium, Low and High Density) zones. Furthermore, the settlement map depicts all locations and spatial extents of all the inhabitants within Jos metropolis.

FIELD WORK
As part of the efforts of this study to ascertain the current location of all fire stations within Jos metropolis, an intensive field work was carried out to gather the GPS locations of the Gas station with the aid of a Gemma GPS receiver and later plotted as a GIS layer. This essential provided the basis upon which several works such as the proximity analysis and spatial distribution of gas stations was premised. Furthermore the GPS location of all gas station was also obtained during this exercise. A data that proved very vital in ascertaining vulnerable risk areas to fire disasters.

High Resolution Spot5 and Quick Bird Satellite Images
The study also engaged the use of high resolution Spots5 image of the study area as part of the base data layer upon which further feature extraction i.e. roads, infrastructure and service location was carried out. Specifically the road data layer proved very important in ascertaining the vulnerable risk areas as a result of in accessibility of emergency and fire service workers in an event of any fire. Figure 2 below shows the schematics/flow chart of the task carried out in the course of this study.

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Figure 2: Flowchart of the analysis carried out
```

RESULT AND ANALYSIS
Spatial Data Extraction
The extraction of various spatial features of interest was the first task carried out in this study. The road network data was extracted through an on-screen digitization on a scale of 1:100,000. This however depicts clearly that the access road leading to a good number of residential and commercial neighborhood outside the central business district (CBD) areas are majorly un-tarred and inaccessible. The road network of any urban area to a large extent dictates the level of accessibility of fire fighters to an area of interest, hence is an important factor that cannot be over looked in this study.
Proximity and Vulnerability Analysis

Closely following the extraction and assessment of the road network map of Jos Metropolis was the importation of the settlement map, Gas Stations and Fire Stations geographical data to carry out the proximity assessment. Two separate proximity analysis was carried out. First was the proximity assessment of all gas stations to the nearest fire station. To achieve this, a three Kilometer buffer ring was created around the fire stations to ascertain the gas stations that are most vulnerable to a prolonged fire incidence as the high consequence area (HCA) before the arrival of fire fighters without the possibility of a flash over. The reason for this operation isn’t far-fetched as research has clearly shown that the optimum distance to be covered by fire service truck should fall within an approximate distance of 3 – 5KM, in which case the speed and time taking to get to any incident point would be optimal (Nisanci, 2010). Furthermore, variables such as accessibility and volume of traffic at that given time are factors that can act negatively in achieving an optimal speed limit of 50 – 80Kilometer per Hour and 3.6 minutes. When a fire occurs, any delay on the side of the fire service companies can make the difference between the rescue of occupants versus serious injury or death. The critical time between fire containment and flashover can be measured in seconds (ESRI, 2007).

The second proximity analyses constitute the ascertainment of the various settlement or neighborhood within the established spatial density areas that are not within the established safe zone (buffer zone) of the fire stations. Here, the same 3KM buffer zone used for the gas station was retained and overlaid with the spatial density layer. Figure 4 below shows the result from this analysis. The result of the operation shows that most settlements outskirts away from the Central Business are not within the established safe zone of the fire station.

The risk of fire in urban areas has increased over the years and the rising cost of fire losses would seem to indicate that they are increasing at a greater rate than the measure devised to control them (Thaper, 2000). The proximity analysis which basically involves the calculation of the optimal distance to be travelled through the
buffered zone by fire service trucks to adjoining gas stations and also between the fire stations and high density areas gave a somewhat worrisome result. It was gathered that a total of eighteen gas stations were at the risk of having a prolonged fire incidence in an event of any fire outbreak, as they are not located within the established safe zone of the fire station (Buffer Zone). Closely related to the foregoing is that a total of three gas station were also established to be of even higher vulnerability as they are situated within the high spatial density area whose structures do not necessary conform to stipulated building codes and standard. This infers that such factors as inaccessibility due to congestion and high volume of traffic will negatively impede on the ability of fire fighters to access them with ease. This particularly poses a serious threat to both residential and commercial settlement in these areas. Figure 5 shows a quick bird image of a typical high spatial density neighborhood.

![Figure 5: Quick bird image of a typical high spatial density neighborhood.](image)

**Figure 5: Quick bird image of a typical high spatial density neighborhood.**

**SPATIAL DISTRIBUTION OF FIRE STATIONS IN JOS METROPOLIS**

The analysis of gas station data collected with specific interest on their spatial distribution through GIS visualization combined with an extensive field work revealed that the fire stations in Jos are not optimally distributed across the extensive coverage of the city. Figure 6 is an overlaid GIS point layer of the gas stations and road network data within the established cordons of the city (Jos North and South).

This clearly shows that the fire service stations are not properly integrated to cover and cater for the city both internally and extensively. The established safe zone (Buffer Zone) in figure 4 demonstrates clearly that a good number of settlement and households are not within the established drive time zones. Hence, fire fighters will have to travel long distance to get to any fire incident area. This is certainly detrimental and can possibly lead to extensive damage and even loss of valuable lives in an inferno. Settlements and residence within such areas as Yelwa, Naraguta, shere hills, Gwafan, Rayfield East, Kuru south and Gamajigo among several others were all observed to be particularly ten’s of kilometers away from the fire station. Although, research has shown that a privately owned fire station does exist belonging to the
Nasco Company situated in the heart of the city. This still doesn’t address the need gap of what is existent and what needs to be provided.

![Figure 5](image)

Figure 5: A Quick Bird View of Part of the unplanned high Spatial Density Area within the CBD

The analysis of the dataset collected has also clearly shown that the under provision of infrastructure such as good roads and portable water supply posed a negative influence in both accessibility of fire fighters to disaster areas and the ability of the local populace to quell any unintended fire disasters.

![Figure 6](image)

Figure 6: The Spatial Distribution of the Government Owned Gas Stations within Jos Metropolis

**Assessment of Hydrant Facilities**

The field observation carried out in the course of this study and oral account from town planning officers, fire fighters and inhabitants across the city shows that there are no hydrant facilities. An extensive research across the country as a whole shows that most of our urban centers are ill-equipped with hydrant facilities. This ordinarily would have served a great purpose in the reduction of loss of properties and lives in most fire disasters. The reason for this trend is as a result of the under provision of
utilities, services and infrastructures across most cities of the country, which ideally should aid in uplifting the environmental, health and socio-economic living condition of the urban populace. The implication however is, the whole responsibility of managing all fire related disasters is completely left for the fire service team to handle, with little or no urban facilities (Hydrants and Public Water Mains) to depend on in an event of an uncontrolled fire disaster.

CONCLUSION
The analysis which dealt specifically with the assessment of the location of fire service stations and their distribution across the study area to cater for the needs of all inhabitants across Jos metropolis shows that most of the functional fire service stations are segregated to the northern part of the city (Jos North) leaving just a single station to the south (Jos South). This in no doubt should be a source of concern to the city stakeholder.

Most of the extensive field work and analysis of the various data collected through GIS in this research has revealed that much of Jos Metropolis and the CBD particularly, are partially protected by the presence of the fire service stations. This specifically is in regard with the evidence gathered from the Buffer Zone analysis carried for both gas stations and high spatial density neighborhoods with reference to the anticipated drive time and distance to be covered by the fire service team. This however does not apply to a good spatial coverage of city especially at the outskirts of the CBD. As results clearly shows that three out of four fire stations within the city are skewed to the extreme north (Figure 4). This is as a result of the high structural development and commercial activities present there. Thus, such areas are evidently under the partial protection of the fire service station assuming such factors as traffic volume and accessibility is favorable. In the same manner, settlements outside the CBD are evidently seen as been the most vulnerable to loss of valuable lives, properties and psychological trauma in any fire incident, since they are not within the established safe zone of the fire service stations (Figure 4).

It is in view of this, that the study made a critical recommendation base on its finding for the planning authority, to provide for the strategic locationing of some new fire service stations across all ends of the city to help tackle the problem of a disproporionate distribution of fire service station in the city. Furthermore, the extensive provision of critical infrastructures such as roads, bridges, water mains and hydrant facilities will in no doubt reduce the rate of concomitant ‘flash over’s’ in every fire disasters which eventually leads to loss of lives and properties as fire disasters cannot be exclusively averted in all urban areas. The use of emergency response systems, intelligent maps and Geo-spatial intelligence by both firemen and health workers within the emergency service realm is still an area that needs to be rigorously explored in the state. This provides for an endless avenue for further research to reinforce and bind the existing gaps in the industry with a more realistic and modern approach in saving more lives and properties consumed by fire annually.

REFERENCES


STRENGTH EVALUATION OF LOW DENSITY POLYETHYLENE AS AN ADMIXTURE IN HOT MIX ASPHALT CONCRETE

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1Department of Civil Engineering, Faculty of Engineering, Ahmadu Bello University, Zaria, Nigeria

This work investigates the effect of waste low density polyethylene bags on the strength properties of Hot Mix Asphalt using Marshall Method of asphalt mix design. The variation of the Marshall Stability, flow and Voids in Mix (VIM), Voids Filled with Bitumen (VFB) and Voids in Mineral Aggregates (VMA) were monitored as the proportion of the polyethylene increases at 4.5%, 5.5%, 6.5% and 7.5% bitumen content respectively. For the various percentages of bitumen content, polyethylene was added at 1%, 2%, 3% and 4% respectively and briquettes were casted with the Marshall properties noted. Optimum Bitumen Content for all percentages of polyethylene was 6.5% and the optimum polyethylene Content for the asphalt mix was 2%. Stability values increase as the percentage of polyethylene increases and the flow properties of the mix decreases. Stability increased in the range of 4-15% while flow decreased in the range of 15-20%. It can be concluded that modifying bitumen with Low Density polyethylene in Hot Mix asphalt increases its stability and decreases flow and thus can be of better resistance against deformation.

Keywords: hot mix asphalt, Marshall method, bitumen, polyethylene, strength

INTRODUCTION

Asphalt concrete is a composite material commonly used for construction of pavement, highways and parking lots. It consists of asphalt (used as a binder), mineral aggregate and fines mixed together then laid in layers and compacted. The terms "asphalt (or asphaltic) concrete", "bituminous asphalt concrete" and the abbreviation "AC" are typically used only in engineering and construction documents and literature. Asphalt concrete pavements are often called just "asphalt" by laypersons that tend to associate the term concrete with Portland cement concrete only.

Asphalt mixtures are a combination of bitumen and a variety of non bituminous materials. In addition to aggregates, which constitute the largest volume of asphalt mixtures, non bituminous materials used in paving mixtures include Mineral and other fillers (Kent, 2001).

A good pavement is expected to among other things, function as attenuator of stresses developed by traffic everywhere to a value which the pavement layers and subgrade can sustain without damage. The functions can only be exhibited if the asphaltic concrete has the following qualities- stability, durability, workability, flexibility,
fatigue resistance, and skid resistance; either during construction or in service (Khanna and Justo, 2001).

In recent years, asphalt technologists have focused their attention on designing a pavement that will be less temperature susceptible and provide greater resistance to deformation caused by the high tyre pressures and imposed loads. In the asphalt industry, the addition of modifiers to asphalt cement has the potential to alleviate these problems. The non degradable thermoplastic polythene plastics used as commodity goods storage and packaging purposes accounts for over 60 million tons of annual wastes generation worldwide (Justo and Vaeeraragaven, 2002).

The problem that has recently called the attention of the various governments in this country is the challenge to the environment. This can be attributed to the increasing industrial and agricultural activities. Thus, tonnes of waste material are deposited into the environment, some of which are not easily decomposed and their accumulation is a threat to the environment. Examples of some of these waste materials include polyethylene bags, plastics, etc.

Polyethylene is a thermoplastic polymer consisting of long hydrocarbon chains. Depending on the crystalline and molecular weight, a melting point and glass transition may or may not be observable. The temperature at which these occur varies strongly with the type of polyethylene.

The aim of this research work is to evaluate the strength and flow properties of Low Density Polyethylene (LDPE) in Hot Mix Asphalt and compare with relevant standards.

With the above the stated aim, the following objectives were adopted:
To determine the composition of the material, Low Density Polyethylene (LDPE).
To subject its briquettes to Marshall testing and compare with standards

RESEARCH METHOD

MATERIALS

The materials used for this work are bitumen, aggregates (coarse and fine), cement (filler), and Low Density Polyethylene. Bitumen was sourced directly from NNPC refinery, Kaduna. The grade of the bitumen is 80/100. The coarse aggregates were obtained from Hassan Quarry along Kaduna-Zaria Road. The fine aggregates (sharp sand) were gotten from Rahusa Block industry Zango Zaria, Kaduna State. The filler material used is DANGOTE CEMENT, an Ordinary Portland Cement gotten through one of its distributors in Zaria. The polyethylenes were gotten from provision shop at Danfodio Hall, Ahmadu Bello University Zaria.

METHODS

The methodology involves the experimental tests carried out to determine the properties of bitumen, coarse aggregate, fine aggregate and cement and Marshal Stability. The properties of bitumen, coarse aggregate, fine aggregate and cement were from secondary source (Umar, 2012).
RESULTS OF PRELIMINARY TEST ON AGGREGATE

SPECIFIC GRAVITY

The specific gravity of an aggregate is the ratio between the weight of a given volume of the aggregate and the weight of an equal volume of water. Specific gravity provides a means of expressing the weight-volume characteristics of materials. Specific gravity of an aggregate is considered as a measure of the quality of material in terms of strength. 2.62% was obtained as the result of both coarse and fine aggregate specific gravity and this fall within the specification range [2.6 – 2.9].

AGGREGATE IMPACT VALUE

The aggregate impact value is expressed as the percentage of the fine formed in terms of the total weight of the sample. This test was carried out in accordance with BS 812-112, 21.31% was obtained and fall within specified range [< 30%].

AGGREGATE CRUSHING VALUE

It is necessary for aggregate to be strong and tough enough so that it can support roller weight during placing and laying of the asphalt concrete and during the repeated impact and crushing action of the traffic. This test is in accordance to with BS 812-111, which gives 22.12% and fall in the range [< 30%].

RESULTS OF PRELIMINARY TEST ON BITUMEN

PENETRATION TEST

The penetration test is a measure of hardness. The test was carried out by conducted this test in accordance with ASTM standard 2001 (ASTM D5) (penetration of Bituminous materials). The result falls within 80-100mm and this is an acceptable value according to ASTM standard.

DUCTILITY TEST

Ductility is a property of bitumen that usually linked with adhesion and temperature susceptibility. A sample with high ductility has high adhesion and susceptibility. Ductility and susceptibility is a measure of change in consistency for change in temperature. Result of ductility test was 75cm.

SOLUBILITY TEST

The solubility test is a procedure for measuring the purity of asphalt. This test is carried out in accordance to ASTM D4. Solubility of 4.85% was obtained.

FLASH AND FIRE POINT

Flash point is the temperature of the flame application that causes a bright flash. The point at which the material gets ignited and continues to burn for five seconds is the fire point. These tests were in accordance to ASTM D92, this point was obtained as 370°C and this is reliable.

VISCOSITY OF BITUMEN

Viscosity is the measure of resistance to flow of bitumen. It is a general term used for the consistency of bitumen. The viscosity of bitumen was determined in accordance with ASTM D2170. The outcome of this test was 192sec under 60°C.
SPECIFIC GRAVITY
The specific gravity measures provide a yardstick for making temperature-volume corrections. This was determined by the pycnometer method at 27°C. The test was carried out in accordance to ASTM D70. This was obtained as 1.0% which is in accordance with standard. The aggregate and bitumen physical properties were within the code limit and can be used for bitumen mixing.

RESULTS OF TEST ON FILLER MATERIALS

TEST ON CEMENT
Dangote brand of Ordinary Portland Cement was used in the experiment. Some preliminary tests like setting time and soundness tests were carried out on the cement according to BS EN196-3 (1995). The results were shown in table 1; the value was an average of three trials conducted.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Setting Time</td>
<td>82 mins</td>
</tr>
<tr>
<td>Final Setting Time</td>
<td>3hrs 31mins</td>
</tr>
<tr>
<td>Soundness Test</td>
<td>3.2mm</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>3.15%</td>
</tr>
</tbody>
</table>

MARSHALL METHOD
This method of designing paving mixtures was formulated by Bruce Marshall, formerly bituminous engineer with the Mississippi State Highway Department. Subsequent improvements were done by American Army Corps of Engineers to evolve the mix design criteria. The method is applicable only to hot-mix asphalt paving mixtures using penetration grades of bitumen and containing aggregates with maximum sizes of 1in. (25.4mm) or less.

The apparatus consists of a cylindrical mould, 101.6mm diameter and 63.5mm height, with a base plate and collar. A compaction pedestal and hammer are used to compact a specimen of mix proportioned 1.2kg mix (including coarse and fine aggregates, filler and bitumen) by 4.54kg weight hammer from a falling height of 457mm. An extrusion plate was used on the sample extractor to pneumatically remove the sample from the mould.

The coarse aggregates, fine aggregates and filler materials are mixed and preheated to a temperature of 175-190°C. The bitumen is equally preheated to a temperature of 121-145°C and the required quantity according to intended trial amounts (4.5, 5.5, 6.5, and 7.5%) is mixed with the aggregate fraction to a temperature of 154 to 160°C. The mould, base plate and the compaction hammer, too, are heated to 93.3 to 148.9°C. The mix was placed in the pre-heated mould at a temperature of 138-149°C and compacted to the required number of blows according to the traffic situation (50 blows for medium traffic) as shown in table 2. Three samples were prepared for trial bitumen content. The diameter and mean height of the specimen were measured and then they are weighed in air and then weighed suspended in water.
The specimens were kept immersed in water in a thermostatically controlled water bath at 60°C for 30 to 40 minutes. The specimens were taken out one by one, placed in the Marshall Test head and tested to determine Stability Value which is the maximum load in kg before failure and Flow Value which is the deformation of the specimen in 0.25mm up to the maximum load.

<table>
<thead>
<tr>
<th>Mix Criteria</th>
<th>Light Traffic (&lt; 10^4 ESALS)</th>
<th>Medium Traffic (10^4 - 10^6 ESALS)</th>
<th>Heavy Traffic (&gt; 10^6 ESALS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaction</td>
<td>35</td>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>Stability (min) N</td>
<td>2224</td>
<td>3336</td>
<td>6672</td>
</tr>
<tr>
<td>Flow (0.01 inch)</td>
<td>8</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>Flow (0.25mm)</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Percentage Air Void</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Asphalt Institute, 1983.

Essentially, the principal features of the Marshall method are that the following are determined (Stability, Flow and Stiffness Value, Bulk Density and Voids Analysis).

The bulk specific gravity \( G_m \) or the Compacted Density of the Mix (CDM), is the specific gravity considering air voids and is obtain using the relationship:

\[
CDM = G_m = \frac{W_m}{W_m - W_w}
\]  

Where; \( W_m \) = Weight of specimen in air  
\( W_w \) = Weight of specimen in water

Note that \( W_m - W_w \) = Volume of mix. Sometimes, when open graded aggregate is used, it is necessary to coat specimens with paraffin wax before measuring weight in water for bulk specific gravity and this however, requires the calculation of weight and volume of wax to get accurate result.

The Compacted Density of Mixed Aggregates (CDMA) is given by:

\[
CDMA = \frac{CDM}{1 + (B/100)}
\]

Where; B = Bitumen content

The Specific Gravity of the Mixed Aggregates (SGMA) is given by:

\[
SGMA = \frac{100}{(W_c/G_c) + (W_f/G_f) + (W_{mf}/G_{mf})}
\]

Where; \( W_c \) = Weight of coarse aggregate in the total mix  
\( W_f \) = Weight of fine aggregate in the total mix  
\( W_{mf} \) = Weight of filler in the total mix  
\( G_c \) = Apparent specific gravity of coarse aggregate  
\( G_f \) = Apparent specific gravity of fine aggregate  
\( G_{mf} \) = Apparent specific gravity of filler

While the Specific Gravity of the Mix (SGM) is calculated by:
\[
SGM = \frac{100}{(P_a/SGMA) + (BC/G_b)}
\]

(6)

Where: \( P_a = 100 - B \) = % aggregate fraction (coarse + fine aggregates + filler)

\( BC = \% \) binder content

Void in the Mix (VIM) is the percentage of air voids by volume in the specimen and is given by:

\[
VIM = \frac{(SGM - CDM) \times 100}{SDM}
\]

(7)

Voids in Mineral Aggregate, VMA, is the volume of voids in the aggregates and is the sum of air voids and volume of bitumen i.e.

\[
VMA = \frac{(SGMA - CDMA) \times 100}{SGMA}
\]

(8)

Void Filled with Bitumen, VFB, is the voids in the mineral aggregate frame work filled with the bitumen and is given by:

\[
VFB = \frac{(VMA - VIM) \times 100}{VMA}
\]

(9)

ANALYSIS AND DISCUSSION OF RESULTS

MARSHAL TEST RESULTS

Table 3 – 7 shows the average result of Marshall Properties at 0%, 1%, 2%, 3% and 4% of Low Density Polyethylene additives at 4.5%, 5.5%, 6.5% and 7.5% bitumen content.

<table>
<thead>
<tr>
<th>Bitumen (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDM (g/cm(^3))</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>3.9</td>
<td>2.4</td>
<td>2.41</td>
<td>5.2</td>
<td>16.8</td>
<td>63.10</td>
</tr>
<tr>
<td>5.5</td>
<td>4.2</td>
<td>2.6</td>
<td>2.43</td>
<td>4.2</td>
<td>23.5</td>
<td>77.45</td>
</tr>
<tr>
<td>6.5</td>
<td>4.7</td>
<td>2.9</td>
<td>2.44</td>
<td>4.1</td>
<td>22.8</td>
<td>79.82</td>
</tr>
<tr>
<td>7.5</td>
<td>4.1</td>
<td>3.4</td>
<td>2.42</td>
<td>4.2</td>
<td>28.1</td>
<td>86.78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bitumen (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDM (g/cm(^3))</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>4.7</td>
<td>2.1</td>
<td>2.30</td>
<td>4.96</td>
<td>18.62</td>
<td>69.00</td>
</tr>
<tr>
<td>5.5</td>
<td>5.4</td>
<td>2.4</td>
<td>2.21</td>
<td>5.20</td>
<td>21.11</td>
<td>72.40</td>
</tr>
<tr>
<td>6.5</td>
<td>5.8</td>
<td>2.7</td>
<td>2.45</td>
<td>5.80</td>
<td>22.34</td>
<td>73.80</td>
</tr>
<tr>
<td>7.5</td>
<td>4.2</td>
<td>3.1</td>
<td>1.70</td>
<td>6.20</td>
<td>23.33</td>
<td>74.20</td>
</tr>
</tbody>
</table>
Table 5: Average Result of Marshall Properties at 2% Low Density Polyethylene

<table>
<thead>
<tr>
<th>Bitumen Content (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDM (g/cm³)</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>5.5</td>
<td>2.3</td>
<td>2.21</td>
<td>7.5</td>
<td>11.8</td>
<td>36.00</td>
</tr>
<tr>
<td>5.5</td>
<td>5.1</td>
<td>2.5</td>
<td>2.30</td>
<td>6.4</td>
<td>14.7</td>
<td>56.46</td>
</tr>
<tr>
<td>6.5</td>
<td>6.0</td>
<td>2.6</td>
<td>2.50</td>
<td>5.3</td>
<td>18.0</td>
<td>70.60</td>
</tr>
<tr>
<td>7.5</td>
<td>4.2</td>
<td>3.0</td>
<td>2.06</td>
<td>4.6</td>
<td>20.0</td>
<td>87.00</td>
</tr>
</tbody>
</table>

Table 6: Average Result of Marshall Properties at 3% Low Density Polyethylene

<table>
<thead>
<tr>
<th>Bitumen Content (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDM (g/cm³)</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>5.80</td>
<td>2.1</td>
<td>2.38</td>
<td>6.30</td>
<td>19.80</td>
<td>68.18</td>
</tr>
<tr>
<td>5.5</td>
<td>6.40</td>
<td>2.3</td>
<td>2.41</td>
<td>5.13</td>
<td>23.90</td>
<td>78.50</td>
</tr>
<tr>
<td>6.5</td>
<td>7.00</td>
<td>2.4</td>
<td>2.44</td>
<td>4.81</td>
<td>24.75</td>
<td>80.85</td>
</tr>
<tr>
<td>7.5</td>
<td>3.69</td>
<td>3.1</td>
<td>2.10</td>
<td>4.23</td>
<td>33.50</td>
<td>87.00</td>
</tr>
</tbody>
</table>

Table 7: Average Result of Marshall Properties at 4% Low Density Polyethylene

<table>
<thead>
<tr>
<th>Bitumen Content (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDM (g/cm³)</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>5.67</td>
<td>2.2</td>
<td>2.41</td>
<td>7.52</td>
<td>21.62</td>
<td>68.40</td>
</tr>
<tr>
<td>5.5</td>
<td>6.2</td>
<td>2.31</td>
<td>2.32</td>
<td>6.38</td>
<td>22.33</td>
<td>71.32</td>
</tr>
<tr>
<td>6.5</td>
<td>6.8</td>
<td>2.14</td>
<td>2.37</td>
<td>5.80</td>
<td>23.11</td>
<td>72.30</td>
</tr>
<tr>
<td>7.5</td>
<td>5.4</td>
<td>2.58</td>
<td>2.20</td>
<td>5.28</td>
<td>24.30</td>
<td>73.00</td>
</tr>
</tbody>
</table>

Table 8 – 12 shows the Optimum bitumen Content for 0%, 1%, 2%, 3% and 4% of Low Density Polyethylene additives.

Table 8: Optimum bitumen Content 0% Polyethylene

<table>
<thead>
<tr>
<th>Optimum Parameter</th>
<th>Value</th>
<th>Optimum Bitumen Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>4.7</td>
<td>6.5</td>
</tr>
<tr>
<td>CDM (g/cm³)</td>
<td>2.44</td>
<td>6.5</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>4.1</td>
<td>5.9</td>
</tr>
<tr>
<td>Average Bitumen Content</td>
<td></td>
<td>6.3</td>
</tr>
</tbody>
</table>
Table 9: Optimum bitumen Content 1% Polyethylene

<table>
<thead>
<tr>
<th>Optimum Parameter</th>
<th>Value</th>
<th>Optimum Bitumen Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>5.8</td>
<td>6.5</td>
</tr>
<tr>
<td>CDM (g/cm³)</td>
<td>2.45</td>
<td>6.5</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>5.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Average Bitumen Content</td>
<td></td>
<td>6.5</td>
</tr>
</tbody>
</table>

Table 10: Optimum bitumen Content 2% Polyethylene

<table>
<thead>
<tr>
<th>Optimum Parameter</th>
<th>Value</th>
<th>Optimum Bitumen Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>6</td>
<td>6.5</td>
</tr>
<tr>
<td>CDM (g/cm³)</td>
<td>2.5</td>
<td>6.5</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>5.3</td>
<td>5.9</td>
</tr>
<tr>
<td>Average Bitumen Content</td>
<td></td>
<td>6.3</td>
</tr>
</tbody>
</table>

Table 11: Optimum bitumen Content 3% Polyethylene

<table>
<thead>
<tr>
<th>Optimum Parameter</th>
<th>Value</th>
<th>Optimum Bitumen Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>7.1</td>
<td>6.5</td>
</tr>
<tr>
<td>CDM (g/cm³)</td>
<td>2.44</td>
<td>6.5</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>4.81</td>
<td>5.9</td>
</tr>
<tr>
<td>Average Bitumen Content</td>
<td></td>
<td>6.3</td>
</tr>
</tbody>
</table>

Table 12: Optimum bitumen Content 4% Polyethylene

<table>
<thead>
<tr>
<th>Optimum Parameter</th>
<th>Value</th>
<th>Optimum Bitumen Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>6.8</td>
<td>6.5</td>
</tr>
<tr>
<td>CDM (g/cm³)</td>
<td>2.37</td>
<td>6.5</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>5.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Average Bitumen Content</td>
<td></td>
<td>6.3</td>
</tr>
</tbody>
</table>

Below are the graphs showing the relationship between stability and bitumen content for mix containing varying proportion of polyethylene.
From the graph of bitumen content versus stability, it was observed that stability for 0%, 1%, 2%, 3% and 4% polyethylene admixtures increases with an increase in bitumen content up to 6.5% bitumen content. It can be deduced from this figure that the stability increases as the % polyethylene admixtures in the mix is increased.

From Fig. 2, it was observed that higher values of flow occur at 0% LDPE, but as the percentage of LDPE increases, the values of flow begin to fall but still fall within the
range of 2.3mm to 5mm as specified for medium Traffic by the Asphalt Institute, 1983.

![Graph showing the relationship between Bitumen Content and CDM](image1)

**Fig. 3: Combined graph of Bitumen Content against CDM**

Figure 3 shows the relationship between the bitumen content and CDM for 0%, 1%, 2%, 3% and 4% LDPE. It was observed from the figure that the values of CDM decrease as LDPE content increases. All the values fall within the range specified by Asphalt Institute except the value at 4% LDPE content.

![Graph showing the relationship between Bitumen Content and VIM](image2)

**Fig. 4: Combined graph of Bitumen Content against VIM**

Figure 4 shows the relationship between the bitumen content and VIM for 0%, 1%, 2%, 3% and 4% LDPE. It was observed from the figure that the values of Voids in the
Mix increased slightly with corresponding increase in the percentage of the Low Density Polyethylene (LDPE).

**Fig. 5**: Combined graph of Bitumen Content against VMA

Figure 5 illustrate the relationship between bitumen content and VMA for 0%, 1%, 2%, 3% and 4% LDPE additives. Increase in VMA was noticed as the bitumen content increases for all the percentages of admixtures.

**Fig. 7**: Combined graph of Bitumen Content against VFB
From the Fig 6, it was observed that at all the percentages, there is a little or no difference in the VFB values which implies that the addition of LDPE to the mix has a little effect on the percentage VFB.

**CONCLUSION**

The Bitumen, aggregates (fine and coarse), cement (filler) used meet specifications for use in Asphalt Concrete. The optimum Bitumen Content for all percentages of polyethylene is 6.5%.

From the results, it can be concluded that the optimum polyethylene Content suitable as an admixture in Hot Mix Asphalt is 2%.

Finally, bitumen modified with Low Density polyethylene in Hot Mix asphalt increases its stability and decreases flow and thus can be of better resistance against deformation.

**RECOMMENDATIONS**

Further research should be carried out to find out if above 4% of the mix, polyethylene can still be used in Hot Mix asphalt.

Waste recycling plants should be set up to recycle polyethylene in domestic and industrial Waste so that it can be used for large scale Asphalt.

**REFERENCES**


Justo E. and Veeraragavan (2001): Review note on use of plastic Litter on roads, Department of Civil Engineering, NIT Wrangal, Bangalore India


SUITABILITY OF BAGASSE ASH AS A FILLER MATERIAL IN HOT MIX ASPHALT (HMA) CONCRETE

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Several waste and used material from different sources such as mineral, agricultural, domestic and industrial are generated every day in large quantities and their safe disposal has been a major concern. However, these wastes have been found to be useful in the stabilization and/or improvement of construction materials, such as soil and concrete. Amongst these techniques is the use of Bagasse Ash (BA). It is in this light that a laboratory based investigation for the possible use of BA as filler that can partially replace Ordinary Portland Cement (OPC) in Hot Mix Asphalt (HMA) was conducted. Tests were conducted on the materials used and a trial mix of 10%BA and 90%OPC at bitumen contents of 4.5%, 5.5%, 6.5% and 7.5% respectively were prepared using the Marshall Method. The results show that the stability of the samples was maximum at 5.5% bitumen content, the flow at optimum bitumen content was 2.5mm, the compacted density of mix increased up to a bitumen content of 5.5% and then began to fall with increase in bitumen content, the voids in mixed aggregates increases with increase in bitumen content which gave 20.1% of void in the mixed aggregate and the volume of void in the mix at 5.5% bitumen content was 4.0%. The optimum bitumen content for the experiment was 5.5%. This study proves that BA can be used as a filler partially replacing cement in HMA.

Keywords: hot mix asphalt, Marshall method, bitumen, bagasse ash, strength

INTRODUCTION

Asphalt concrete is a mixture of aggregate (coarse and fine), binder (bitumen) and filler (majorly cement), used for construction and maintenance of all kinds of roads, parking areas but also playground and sport areas. The function of the filler in an asphalt concrete mix is to act as a final void filling material as well as a means of stiffening the bitumen film on the aggregate particles. Suitable materials for use as filler are limestone dust, cement, hydrated lime or other fine mineral dust having not less than 65% passing a 200 mesh sieve. The criterion as regard the suitability of a filler is its fineness, but there are some indications that hydrated limes and possibly other active fillers provide some additional structure effect which increases the stability of the paving. The ratio of filler to bitumen must be kept in balance (Jackson and Brien, 1962).

In civil engineering works, various waste products have been used for several purposes amongst which are stabilization of soil and replacement of materials. These wastes utilization would not only be economical but may also result to foreign exchange earnings and environmental pollution control (Aigbodion et al, 2008).

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Bagasse ash

Sugarcane Bagasse (SCB) is a fibrous waste-product of the sugar refining industry, along with ethanol vapour. This waste-product is already causing serious environmental pollution which calls for urgent ways of handling the waste. Its analysis from sugar industry shows that it contains unburned carbon along with the other constituents present in Portland cement. Thus, its ash can be considered as one of the potential raw material in cement manufacturing and can be added during clinkerization process. It will help to remediate the environmental pollution problem and reduce the cost of production of cement. Bagasse Ash (BA) can replace some of the raw materials; reduce the energy cost and increasing revenue from the cement industry (Mohammad et al, 2009).

The use of BA as an Supplementary Cementitious Material (SCM) to partially replace OPC not only helps reduce methane emissions from dispose of organic waste and reduce the production of cement, which is in famous for its high energy consumption and CO₂ emission, but also can improve the compressive strength of cement based materials (Sirirat and Supaporn, 2010).

BA can improve the compressive strength of cement-based materials. As stated by Cordeiro et al. (2008), the improved compressive strength depends on both physical and chemical effects of the SCB ash. The physical effect (the filler effect) is concerned with the packing characteristics of the mixture, which in turns depends on the size, shape and texture of SCB ash particle. The chemical effects relates to the ability of the BA to provide reactive siliceous and/or aluminous compounds to participate in the pozzolanic reaction with calcium hydroxide and water.

BA in conjunction with lime has also been used as chemical stabilizers in compacted soil-blocks. These blocks were tested for flexure and compression in a saturated state. Lime and BA as cement replacement seems promising when considering the issue of energy consumption, these improved the strength in comparison with the referent due to the formation of strong phases (Rafael et al, 2012).

Laboratory study on the influence of three compactive efforts on the strength properties to treated black cotton soil shows that the tropical black cotton clay treated with a maximum of 10% BA by weight of dry soil indicated that the strength properties increased with higher compactive effort (Osinubi and Thomas, 2007).

Amin, (2011) utilized BA in high strength OPC mortar. The effects of BA content on the physical and mechanical properties of hardened mortar were studied, which include compressive strength, consistency, setting time and chloride diffusion. The result indicated that BA was an effective mineral admixture and pozzalana.

The aim of this work is to examine the suitability of Bagasse Ash as mineral filler in Asphalt Cement Concrete. This was to be achieved through the following objectives;

Preliminary tests on all the constituents of asphalt concrete were carried out.

The pozzolana content of the Bagasse Ash in terms of its adequacy for use as partial replacement was assessed.

A trial experiment was carried out and the desirable engineering properties of the asphalt mix in the light of its requirement to maximize strength, durability and service performance of the pavement were observed.
MATERIALS

Materials used in the design of asphalt includes the main constituent of asphalt concrete which includes filler materials (Bagasse Ash and cement), aggregates (fine and coarse) and binder (bitumen). The fibrous residue after crushing and extraction of sugar cane was obtained from Kura in Kano State where it is in abundance after which it was burnt in open air to obtain its ash. The fresh coarse and fine aggregate were obtained from Zaria in Kaduna State. The Ordinary Portland Cement was of Dangote brand and obtained from Samaru in Zaria, Kaduna State. The bitumen used was obtained from Nigeria National Petroleum Co-operation (NNPC) in Kaduna State.

METHODS

The methodology involves the experimental tests carried out to determine the physical properties of bitumen, coarse aggregate, fine aggregate, cement and the chemical properties of Bagasse Ash.

The tests carried out on Bagasse Ash and the components of HMA are as follows:

Tests on Bagasse Ash

Chemical Composition

Particle Size Distribution of Bagasse Ash (ASTM D546)
Specific gravity (ASTM C188)
Test on aggregates
Aggregate impact value/hardness test (BS 812-111)
Aggregate crushing value (BS 812-112)
Aggregate specific gravity (ASTM C127 and ASTM C128)
Size and gradation (BS 812-103)

Tests on bitumen

Penetration test (ASTM D5)
Solubility test (ASTM D2042)
Viscosity test (ASTM D2170)
Ductility test (ASTM D113)
Flash and fire point test (ASTM D92)

Experimental test on cement

Initial and Final setting time (BS EN 196-3)
Soundness test (BS EN 196-3)

5. Marshall Test (Asphalt Institute, 1983)

TEST ON BAGASSE ASH

CHEMICAL COMPOSITION OF BAGASSE ASH

The chemical analysis was conducted at the Centre for Energy Research and Training (CERT), Ahmadu Bello University, Zaria by mini pal which is a compact energy dispersive X-ray spectrometer designed for element analysis for a wide range of
samples. The system was controlled by PC running dedicated mini pal analytical software. The sample for the analysis was weighed and grounded in aggregate mortar and a binder (PVC dissolved in toluene) was added to the sample, carefully mixed and pressed in a hydraulic press into a pellet. The pellet was loaded into the sample chamber of the spectrometer and voltage (30kV maximum) and a current (1mA maximum) was applied to produce the X-ray to excite the sample for preset time of 10 minutes. The spectrum from the sample was now analyzed to determine the concentration of the elements in the sample.

PARTICLE SIZE DISTRIBUTION OF BAGASSE ASH

This test was carried out in accordance with ASTM D546. The BS sieves were nested in order of decreasing size from top to bottom. With the sample in the top most of the sieve, the sieves were agitated mechanically for a sufficient amount of time. After shaking the nested sieves, the material retained on each sieve was weighed and the percentage passing each of the sieves is calculated.

TEST ON COARSE AGGREGATE

AGGREGATE IMPACT VALUE/HARDNESS TEST

A sample of coarse aggregate which passes the 12.5mm sieve and retained on the 9.52mm sieve was prepared ensuring that the sample was in a clean and surface dry condition. A cylinder of diameter 7.6mm was then filled in three layers with each layer given 25 stroke of the 22.9cm metal tamping rod to each layers. The top of the aggregate was levelled to the nearest gram and the same weight of material used for each test. The whole of the sample was placed in the cup, fixed firmly in position on the base of the impact machine and 25 blows of the tampering rod. The sample was subjected to 15 blows by allowing the hammer fall freely. The crushed aggregate was sieved with the 2.40mm sieve and the percentage passing by weight was determined.

The test was repeated thrice and the average of the three result taken. The impact value result was expressed as the percentage of fines passing the 2.4mm sieve to the weight of the sample.

AGGREGATE CRUSHING VALUE

The sample consists of aggregate passing the 12.5mm and retained on the 9.52mm BS sieve. A sufficient aggregate of about 5kg was prepared and it was ensured that the aggregate was in a clean and surface dry condition. The cylinder was placed on the base plate and filled with aggregate in three equal layers and each layer was given 25 blows. The top was levelled off of the aggregate with the tamping rod and the plunger inserted such that it rests horizontally on the surface of the aggregate. The sample was then tested in a compression machine loading at 40kN/min to a load of 400kN (10 minutes). The material was then removed from the cylinder and passed through sieve size 2.40mm BS test sieve. The test was repeated thrice and the average of the three results obtained taken. The aggregate crushing value is expressed as the percentage of the fines passing the 2.40mm sized sieve to the total weight of the sample.

AGGREGATE SPECIFIC GRAVITY

A gas jar and ground glass disc was used; it was filled with distilled water to full capacity with the screw cap in position. The outside of the glass jar was dried and weighed, p. The cap was then unscrewed and the sample introduced, the sample was of weight 1kg, B. The disc was then replaced and the gas jar refilled to full capacity
with distilled water. The outside was dried and reweighed, ps. The gas jar at this point contained less water and the weight of the water occupying the same volume as the sample is \((p + B + ps)\). The apparent specific gravity of the surface dry sample was obtained with this relationship:

\[
\text{specific gravity} = \frac{B}{(p + B + ps)}
\]

### SIZE AND GRADATION

The coarse aggregate gradations were considered by carrying out sieve analysis. These were carried out according to BS standard for coarse aggregate.

### TEST ON FINE AGGREGATE

#### SPECIFIC GRAVITY TEST

A pycnometer was filled with distilled water to full capacity with the screw cap in position. The outside was dried and weighed, \(p\). The cap was unscrewed and the sample of surface-dry sand of weight 500g, \(B\), introduced. The cap was placed and the pycnometer refilled to full capacity with distilled water. The whole of the pycnometer was covered with a finger and the pycnometer was rotated on its side in order to eliminate entrapped air. The outside was dried and reweighed, \(ps\). The pycnometer then occupied less water than before and the weight of the water occupying the same volume as the sample was \((p + B - ps)\). The apparent specific gravity of the surface of dry sample was obtained by the expression:

\[
\text{Specific gravity} = \frac{B}{(p + B - ps)}
\]

### PARTICLE SIZE DISTRIBUTION

This test was also carried out in accordance with BS standard. The sieves were nested in order of decreasing size from top to bottom. With the sample in the top most of the sieve, the sieves were agitated mechanically for a sufficient amount of time. After shaking the nested sieves, the material retained on each sieve was weighed and the percentage passing each of the sieves was calculated.

### TEST ON BITUMEN

#### DUCTILITY TEST

This was conducted in accordance with the ASTM standard. The bitumen was completely melted by heating it at a temperature needed to properly liquefy the sample (150°C-160°C). After thoroughly stirring it to remove air bubbles, it was then poured into a thoroughly amalgamated briquette brass mould. The mould containing the material was allowed to cool at room temperature for a period of 30-40 minutes then was placed in a water bath which was maintained at a temperature of 25±0.9°F for another 30 minutes, the excess bitumen was cut off with a straight edge puffy knife to make the mould just level full. After the briquette brass mould containing the sample had been in the water bath for 80-85 minutes, the plate was then removed and the side pieces detached and the sample was tested immediately by attaching the rings at each of the clips or pin to the hooks in the testing machine and then the two clips pulled apart at a uniform speed of 5cm/min. The distance in centimeter through which the clips have been pulled to produce rupture was measured. This test helps to
determine the measure of internal cohesion of the material and also to know whether ductility is present in the material.

**VISCOSITY TEST**

The method used to determine the viscosity of the bitumen for this work was in accordance with ASTM standard. A cork was inserted into the bottom of the viscometer cup and the cup filled with the prepared bitumen sample. A cork with central hole and a groove on one side was then inserted and a thermometer was passed through the central hole so that its bubble was directly at the geometric centre of the sample. The cup was then suspended up to its rim in a water bath maintained within $\pm 0.1^\circ C$ of the test temperature for a period of one and half hour.

The viscometer was set up in a level position and the viscometer water bath was filled with water and adjusted to a temperature of $\pm 0.1^\circ C$ of the test temperature. Throughout the test, the temperature of the bath was kept constant with frequent stirring. The cup was then placed in the viscometer water bath and cork and thermometer removed. Liquid mineral oil was poured into the receiver up to 20 ml graduation mark and placed the receiver directly under the orifice of the cup. The valve was lifted and suspended on valve support. The timer started when the liquid in the receiver reaches 25ml graduation mark and the timer stopped when the liquid reaches the 75ml graduation mark. The time interval multiplied by a calibration factor for the viscometer gives the viscosity in $m^2$/sec (or stokes i.e. $m^2$/sec).

**SOLUBILITY TEST**

Two 5g of the dry samples were weighed to the nearest 0.01g into a 200ml conical flask and 100ml of CS$_2$ added. The content in the flask was stirred and then allowed to stand, loosely cored for 1hr. The content of the flask was filtered through a prepared and dried couch crucible which has been weighed to the nearest 0.5mg and the asbestos material of which has been moistened with CS$_2$ before filtering. It was then filtered at a rate of not more than two drops per seconds (2 drops/sec.). The insoluble matter remaining in the flask was then transferred to the crucible by washing out the flask with a steam of CS$_2$ from a wash bottle. The retained material in the crucible was washed with successive small amount of CS$_2$ and a filtration which was not coloured obtained. The crucible was allowed to dry in air for 30 minutes and then placed in the oven at a temperature of 100$^0$-110$^0$C for one hour. The crucible was allowed to cool in desiccators and then weighed.

**PENETRATION TEST**

This test was conducted in accordance with ASTM standard. The bitumen was heated until it became sufficiently fluid for pouring. It was then stirred until it became homogenous and devoid of air bubbles. The sample was then poured into the container such that the impenetrable thickness was about 10mm. The container and content were covered and cooled in the atmosphere to a temperature of about 25$^0$C for one and half hour to two hours. The sample along with the transfer dish was transferred into the water bath for another one and half hour to two hours after which the sample and the container were transferred to the penetration machine. The loaded needle was adjusted to make contact with the surface of the sample. The pointer was adjusted to zero and the needle then released for the specified period of time and the distance of penetration was measured.
FLASH AND FIRE POINT TEST

These properties were determined in the following procedure. Bitumen was softened between 75°C and 100°C then thoroughly for the removal of air bubble and water from the sample. The sample was heated in a brass cup while periodically holding a small flame over the surface of the sample with heat supplied at a rate of 5°C to 6°C increase per minutes. The flash point was taken as the temperature of the flame application that causes a bright flash in the interior of the cup. The heating was continued until the material gets ignited and continues to burn for five (5) seconds, this temperature was taken as the fire point.

TESTS ON CEMENT

INITIAL AND FINAL SETTING TIMES

A sample of cement paste was prepared and the time of first mixing the water with cement was noted. A mould was then filled with the paste and a needle with cross-sectional area 1mm² was used to determine the initial set. The mould was then placed under the needle of the vicat apparatus and the needle lowered gently onto the surface of the paste and then released quickly and allowed to sink to the bottom of the mould.

This was repeated each 10 minutes in different positions of the mould until the paste was stiffened sufficiently for the needle to penetrate not deeper than 5mm above the bottom of the mould, this is read from the scale. The initial setting time was expressed as the time elapsed since the mixing water was added to cement until the last reading. The 1mm² needle was replaced with a metal annular attachment and then allowed to come gently in contact with the surface of the cement paste every 15 minute interval. The final setting was said to be reached when the needle makes an impression on the surface but annular cutting edge fails to do so.

SOUNDNESS TEST

A cement paste of standard consistency was prepared and the le-Chartelier mould placed on the glass plate and filled with the paste keeping the split of the mould gently closed by tying the mould with a piece of cotton whisk on which this operation was being performed. The top of the mould was then covered with another piece of glass plate and the whole immediately immersed in clean water. The mould was removed from water after 24hrs and the distance between the pointers measured. The mould was again re-immersed in water and allowed to boil for 30 mins and afterwards for one hour, then the mould was removed from water and allowed to cool. The distance between the pointers was measured and the difference between the two distance measured represents the expansion of the cement.

MARSHALL TEST

Marshall Test method is the method of choice for the specimen preparation and testing because of its universal acceptance. The plans include an effective proportioning of trial bitumen contents, coarse and fine aggregates and the filler. Three (3) specimens each were produced for each bitumen content and a total of ninety (12) specimens in all to run a trial experiment for the effect of bagasse ash in their strength properties. The test was in accordance to Marshall Test of Asphalt Institute (1983).
PREPARATION OF TEST SAMPLES

1. Mixing

Before mixing, the aggregates and bitumen are preheated to the desired temperature of mixing. The heated aggregate sample was placed in the mixing bowl and thoroughly mixed using a trowel. A crater was formed in the centre of the mixed aggregate to which the required weight of bitumen was poured. Mixing continued until a uniform distribution of material was achieved.

2. Compaction

The mould, base plate, filling collar and an inserted paper disc were assembled and preheated and the mixed material was transferred into the mould with a spatula. The surface of the material was then smoothed to rounded shape onto which another paper disc was placed and then the mix was compacted using 50 blows (for medium traffic) of the Marshall hammer on each surface, making a total of 100 blows on a sample. After compaction, the mould assembly was then placed on a bench where the base plate, filling collar and paper discs were removed. The mould and the specimen were allowed to cool in air to a temperature at which there will be no deformation of the specimen during extraction from the mould using an extrusion jack. The compacted briquette was labelled and allowed to cool to room temperature ready for testing the next day. The whole procedure was then repeated on the remaining prepared samples.

TESTING OF SPECIMEN

The briquettes were tested to determine their volumetric composition and strength characteristics. The bulk specific gravity was determined for each briquette at 25°C in accordance with the test procedure described in ASTM D2726. After measuring the bulk specific gravity, the briquettes were immersed in a water bath at 60°C for 35 ± 5 minutes. Each briquette was then removed in turn and tested using a Marshall crushing apparatus to determine the stability and flow values. The mean value of stability and flow for each triplicate set of briquette was calculated and recorded. After completion of stability and flow tests, two of each triplicate set of briquettes were dried to constant weight in an oven at 105°C ± 5°C. Each pair of briquettes were combined to give bulk samples to be tested in accordance with the ASTM D2041 procedure for the determination of maximum specific gravity of the mixes.

ANALYSIS OF RESULTS FROM MARSHALL TEST

The properties that are of interest include the bulk specific gravity otherwise known as the compacted density of the mix, compacted density of mix aggregate, percentage air voids, percentage void in mixed aggregate, and percent voids filled with bitumen.

The bulk specific gravity \( G_m \) or the Compacted Density of the Mix (CDM), is the specific gravity considering air voids and is obtained using the relationship:

\[
CDM = G_m = \frac{W_m}{W_m - W_w}
\]

(3)

Where; \( W_m \) = Weight of specimen in air

\( W_w \) = Weight of specimen in water

Note that \( W_m - W_w \) = Volume of mix. Sometimes, when open graded aggregate is used, it is necessary to coat specimens with paraffin wax before measuring weight in
water for bulk specific gravity and this however, requires the calculation of weight and volume of wax to get accurate result.

The Compacted Density of Mixed Aggregates (CDMA) is given by:

\[
CDMA = \frac{CDM}{1 + (B/100)}
\]

(4)

Where; \( B \) = Bitumen content

The Specific Gravity of the Mixed Aggregates (SGMA) is given by:

\[
SGMA = \frac{100}{(W_c/G_c) + (W_f/G_f) + (W_{mf}/G_{mf})}
\]

(5)

Where; \( W_c \) = Weight of coarse aggregate in the total mix

\( W_f \) = Weight of fine aggregate in the total mix

\( W_{mf} \) = Weight of filler in the total mix

\( G_c \) = Apparent specific gravity of coarse aggregate

\( G_f \) = Apparent specific gravity of fine aggregate

\( G_{mf} \) = Apparent specific gravity of filler

While the Specific Gravity of the Mix (SGM) is calculated by:

\[
SGM = \frac{100}{(P_a/SGMA) + (BC/G_b)}
\]

(6)

Where; \( P_a = 100 - B \) = % aggregate fraction (coarse + fine aggregates + filler)

\( BC \) = % binder content

Void in the Mix (VIM) is the percentage of air voids by volume in the specimen and is given by:

\[
VIM = \frac{(SGM - CDMA) \times 100}{SDM}
\]

(7)

Voids in Mineral Aggregate, VMA, is the volume of voids in the aggregates and is the sum of air voids and volume of bitumen i.e.

\[
VMA = \frac{(SGMA - CDMA) \times 100}{SGMA}
\]

(8)

Void Filled with Bitumen, VFB, is the voids in the mineral aggregate frame work filled with the bitumen and is given by:

\[
VFB = \frac{(VMA - VIM) \times 100}{VMA}
\]

(9)

**ANALYSIS AND DISCUSSION OF RESULT**

**TESTS ON AGGREGATES (COARSE, FINE AND FILLER)**

The table 1 shows the strength properties which are measures of mechanical properties (crushing and impact tests) of the aggregate and specific gravity (measure of aggregates and filler density).
Table 1: Comparison of Test Result on Aggregates and filler with Standard

<table>
<thead>
<tr>
<th>Property</th>
<th>Result</th>
<th>Code Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Crushing Value</td>
<td>22.12%</td>
<td>&lt; 30</td>
</tr>
<tr>
<td>Aggregate Impact Value</td>
<td>21.31%</td>
<td>&lt; 30</td>
</tr>
<tr>
<td>Specific Gravity (Coarse)</td>
<td>2.5</td>
<td>2.6 - 2.9</td>
</tr>
<tr>
<td>Specific Gravity (Fine)</td>
<td>2.62</td>
<td>2.6 - 2.9</td>
</tr>
<tr>
<td>Specific Gravity (Bagasse)</td>
<td>2.85</td>
<td>2.85</td>
</tr>
</tbody>
</table>

The results obtained from the tests conducted on aggregates all falls within the specified values quoted in the code of specifications as such the aggregate is suitable for HMA design.

PARTICLE SIZE DISTRIBUTION CURVES FOR AGGREGATES

The graphs of particle size distribution performed on the aggregates are presented below as figures 1 and 2. Also, the particle size distribution graph of the cumulative percentage passing of the combined materials is shown in figure 3.

Figure 1: Particle Size Distribution Curve for Coarse Aggregate

Figure 2: Particle Size Distribution Curve for Fine Aggregate

Coarse aggregate can be defined as all materials retained in sieve 2.36mm sieve. Since the coarse aggregate used for this study has zero percent (0%) passing sieve 2.36mm,
it can be inferred that the aggregates meet the requirements. Also, fine aggregate is defined as all materials passing 2.36mm sieve size. Since the fine aggregate used for this study satisfies this requirement, then it is suitable for use in asphalt concrete.

**TESTS ON BITUMEN**

The test results obtained are compared with those specified by the relevant codes so as to see its suitability or otherwise of the tested materials for HMA pavement design. The comparison was as shown in table 2.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Code Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration at 25°C</td>
<td>92mm</td>
<td>80 – 100 (mm)</td>
</tr>
<tr>
<td>Flash and Fire Point (min)</td>
<td>243 ºC</td>
<td>219 ºC</td>
</tr>
<tr>
<td>Solubility in CCl₄</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1</td>
<td>0.97 - 1.02</td>
</tr>
<tr>
<td>Ductility at 25°C</td>
<td>75cm</td>
<td>75cm</td>
</tr>
<tr>
<td>Viscosity at 60°C</td>
<td>192 mm²/s</td>
<td>120 – 250 (mm²/s)</td>
</tr>
</tbody>
</table>

From the results shown, it can be seen that the penetration, viscosity, flash and fire point, ductility, solubility and specific gravity falls within the range specified by the code. Therefore, the material can be used in HMA design.

**TESTS ON BAGASSE ASH**

**CHEMICAL COMPOSITION OF BAGASSE ASH**

The result of chemical analysis conducted of bagasse ash was as shown in Table 3. According to ASTM standard which specifies a material having combined weight of silica, aluminium and iron oxides of a given percentage (%) by weight of fraction as shown in table 4 is considered a pozzolana of either class F, N or C; therefore, it can be deduced that the BA is of class C (SiO₂ + Al₂O₃ + Fe₂O₃ = 53.4%) and can be used as mineral filler in HMA design as a partial replacement of cement.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight of fraction %</th>
<th>Component</th>
<th>Weight of fraction %</th>
<th>Component</th>
<th>Weight of fraction %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>5.5</td>
<td>SiO₂</td>
<td>38</td>
<td>Fe₂O₃</td>
<td>9.9</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>3.14</td>
<td>K₂O</td>
<td>15.3</td>
<td>S₀₃</td>
<td>2.61</td>
</tr>
<tr>
<td>Re₂O₇</td>
<td>0.02</td>
<td>TiO₂</td>
<td>1.62</td>
<td>CaO</td>
<td>9.25</td>
</tr>
<tr>
<td>V₂O₅</td>
<td>0.079</td>
<td>Cr₂O₃</td>
<td>0.071</td>
<td>MnO</td>
<td>0.32</td>
</tr>
<tr>
<td>NiO</td>
<td>0.084</td>
<td>CuO</td>
<td>0.073</td>
<td>ZnO</td>
<td>0.23</td>
</tr>
<tr>
<td>BaO</td>
<td>0.53</td>
<td>Cl</td>
<td>3.52</td>
<td>Rb₂O</td>
<td>9.7</td>
</tr>
</tbody>
</table>
Bagasse ash

Table 4: Classes of Pozzolana (Deduced from ASTM C618-78)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>F</th>
<th>C</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂ + Al₂O₃ + Fe₂O₃ (min %)</td>
<td>70</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>SO₃ (max %)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Loss of Ignition (max %)</td>
<td>6</td>
<td>6%</td>
<td>10</td>
</tr>
</tbody>
</table>

PARTICLE SIZE DISTRIBUTION OF BAGASSE ASH

The result of the particle size distribution is as shown in figure 3. It was observed that about 65% of BA passed the 0.075mm sieve which signifies that the ash is suitable for use in HMA.

![Particle Size Distribution Curve for Bagasse Ash](image)

TESTS ON CEMENT

The results obtained compared with standard from code of practice were as shown in Table 5. It was observed from the table that the OPC used conforms to the standard stipulated in the specification. Hence, the cement is suitable for use in Civil Engineering work of which asphalt pavement design is one of them.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Code Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Setting Time</td>
<td>68 min</td>
<td>&gt; 45 min</td>
</tr>
<tr>
<td>Final Setting Time</td>
<td>3hrs 75 min</td>
<td>&lt; 10 hrs</td>
</tr>
<tr>
<td>Soundness</td>
<td>3.1mm</td>
<td>&lt; 10 mm</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.44</td>
<td>3.15</td>
</tr>
</tbody>
</table>

MARSHALL TEST

The Marshall stability of the mix is defined as the maximum load carried by the specimen at a standard test temperature of 60°C. The flow value is the deformation that the test specimen undergoes during loading up to the maximum load. Flow is measured in 0.25mm units. In this test, an attempt is made to obtain optimum binder content for the type of aggregate mix used and the expected traffic intensity. The
Marshall Stability Test results were as presented in Table 6 and the average values were presented in Table 7.

Table 6: Marshall Analysis Result for 10% BA Specimens

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Binder Content (%)</th>
<th>Air Specimen Weight (g)</th>
<th>CDMA (g/cm³)</th>
<th>CDM (g/cm³)</th>
<th>SGMA</th>
<th>SGM</th>
<th>VIM</th>
<th>VMA</th>
<th>VFB</th>
<th>Volume (Cm³)</th>
<th>Correction Factor</th>
<th>Stability (kN)</th>
<th>Adjusted Stability (kN)</th>
<th>Flow (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A21</td>
<td>4.5</td>
<td>1128</td>
<td>625</td>
<td>2.243</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>543</td>
<td>0.93</td>
<td>4.1</td>
<td>3.8</td>
<td>2.4</td>
</tr>
<tr>
<td>A22</td>
<td>4.5</td>
<td>1176</td>
<td>680</td>
<td>2.371</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>565</td>
<td>0.86</td>
<td>3.5</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>A23</td>
<td>4.5</td>
<td>1065</td>
<td>587</td>
<td>2.228</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>484</td>
<td>1.09</td>
<td>3.8</td>
<td>4.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Av</td>
<td>4.5</td>
<td>-</td>
<td>-</td>
<td>2.280</td>
<td>2.182</td>
<td>2.586</td>
<td>2.414</td>
<td>5.0</td>
<td>15.6</td>
<td>64.7</td>
<td>-</td>
<td>-</td>
<td>3.7</td>
<td>2.2</td>
</tr>
<tr>
<td>B21</td>
<td>5.5</td>
<td>1106</td>
<td>597</td>
<td>2.173</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>503</td>
<td>1.04</td>
<td>4.1</td>
<td>4.3</td>
<td>2.5</td>
</tr>
<tr>
<td>B22</td>
<td>5.5</td>
<td>1088</td>
<td>618</td>
<td>2.315</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>516</td>
<td>1.00</td>
<td>4.2</td>
<td>4.2</td>
<td>2.6</td>
</tr>
<tr>
<td>B23</td>
<td>5.5</td>
<td>1047</td>
<td>604</td>
<td>2.361</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>503</td>
<td>1.04</td>
<td>3.4</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Av</td>
<td>5.5</td>
<td>-</td>
<td>-</td>
<td>2.283</td>
<td>2.164</td>
<td>2.586</td>
<td>2.379</td>
<td>4.0</td>
<td>16.3</td>
<td>75.5</td>
<td>-</td>
<td>-</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>C21</td>
<td>6.5</td>
<td>1071</td>
<td>601</td>
<td>2.279</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>508</td>
<td>1.04</td>
<td>3.3</td>
<td>3.4</td>
<td>2.7</td>
</tr>
<tr>
<td>C22</td>
<td>6.5</td>
<td>1007</td>
<td>540</td>
<td>2.156</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>465</td>
<td>1.19</td>
<td>3.7</td>
<td>4.4</td>
<td>3.0</td>
</tr>
<tr>
<td>C23</td>
<td>6.5</td>
<td>1107</td>
<td>628</td>
<td>2.311</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>525</td>
<td>0.96</td>
<td>3.5</td>
<td>3.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Av</td>
<td>6.5</td>
<td>-</td>
<td>-</td>
<td>2.249</td>
<td>2.112</td>
<td>2.586</td>
<td>2.344</td>
<td>4.0</td>
<td>18.3</td>
<td>78.1</td>
<td>-</td>
<td>-</td>
<td>3.7</td>
<td>2.8</td>
</tr>
<tr>
<td>D21</td>
<td>7.5</td>
<td>1043</td>
<td>585</td>
<td>2.277</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>486</td>
<td>1.09</td>
<td>3.9</td>
<td>4.2</td>
<td>3.9</td>
</tr>
<tr>
<td>D22</td>
<td>7.5</td>
<td>1123</td>
<td>631</td>
<td>2.283</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>519</td>
<td>1.00</td>
<td>3.1</td>
<td>3.1</td>
<td>2.6</td>
</tr>
<tr>
<td>D23</td>
<td>7.5</td>
<td>1109</td>
<td>583</td>
<td>2.108</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>473</td>
<td>1.14</td>
<td>2.2</td>
<td>2.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Av</td>
<td>7.5</td>
<td>-</td>
<td>-</td>
<td>2.222</td>
<td>2.067</td>
<td>2.586</td>
<td>2.311</td>
<td>3.8</td>
<td>20.1</td>
<td>81.1</td>
<td>-</td>
<td>-</td>
<td>3.3</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Table 7: Average Marshall Analysis Result for 10% BA Specimens

<table>
<thead>
<tr>
<th>Bitumen Content (%)</th>
<th>Stability (kN)</th>
<th>Flow (mm)</th>
<th>CDMA (g/cm³)</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>3.7</td>
<td>2.2</td>
<td>2.280</td>
<td>5.0</td>
<td>15.6</td>
<td>64.7</td>
</tr>
<tr>
<td>5.5</td>
<td>4.0</td>
<td>2.5</td>
<td>2.283</td>
<td>4.0</td>
<td>16.3</td>
<td>75.5</td>
</tr>
<tr>
<td>6.5</td>
<td>3.7</td>
<td>2.8</td>
<td>2.249</td>
<td>4.0</td>
<td>18.3</td>
<td>78.1</td>
</tr>
<tr>
<td>7.5</td>
<td>3.3</td>
<td>3.0</td>
<td>2.222</td>
<td>3.8</td>
<td>20.1</td>
<td>81.1</td>
</tr>
</tbody>
</table>
Bagasse ash

Table 8: Typical Marshall Mixture Design Criteria

<table>
<thead>
<tr>
<th>Mix Criteria</th>
<th>Light Traffic (&lt; 10⁴ ESALS)</th>
<th>Medium Traffic (10⁴ - 10⁶ ESALS)</th>
<th>Heavy Traffic (&gt; 10⁶ ESALS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaction</td>
<td>Min. 35</td>
<td>Max. 50</td>
<td>Min. 75</td>
</tr>
<tr>
<td>Stability (min) N</td>
<td>2224</td>
<td>3336</td>
<td>6672</td>
</tr>
<tr>
<td>Flow (0.01 inch)</td>
<td>8</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>Flow (0.25mm)</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Percentage Air Void</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Asphalt Institute, 1983

Comparing the maximum average values in Table 7 for 10% BA obtained for stability, flow and VIM for medium traffic with that in Table 8, it was observed that they all falls within the specified range by the standard. The VMA increases with an increase in bitumen content with 20.1% as the maximum value. This value is greater than the minimum value of 15% for a maximum aggregate size of 12.5mm (used for the mix) specified by the standard as shown in Table 9.

Table 9: Typical Marshall Minimum VMA

<table>
<thead>
<tr>
<th>Nominal Maximum Particle Size (mm)</th>
<th>Minimum VMA (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>11</td>
</tr>
<tr>
<td>50</td>
<td>11.5</td>
</tr>
<tr>
<td>37.5</td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>12.5</td>
<td>15</td>
</tr>
<tr>
<td>9.5</td>
<td>16</td>
</tr>
<tr>
<td>4.75</td>
<td>18</td>
</tr>
<tr>
<td>2.36</td>
<td>21</td>
</tr>
<tr>
<td>1.18</td>
<td>23.5</td>
</tr>
</tbody>
</table>

Source: Asphalt Institute, 1983.

The maximum particle size used was 12.5mm; which implies that minimum VMA is 15%.

CONCLUSION

The desirable properties of aggregates in terms of hardness, durability and size were met by the aggregate. The values of for ACV, AIV, specific gravity for coarse and fine aggregate falls within the value specified by the relevant standards. With these properties the aggregate can be used for HMA design. Also, the required properties of
bitumen as a binder as regards its penetration, viscosity, flash point etc has also conform to those of those of the standard specified by the relevant codes. Therefore, it can be used in the design of asphalt pavement.

The recommended properties of mineral filler in terms of pozzolanic characteristics and fineness was met by the Bagasse Ash since the combined percentage of silica, aluminium and iron oxides meets that specified in ASTM standard. Owing to this, BA can be used as mineral filler in HMA pavement design.

The trial mix using 10%BA and 90%OPC at varying percentages of bitumen content meets the standard specified in terms of stability, flow and VMA and VIM and at an optimum bitumen content of 5.5%.

RECOMMENDATIONS

It can be said that the use of BA as a partial replacement for cement would be suitable in the design of HMA pavement most especially as Bagasse is readily available as a waste material in this part of the world (Nigeria) and the demand of cement is on the high side

BA as a partial replacement for cement will help to solve environmental problems encountered in urban settings where Bagasse is disposed; hence this can help in the actualization of the phrase “waste to wealth”.

It is also recommended that a further research be carried out using varying proportion of BA and also its cost evaluation.

REFERENCES


SUSTAINABILITY AND THE BUILT ENVIRONMENT: A CASE STUDY OF THE HAUSA MIGRANT SETTLEMENT, SABO, IN ILE-IFE, NIGERIA

Adisa Buki
Department of Architecture, Obafemi Awolowo University, Ile-Ife, Nigeria.

The built environment in Sabo, a Hausa migrant settlement in Ile-Ife Nigeria, has existed for over a century (since 1903). This community bears features of sustainable architecture and accommodates a homogenous group with respect to social and cultural qualities. A good understanding of the relationship between the built environment of Sabo (which in itself is a prototype of migrant communities spread all over the country) and sustainability issues is reveals certain qualities. These qualities help in understanding the state of the built environment of Sabo, its merits and drawbacks, and how sustainable it is in its present state in relation to cultural practices. In other words the study seeks to understand the role culture plays in the community in the journey towards achieving sustainability. Therefore while exploring the community as a whole: the buildings, the people, other environmental features, as well as their cultural practices (as a homogenous community), it is evident that plausible ways of achieving better sustainability calls for culture change. This exploratory study of the Hausa migrant settlement in Ile-Ife involved the administering of 203 questionnaires to at least one (1) resident/house in the enclave as well as 11 structured/open-ended interviews. The environmental attitudes of residents were subjected to principal component analysis and ‘Community Attachment’ emerged the strongest with explanations rooted in culture.

Keywords: built environment, culture change, cultural practices, homogenous community, and sustainability

INTRODUCTION

Current discourses on the environment have focused on providing environments that are sustainable, particularly since targets for the built environment have centred on the creation of buildings and environments which are less-dependent on energy and water; made of materials derived from sustainable sources, and that produce little or no waste in either its use or construction. In reality, these targets may be difficult to achieve, nevertheless as a world trend, communities have moved closer to achieving sustainable environments through economic, social or environmental means.

The environment of the Sabo community in Ile-Ife, Nigeria reveals neglect and features that are peculiar to other communities similar to it in Nigeria. The Hausa migrant settlement, Sabo, similar to the Sabon Zongo in Ghana (Pellow, 1988) is a community found in most towns and cities of Nigeria, especially in south-west Nigeria (Figures 1-2). The Sabo settlement is set as an enclave (which is a distinct group that is culturally or ethnically different from a surrounding larger and distinct political unit - Encarta dictionary 2009). This is a strategy to establish a presence in the host communities in
Hausa migrant settlements

In order to foster the cattle/kolanut trade. They set up both business and residence along the major business spine of these towns and cities.

The oldest of such is the Sabo in Ibadan, Oyo State Nigeria which is referred to as the ‘Nerve Centre’ and headquarters of these settlements in south-west Nigeria. Every Sabo community in the South-west of Nigeria have a link with it. Figure 2 shows the states in south-west Nigeria.

Figure 1: Map of Nigeria highlighting Osun State and the other 35 states

Figure 2: South-west Nigeria

These enclaves generally exemplify ‘poor neighbourhoods’ characterised by heterogeneous populations (to a level since there is still a mix with the Yoruba hosts), high rates of residential instability as well as a large percentage of its population living in abject poverty. They are saddled with the responsibility of providing certain essential services; in this case the provision of portable water and drainages, and others like social security, and habitable houses. Some peculiarities these enclaves have include the presence of an open market for the cattle/kolanut trade, poorly finished houses organized in a haphazard manner all over the settlement, and a Friday mosque (which is open to more than the Hausa).

The Sabo Ile-ife enclave which is surrounded by the host Yoruba residential areas are in poor structural conditions which in turn produce a socially disorganized community as posited by the ‘Social Organization Theory’ (Shaw and Mckay, 1969).
The physical facilities in the enclave have been sustained mainly through the traditional Hausa practice of reconstructing houses using traditional techniques and readily available materials, in order to keep the housing units in habitable conditions (Moughton, 1985). These are some of their moves towards achieving sustainability. However there are more salient factors that underlie the settlement’s existent for over a century which is rooted in the social/cultural aspects of the community. This explorative study particularly focuses on exposing these other non-environmental aspects of sustainability, which are not immediately observable but that offer salient explanations to sustainability issues in the Hausa migrant settlement in Ile-ife, Nigeria.

THE FOCUS, THE PROCESS AND THE DESTINATION

Sustainable development or at times ‘quality of life’ is often used synonymously to mean ‘Sustainability’ but these two terms have been clearly differentiated from ‘sustainability’. Quality of life is argued to be only a part of what is meant by ‘sustainable development’ according to Hammond (2000), since the latter is seen as a balance of economic and social development with environmental protection (“people, planet, prosperity”).

Sustainable development is defined as “the development which meets present needs without compromising the ability of future generations to achieve their needs and aspirations” (WCED, 1987). It appears to be basically concerned with improving the quality of life of human beings in both urban and architectural scales. Oktay (1999) buttresses this by suggesting that sustainable development is more specifically based upon balancing urban development with the conservation of environmental resources such as land, air, water, forests, and energy. Also that ‘In housing environments, local sustainable development is concerned with improving the quality of life of the local community through the prudent use of local resources, which is aimed at achieving a high degree of local self-efficiency that is related to the location.

However Sutton (2004) has argued that it is unreasonable to use ‘sustainable development’ as a synonym for ‘sustainability’ because sustainability is about continuity and development is about change. And that if these two meanings combine it produces change processes where some things are transformed while other attributes are maintained’. Summarily, he believes that ‘sustainable development’ means ‘genuine progress that can be sustained because the underpinnings of the environment, society and the economy are maintained’. Most submissions though are that sustainable development is only a process or journey towards a destination, which is ‘sustainability’.

Precedence in the quest for sustainability for communities is rooted in the Talloires Conference of 1990, which is antecedent to the ‘Talloires Declaration’; and the UN Rio Summit of 1992 that saw ‘Agenda 21’ to fruition. While the Talloires Declaration focused on sustainable university campuses, the Rio summit was more of an international agreement both emphasizing as well as clarifying the vital role of formal and non-formal education in promoting sustainable development and the increasing knowledge of environment and development issues (United T

Norton et al (2007) in a review of initiatives of different Universities in the United States, with respect to achieving possible sustainability, reveal that most of these initiatives focus only on environmental aspects and neglect both equity and economic concerns; whereas all these aspects go together. In fact while most initiatives are
based only on environmental aspects of environment, it has been observed that the focus most of the time has been on energy consumption and waste streams resulting from building design, the use of technology, and everyday activities, while neglecting broader environmental aspects, as well as social, economic and equity concerns.

Sustainable development is seen here as a continuous process geared towards ‘Sustainability’, the destination. The focus has been on environmental aspects alone, neglecting the other aspects which in reality add up to the effectiveness of these initiatives at achieving sustainability. This study’s exploration of the sustainable developmental practices aims to employ this as an explanation for justifying the move towards achieving sustainability in the community, through cultural practices that culminate in efforts to keep the settlement existent.

THE STUDY AREA

Ile-ife is a town in Osun State, South-west Nigeria (figure 2 above), which is said to be the historical root of all Yoruba-speaking people. The town is situated 86km east of Ibadan (another large Yoruba city) in Oyo state, 32km south-west of Ilesha (a major town in Osun State), and 58km north of Ondo (a major town in Ondo State), which are its immediate neighbours. It is made up of two local governments namely Ife-central and Ife-east and both are located in the Osun-east Senatorial district as indicated in Figure 3. Ife as it is mostly referred to is a big town with the prestigious Obafemi Awolowo University situated in Ife-central local government and has a population of 167, 254 (NPC, 2006 Census figures).

Figure 3: Map of Osun State showing Local Government Areas and Senatorial Districts

The Sabo settlement is a small portion of Ife covering less than 62.5 hectares (0.625Km²) of land in a town with about 10, 500 hectares (105 Km²) of landed area (about 0.6% of total landed area) and accommodates about 7% of the town’s population. It is known to be the most densely populated portion of town with an overwhelming growth rate; it is a slum settlement with low quality of life for its occupants.
Sabo Ile-ife is a landlocked enclave Flanked by Obalufon - Fajuyi road (which is a part of the major intercity road) on its commercial side, Hezekiah Oluwasanmi Road (also nicknamed ‘Road 7’, which is likely because is linked to Road 7 of the Obafemi Awolowo University), the Olaolu Street off ‘Road 7’ and lastly by the Methodist Church/ Primary School. Figure 4 is an aerial view of the settlement showing its present state of congestion and chaos. The reference points visible on the map are the boundaries and the two Primary Schools, the AUI and the Methodist Primary Schools. The AUI (Ansarul Islam) Primary School is situated along the Olaolu Street. The layout is better viewed in Figure 5.

Figure 4: Showing the aerial map of Sabo Ile-ife (Source: Google Maps)

The enclave, which exemplifies a typical neighbourhood, has an administrative head called the Sarkin Hausawa (king or chief of the Hausa and similar to the Sarkin Zongo of Sabon Zongo communities in Ghana) who relates directly with the local authorities (the local government as well as the traditional seat of power) on matters involving the progress and welfare of his people and community. In this case the Ife Central local government authority and the traditional seat of power of the legendary Ooni of Ife. The Sarkin Hausawa also has subordinates who are chiefs helping with administrative works (such as administering the smooth running of the enclave, representing the community in courts of law, or in the wider host community) as well as acting as law enforcers, since the enclave is guided mainly by certain set standards of implicit social rules dictated by the shared culture.

Migrant Hausa settlements abound in cities and towns in Nigeria and beyond. In Nigeria, most south-west towns and cities have one. These migrants have established a presence in the business of Kola nuts/ cattle trade; where they trade the healthy northern cattle that feed on the northern/middle belt/ savannah of Nigeria, for the kola nuts that grow in the south-west parts of the country. To establish this link, these migrants set up settlements usually in the central parts of these towns/cities where heavy commercial activities take place. These settlements are called ‘Sabo’ or ‘Sabon gari’ meaning ‘new’ or ‘new place/town in the Hausa language.

However the settlement’s growth rate is overwhelming (NPC 2006) as it serves also as a squatter settlement and harbour other northern immigrants who may engage in
businesses other than the cattle/kola trade ranging from hand crafts (like raffia mats, and flexible pails for fetching water from wells), the illegal foreign exchange vendors, to those who excavate wells for water and hired labourers in the building industry. While the population size of the settlement increases, the area remains constant so that before long, the settlement experiences very high densities that can lead to poor housing/living conditions.

The Sabo settlement in Ile-ife is typical and bears every feature of the migrant settlement; the Hausa migrants, their culture, the decay and problems with the settlement.

METHOD

Both quantitative and qualitative methods were employed in data collection and interpretation, because of the peculiarities of the work and to some extent the subjective nature of some of the variables to be measured. The original study was a survey that examined the characteristics of the housing environment in Sabo, Ile-ife in order to explain how these were used as reference to their ethnic identity. Firstly, the data collection process involved a reconnaissance survey of the area to get better familiar with it, test the relevance of questions raised in the questionnaire, and to get possible links from persons in the settlement that would be useful at the stage of data collection.

Next the data collection was performed after the questions were modified. This involved the administration of questionnaires to at least one household in every Sabo house. Each questionnaire was administered like a structured interview to nearly all respondents because of their level of literacy. Data collection also involved some in-depth open-ended interviews with 11 key persons in the settlement. Some of these key informants included four (4) enlightened youths who could speak English fluently, a well-known Hausa trader who lived outside of the settlement (but was always visiting the settlement), the remaining were elderly Hausa men and women who had lived in the settlement for long.

The structured/open-ended interviews were transcribed and interpreted. The quantitative data was analysed using the analytical software for social sciences, SPSS, to find frequencies, bivariates, correlations, and factor analysis. The factor analysis was used to analyse the attitudes of respondents to certain variables and values in the enclave while testing the significance of their responses.

On one hand, this study attempts to explore how the ‘Sabo Hausa’ in Ile-ife have sustained the architecture of their hosts without compromising their own cultural perceptions and practices as migrants in the host community. This is because the migrant Hausa in Ile-Ife do not build houses like the traditional Hausa house in Northern Nigeria, but transform the architecture of their host, in this case ‘rooming apartments’ (these are detached bungalows with rooms arrayed on opposite sides of a long and wide corridor beginning at the entrance door and culminating in the back door) to suit their housing needs. However, on the other hand it explores how these migrants deal with issues of sustainability within the landlocked settlement they live in, despite their rapidly growing population.
Table 1: Showing Survey Design

<table>
<thead>
<tr>
<th>Methodology for sourcing Primary Data</th>
<th>Methodology for sourcing Secondary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative method: Survey</td>
<td>Tools: Reconnaissance survey, Questionnaire</td>
</tr>
<tr>
<td>Qualitative method</td>
<td>Structured open-ended interviews, observations, and photographs</td>
</tr>
</tbody>
</table>

The entire settlement was the sample frame. In all, 203 residents responded to the questionnaires. These represented at least one household per Sabo house. Most houses in the enclave accommodated multiples of households.

RESULTS

Culturally Stratified Layout and Land-Use

The built environment in Sabo, Ile-ife appears stratified into three culturally defined parts as revealed in the layout below; the Hausa residential area marked ‘H’, the Hausa-Yoruba mixed residential areas marked ‘HY’, and the Yoruba area marked ‘Y’. Only Hausa residents live in the residential area marked ‘H’ and most houses there have Hausa landlords. In the mixed residential area marked ‘HY’ Yoruba residents live there, as well as inter-married Hausa-Yoruba couples (a Hausa man married to a Yoruba wife and vice versa). Lastly, in the Yoruba area houses are only owned by the Yoruba hosts and one would hardly find a Hausa family living there for now, (though young unmarried Hausa males rent rooms there).

The settlement is not purely residential but has heavy commercial activities on its fringes in addition to the market (which is actually called the kolanut market). The shops form a fence for the settlement at the front which served as security for the settlement. It was impossible to enter the settlement by the front without being noticed and interrogated. The back of the settlement is fenced off by houses owned and occupied by Yoruba residents, this is by Olaolu Street. On one of the sides of the enclave is the Methodist Church and Primary School which serves as boundary. The other side is delineated by shops but this time owned by Yoruba traders who may not necessarily live in the settlement.

It also has religious facilities mosques (small ones within the residential area and the Friday mosque in front of the enclave, which was recently pulled down and rebuilt with modern building materials). The Friday mosque overlooks the kolanuts market. Other facilities are Churches (on the Yoruba side of the settlement), educational facilities (two primary schools at the boundaries of the settlement, Arabic schools within the settlement, and an adult literacy facility just by the market outside of the enclave).

Socio-Physical and Environmental Characteristics of the Enclave

The Sabo Hausa are gradually moving inwards and possessing more land for their fast growing population, by buying houses from the hosts and modifying to suit their needs. Generally the enclave is marked by unguided physical development and haphazard layouts with alleys in between them. The present state of the built
Hausa migrant settlements

Environment reveals the failures and lapses in governance as well as the poverty of the migrant community. It exposes the residents of the enclave to environmental and health risks from:

- lack of drinkable water,
- unattended waste dumps,
- free flowing drains from the houses to the alleys and access roads,
- unapproved house designs without adequate ventilation, lighting
- breeding of livestock within the enclosure of the compounds in the settlement
- over-populated houses that encourage the fast spread of epidemics.

![Figure 5: The layout of the Sabo built environment in Ile-ife](Source: ADISA, O.O. (2008))

The Sabo residents’ sink a well in nearly all the compounds where water is drawn manually to drink, wash, and cook (often times they visit borehole points outside their enclave to fetch drinkable water). The very few compounds without wells use those of their nearest neighbour or mosque (each mosque had a well by it because of the usual ritual of cleaning up before praying). In the enclave, a failed borehole water project exists located by a high refuse heap.

The refuse heap full of trash has existed for at least 5 years and the pile is heaped higher than a Sabo house. The occupants of houses located around it often complain about the odour from decomposing waste. The refuse heap is shown in Picture 1.

The settlement is endowed with electricity as the residents of the enclave attest to having power nearly all through the day, which is good relative to most areas of Ife town. Though there are assertions that this is so because the residents Sabo use less power than other residential areas.

By the year 2007 the migrant settlement had recorded a depth of four generations on the same location, the Sabo enclave after 104 years of its existence (since 1903). The
residents feel at home there and have acquired the language of the host community (mainly because of the nature of their trade and their long stay in the environment). A few have intermarried and are accepted in the community, though a few have moved out of the enclave to other areas of the host community. The settlement is landlocked, cannot be extended to any sides but bound on every side by roads so that as the population increases the housing units cannot increase at the same rate. The Sabo enclave was the first ever approved land for the Hausa merchants by the Ooni of Ile-ife (the traditional ruler of Ile-ife). In this settlement, the Hausa feel secure and free to express their cultural identity.

Plate 1: Showing the Refuse Heap

<table>
<thead>
<tr>
<th>Table 2: Showing Religion of Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Islam</td>
</tr>
<tr>
<td>Traditional</td>
</tr>
<tr>
<td>Christianity</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Religion and Ethnicity**

The statistics showed that out of about 203 residents of the settlement, only 15 were not Muslims (Table 2) and it also showed that all Sabo Hausa practiced Islam. Table 2 shows that 188 (92.6%) respondents were Muslims, 14 (6.9%) Christians and 1 (0.5%) practiced the traditional religion. The few residents who were Christians were either immigrants from other places other than the north or the Yoruba residents. Table 3 shows the ethnicity/language of the residents. A bivariate analysis of the two tables showed that a total of 176 of the Muslims are Hausa/Fulani and 12 are Yoruba. The Isoko respondent is a Christian together with 13 other respondents who are Yoruba. The one who practiced the traditional religion was of Yoruba origin.
Table 3: Showing Mother tongue (language) of residents

<table>
<thead>
<tr>
<th>Mother tongue of residents</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hausa</td>
<td>157</td>
</tr>
<tr>
<td>Yoruba</td>
<td>5</td>
</tr>
<tr>
<td>Fulani</td>
<td>16</td>
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<tr>
<td>Isoko</td>
<td>1</td>
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<tr>
<td></td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>1</td>
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<tr>
<td></td>
<td>2</td>
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<td></td>
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</tr>
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<td></td>
<td>8</td>
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<td></td>
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</tr>
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<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>203</td>
</tr>
</tbody>
</table>

Environmental Attitudes of Residents

A set of attitudinal questions were asked the residents regarding the environment and living in it. Some of these questions were: Is Sabo is the best place for the Hausa?; Should every Hausa live in Sabo? Each of these questions were responded to by ranking responses on a 5-point likert scale from ‘Strongly Agree’ to ‘Strongly Disagree’. Data got on these environmental attitudes of residents was analysed using Principal Component Analysis and showed that ‘Community Attachment’ was strongest and then the idea of ‘Difference’.

Community Participation

Kinship and kinship relations are strongly respected as the immigrants see the enclave as home away from home and have generations of kin in the settlement which is about four-generations deep. Most family structures in the settlement are polygamous, just like it obtains in northern Nigeria. The principal component analysis showed that most important attitudes of the Sabo Hausa is their attachment to the community which had an initial eigen value of 14.98%. Variables explaining this are: that they believe all friends and family of the Hausa should live in the settlement; that the enclave is self-sustaining and so a sabo Hausa can remain in the enclave for a week or more in a row and still get essentials daily which suits the lifestyle of the Hausa women in purdah (in seclusion); sabo houses are designed to suit the sabo Hausa lifestyle; sabo is the best place for the Hausa immigrant to live in; and finally that sabo is home away from home. This is most practicable since the Hausa shared the same language, religion and other practices cultural practices as a homogenous community.

The Idea of Difference

The second factor which emphasized the difference between the migrant Hausa and their Yoruba host has an initial eigen value of 10.434% and is explained by the difference in language, religion, and the other two were related to the ‘organization’ and ‘appropriation’ of their houses. All these still stress how central culture is to the existence and practices of the sabo Hausa.

Reconstruction of Housing

One important practice to note about the traditional Hausa is that just like Moughtin (1985) documented is that they pull down their house when it is in a bad state or when they wish to modify it and then on the same site, rebuild again. Plateplate 2 shows a residential building being reconstructed with locally available materials as well as some of the materials pulled down reused. The residents of the settlement gather to
help build using readily available building materials and local technology recycled from generation to generation. It however clearly shows that the sabo Hausa engage in strong community participation. This way is the sabo Hausas’ attempt at sustainable development. In the course of data collection, two residential buildings including the Friday mosque were pulled down partially or totally for reconstruction. The Friday mosque was replaced by a better building, with two floors (a ground floor and an upper floor), making it the tallest Hausa building in the settlement. It also is the most modern building in the enclave because it is made of sandcrete blocks, plastered, with casement windows. It is also the most significant building in the enclave which bears the symbol of power and authority ruling and dictating every move of the community and the lives of its residents. About five other mosques are located in the enclave where the immigrants could go to for prayers when called out for it during the prayer times of the day. The few Yoruba who live around and on the fringes of the settlement were also welcome to use the facilities. This was a way of getting more allies from the host community and as a result strengthening their social security.

Initial Eigen value - 14.98%

<table>
<thead>
<tr>
<th>S/No</th>
<th>Variable</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All friends and family of the Hausa should live in Sabo.</td>
<td>0.820</td>
</tr>
<tr>
<td></td>
<td>The Sabo Hausa can stay in the Sabo settlement for a whole week or more and will still get their daily needs.</td>
<td>0.757</td>
</tr>
<tr>
<td></td>
<td>The Sabo house is designed to suit the Hausa lifestyle.</td>
<td>0.663</td>
</tr>
<tr>
<td></td>
<td>Sabo is the best place for the Hausa to live in</td>
<td>0.641</td>
</tr>
<tr>
<td></td>
<td>The Sabo settlement is ‘Home Away from Home’</td>
<td>0.633</td>
</tr>
</tbody>
</table>

Initial Eigen value - 10.434%

<table>
<thead>
<tr>
<th>S/No</th>
<th>Variable</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Hausa do not live with their Yoruba neighbours because their languages differ.</td>
<td>0.773</td>
</tr>
<tr>
<td></td>
<td>The Hausa do not live with their Yoruba neighbours because their religions differ.</td>
<td>0.925</td>
</tr>
<tr>
<td></td>
<td>The Hausa do not live with their Yoruba neighbours because their houses are differently organised.</td>
<td>0.890</td>
</tr>
<tr>
<td></td>
<td>The Hausa do not live with their Yoruba neighbours because their houses are used differently.</td>
<td>0.899</td>
</tr>
</tbody>
</table>

Culture undoubtedly controls not only the worldview of the immigrants but also determines what becomes of the people, their settlement and their relation with others. Sustainable developments are imbued in their cultural practices as well which explains why and how in more than a century the settlement has survived in its original location even as the long distance trade business still thrives.
DISCUSSION

The physical environment in Sabo Ile-ife is generally unsightly and this is in spite of the fact that the settlement has existed for over a century. The environment shows a state of disrepair, lack of attention by Government especially with the provision of essential services and the enforcement of standards through the local authorities. However, one central explanation has been with the ‘collective will’ of the people of the community who though come from different states in Northern Nigeria have a common worldview (by this collective will, they accept or reject development as the case may be). The individual’s life goals and ideals are congruent to the general cultural values, mainly because the society plays a dominant role in the lives of the people and shield them from external influences. The common religion, Islam, is directly responsible for this (Moughtin 1985, 24).

Privacy as a theme has ordered the environment of the enclave to the extent that even Local Authorities find it difficult to navigate through the enclave let alone see the houses of the migrants for inspection purposes. The excuse all the time has been to protect their ‘women in purdah’ (even though the isolation of women is becoming more and more liberal in the enclave). By this theme, the Sabo Hausa have kept their worldviews intact as well as other cultural perceptions.

However, the move towards sustaining their physical environment has been with the practice of reconstruction of their housing. Their priorities are with their housing units (so they can have constant accommodation) and the Friday mosque (which serves as a symbol of their political presence, while they foster their business and friendship with the host community). The Friday Mosque also symbolises the hierarchy of the social and cultural tenet, and so requires the most attention.

While this is so, the economic aspects and the businesses established by Sabo merchants have improved over the years. Now in the Sabo enclave in Ile-ife, other businesses other than the cattle/Kolanut trade exist like exportation of other food/fruits to the Northern parts of the country; initiating transportation to Abuja and other northern towns/cities like Kano; provides labour services for the building industry in Ile-ife; provide the cheapest and most effective well–boring services in town; and
offers the sale of rare and durable products like raffia mats, cheap leather wallets and a host of other things. Many of these items will only be found in the enclave. Even the Commercial Banks in Ife rely on the illegal money-changers to strengthen their business.

While the environmental aspects of sustainability appear unattended to, the non-environmental aspects have thrived and the link can be traced to strong cultural attachments/community participatory efforts of the Sabo people especially fostered by their religion, Islam. It is evident that in order to achieve even more strategic sustainability especially with the environment of Sabo Ile-ife only a community-participatory initiative will suffice. The initiative must also align with cultural perspectives especially the worldviews of the Sabo Hausa. This call for radical change in the Sabo enclave can only be achieved through culture change, when the Hausa can be made to embrace change.

References


Encarta dictionary 2009.


Hausa migrant settlements


Archival Documents

National Population Commission Nigeria 2006 Reports

Ife Master Plan, 1977
## APPENDIX: The Principal Component Analysis Table

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
<th>11</th>
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<td>All Shld go back to North over time</td>
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<td>-</td>
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<td>.149</td>
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<td>-</td>
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<td>-.101</td>
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<td>.207</td>
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<td>.132</td>
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### Hausa Migrant Settlements

<table>
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</tr>
<tr>
<td>Women stay more at home</td>
<td>910 6.12 4.7E-02</td>
</tr>
<tr>
<td>ALL in spaces used by women</td>
<td>.188 4.1E-02</td>
</tr>
<tr>
<td>Communal spaces shld be more secluded</td>
<td>1.155E-02</td>
</tr>
<tr>
<td>Space around house used, mainly by Xren</td>
<td>1.952E-02</td>
</tr>
<tr>
<td>Spaces used by Xren</td>
<td>.233 5.6E-02</td>
</tr>
<tr>
<td>Xren spaces for parties</td>
<td>7.66 7E-02</td>
</tr>
<tr>
<td>Spaces for pedestrian circulation</td>
<td>6.38 3.156E-02</td>
</tr>
<tr>
<td>Spaces as play area for Xren</td>
<td>9.296E-03</td>
</tr>
<tr>
<td>Spaces as sit out in Xren evenings</td>
<td>1.098E-03</td>
</tr>
<tr>
<td>Sabo, Best place for Hausa to live</td>
<td>.641 9.7E-02</td>
</tr>
<tr>
<td>Sabo, only place for Hausa to live</td>
<td>.166 1.215E-02</td>
</tr>
<tr>
<td>Total</td>
<td>1.141 6E-02</td>
</tr>
</tbody>
</table>

1076
SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION FIRMS

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Environmental change is happening everywhere. Turbulent weather patterns - heat waves, rains, snowfalls, hurricanes and stormy rains are becoming extreme in every sense throughout the world. These climatic changes are today a concern of every individual and world leader alike. The burning of oil and other fossil fuels releases carbon dioxide, which rises, blankets the earth and traps heat causing severe changes in weather patterns. Not only do we have climate problems but we are also dealing with a resource depletion issue. The construction industry has a major impact on the environment because 50% of the material resources for construction are taken from nature. The huge consumption of resources by the construction industry has called for sustainable practices in construction. Sustainable supply chain provides economic, social and environmental requirements in material and service flows occurring between suppliers, manufacturers and customers. Sustainable development has taken the centre stage among different countries of the world. During the 1992 Earth Summit in Rio, the governments and other international organizations decided to take useful measures to protect the environment for long term social and economic development. This paper aims at investigating the compliance of the construction industry to environmental regulations. In this paper, the construction industry of Lagos state in Nigeria was used as a case study.

Keywords: construction industry, environmental regulation, sustainability, sustainability development.

INTRODUCTION

Sustainability is sometimes used interchangeably with green. Sustainable supply chain provides economic, social, and environmental requirements in material and service flows occurring between suppliers, manufacturers and customers (Buyukozkan et al., 2011). While green supply chain management is mainly involved with environmental thinking, sustainable supply chain management broadens its focus to three main pillars; economic, social, and environmental. Sustainable Development is the key concept as discussed in 1992 Earth Summit in Rio Brazil, the governments and other international organizations have decided to take useful measures to protect the environment for long term social economic development (Johannesburg summit, 2002).

References

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The concept of sustainability is not new, but has changed over the past fifty years. According to the international institute for sustainable development, the term first originated in 1962 with the gradual merging of the environmental movement and the post-World War II international development community, unlike the environmental movement a generation ago, sustainability today carries a strong connotations of win-win benefits, efficiency, high performance, long term thinking and getting it. Despite the current recession, leading corporations across all sectors of the industry will increasingly make supply chain sustainability an integral element of their strategy, from product development to manufacturing and the supply chain to marketing and communications (Van den Broek, 2010). Sustainability is a form of development that meets the needs of the present needs without compromising the ability of future generations in meting their own needs. Sustainability design goes far beyond simply creating products that benefits consumer in terms of better air environment, cost savings and durability, rather effective sustainable design must illustrate a thorough understanding of a full systems approach of products in their environment and interaction, with other products, as well as the effect on many other factors. It should be viewed as a process and not just a goal, that allow a broader evaluation over time of the environmental, economical and societal impacts of buildings products. Viewing sustainability as a process is essential for green designs as specifiers are challenged to evaluate the full life cycle of products.

Whether firms can benefit from being “green” has become an important question in the business strategy literature as exemplified by the considerable empirical research analyzing the link between beyond-compliance environmental strategy and financial performance or competitive advantage (Damania, 2001; Dowell, Hart, and Yeung, 2000; King and Lenox, 2001; Konar and Cohen, 2001; Margolis and Walsh, 2003; McWilliams and Siegel, 2000; Orlitzky, 2008; Orlitzky, Schmidt, and Rynes, 2003.). Although, the empirical literature on the link between environmental strategies and competitive advantage, mostly rooted in economics, emphasizes external drivers such as regulation, we still have little understanding of the organizational mechanisms that link the adoption of environmental management practices or strategies to competitive advantage (Marcus, 2005). The term ‘sustainable construction’ is generally used to describe a process which starts well before construction (in the planning and design stages) and continues after the construction team have left the site (Hill and Bowen, 1997). In the light of construction, construction industry plays a vital role towards achieving national and international strategies for social and economic development. It contributes towards increasing the Gross Domestic Product (GDP), stimulating growth of other industries and creating job opportunities as well as providing the societies with facilities and infrastructure projects that meet their needs and fulfill their requirements but having a major impact on the environment because about 50% of the material resources for construction are taken from nature, 40% of energy consumption and 50% of total waste generated (Othman, 2010). The huge consumption of the resources by construction industry has called for sustainable construction in order to meet the present and future needs. Primary goal of sustainability is to reduce humanity’s environmental or ecological footprint on the planet. Sustainable development has given rise to green buildings. Most green building practices fall into seven basic categories: energy saving, land saving, storm water runoff-reducing, material conservation and pollution reduction (ECONorthwest, 2001). A green building uses an average of 30% less energy than conventional building (Economist, 2004). Material waste generated during construction is reduced or recycled. Energy efficiency is improved, perhaps by relying on the use of natural
light and ventilation or solar power. Less water is used, or rainwater harvesting system is installed to ensure a wiser use. Measures taken to make buildings and construction more sustainable rely increasingly on life cycle approaches.(cited by Nwokoro and Onukwube, 2011)

**SUSTAINABLE DEVELOPMENT DEFINED**

Sustainable development refers to a mode of development in which resource use aims to meet human needs while preserving the environment so that the needs can be met not only in the present, but also for generations to come. The term sustainable development was used by the Brundtland Commission which coined what has become the most often –quoted definition of sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). It ties together concern for the carrying capacity of natural systems with the social challenges faced by humanity. As early as the 1970s, sustainability was employed to describe an economy in equilibrium with basic ecological support systems. Ecologists have pointed to the limit to growth, and presented the alternative of a steady state economy.

Sustainable construction is the adoption of materials and products that will require less use of natural resources and increase the reusability of such materials and products for the same or similar purpose, thereby reducing waste as well. Sustainable construction also enhances the resilience of the industry as such; materials are readily available in the world market (Sustainable Construction, 2007).

Macquarie dictionary defines Compliance as an act of conforming, acquiescing and yielding or base subservience. Environmental compliance may be defined by the various stakeholders in the mining industry, companies, governments and communities are considered in the light of their possible objectives in requiring environmental compliance. Example of potentially conflicting environmental requirements in waste management are considered, particularly operational requirements such as minimal dust generation versus completion environmental compliance requirements of establishing a self sustaining ecosystem or geomorphically stable landform. Mechanisms are available to establish standards to determining if environmental compliance has been attained or not. In Administrative and Society report, it was concluded that the environmental compliance means conforming to the environment rather than simply acquiescing or yielding to manmade rules (Parker, 2000).

Standardization (ISO) is becoming more popular among local governments, international commissions, armed forces, and members of the public sector (Moutchnik, 2006). It was established in 1996, the ISO 14001 standard specifies the requirements for an environmental management system. Companies or individual facilities that are certified by ISO 14001 potentially benefit from improved and steady overall performance and regulatory compliance, efficiency in achieving their environmental goals, and strengthened relationship with their stakeholders and customers, not to mention the expanded universe of potential customers not otherwise accessible. This voluntary standard is applicable to any company interested in implementing or improving an environmental management system, demonstrating conformance, and seeking certification of its environmental management system. Many firms believe that using an external third-party organization helps to ensure that a company will comply with the legal and policy requirements associated with environmental management (ISO, 2004).
Regulations in the building industry are becoming increasingly complex and involve more than one technical area, covering products, components, project implementations and also play an important role in ensuring the quality of a building, and to minimize its environmental impact (Bouzidi et al., 2012).

**STUDY AREA**

Lagos State, Nigeria was created on May 27, 1967 by virtue of State (Provisions) Decree No. 14 of 1967, which restructured Nigeria’s Federation into 12 states. Prior to this, Lagos Municipality had been administered by the Federal Government through the Federal Ministry of Lagos Affairs as the regional authority, while the Lagos City Council (LCC) governed the City of Lagos. Equally, the metropolitan areas (Colony Province) of Ikeja, Agege, Mushin, Ikorodu, Epe and Badagry were administered by the Western Region. The State took off as an administrative entity on April 11, 1968 with Lagos Island serving the dual role of being the State and Federal Capital of Nigeria. However, with the creation of the Federal Capital Territory of Abuja in 1976, Lagos Island ceased to be the capital of the State which was then moved to Ikeja. Equally, with the formal relocation of the seat of the Federal Government to Abuja on 12 December 1991, Lagos Island ceased to be Nigeria’s political capital but remains the center of commerce for the country (www.city-data.com).

**RESEARCH METHODOLOGY**

In this section, we present the method of how we obtained the statistics about Nigerian firms. This paper makes use of detailed questionnaire to verify environmental compliance by the construction companies in Lagos state, Nigeria. Section A comprised of the demographical characteristics of the respondents while section B contained the specific questions addressing the focus of this study. It was administered to site managers/project managers/environmental managers of both public and private construction companies in the state. A total of 35 valid responses were received from the 100 questionnaires successfully e-mailed and sent out, representing a response rate of 35%. Whilst this response rate is perhaps a little disappointing, it is not surprising as the research focus; Green Supply Chain Management is new to them, given the commercially sensitive nature of questions relating to an organization’s competitive positioning, and the nature of the research instrument. However, the fact that our sample comprised responses from organizations representing a wide variety of sizes and sectors provides much reassurance that our sample is likely to represent the Environmental Compliance in Lagos State.

Use of questionnaire was adopted for this data collection due to the nature of the respondents involved. They are generally very busy people and it is hard to keep appointment with them for an interview.

**RESEARCH QUESTIONS**

The research questions used in this study are stated below:

- Is Green Supply Chain Management (GSCM) new in Nigeria?
- Does GSCM relevant to Nigerian construction firms?
- Is GSCM environmental compliance?
- How sustainable is GSCM?
DATA ANALYSIS

This sub-section is concerned with how the data collected will be transformed in order to satisfy the requirements needed to answer the research questions formulated in the study. Firstly, the data was coded and analyzed using the Statistical Package Software for Social Sciences (SPSS) ; both descriptive and inferential statistics was used for the analyses. Frequency, percentages and cross tabulation of variables was used for the descriptive statistics (Cody, 2011). This method of analysis has been employed by other construction management studies.

The demographic information of the respondents are presented in Table 1.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Project</td>
<td>Civil Engineering</td>
<td>21</td>
<td>60.0</td>
<td>67.7</td>
<td>67.7</td>
</tr>
<tr>
<td></td>
<td>Building Construction</td>
<td>10</td>
<td>28.6</td>
<td>32.3</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>31</td>
<td>88.6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>4</td>
<td></td>
<td></td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
<td></td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Years of Experience</td>
<td>2-4</td>
<td>6</td>
<td>17.1</td>
<td>19.4</td>
<td>19.4</td>
</tr>
<tr>
<td></td>
<td>5-8</td>
<td>13</td>
<td>37.2</td>
<td>41.9</td>
<td>61.3</td>
</tr>
<tr>
<td></td>
<td>9-11</td>
<td>6</td>
<td>17.1</td>
<td>19.4</td>
<td>80.7</td>
</tr>
<tr>
<td></td>
<td>12-15</td>
<td>4</td>
<td>11.4</td>
<td>12.9</td>
<td>93.6</td>
</tr>
<tr>
<td></td>
<td>16-18</td>
<td>1</td>
<td>2.9</td>
<td>3.2</td>
<td>96.8</td>
</tr>
<tr>
<td></td>
<td>19-21</td>
<td>0</td>
<td>0</td>
<td></td>
<td>96.8</td>
</tr>
<tr>
<td></td>
<td>22-24</td>
<td>1</td>
<td>2.9</td>
<td>3.2</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>31</td>
<td>88.6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>4</td>
<td></td>
<td></td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>21</td>
<td>60.0</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>40.0</td>
<td>40.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>35</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Qualification</td>
<td>HND/BSC</td>
<td>27</td>
<td>77.1</td>
<td>77.1</td>
<td>77.1</td>
</tr>
<tr>
<td>Status in the Organization</td>
<td>Managing Partner/Director</td>
<td>2</td>
<td>5.7</td>
<td>5.7</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>65.7</td>
<td>82.1</td>
<td>87.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manager Environmental/Supply Manager</td>
<td>3</td>
<td>8.6</td>
<td>10.7</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28</td>
<td>80.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>7</td>
<td>20.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>35</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 illustrates the demographic information about the respondents of this study. From the Table, it can be seen that there are valid 35 respondents, though in some variables, there are some missing which means some of the respondents did not answer some of the questions.
The results show that the respondents are more into civil engineering compared to building construction.

For their years of work experience, the mean was estimated at 8 years, which represents the working experience of about 41.95% of the valid respondents. Hence, with this average working experience, respondents are deemed experienced enough to supply reliable data for this study.

The Table also shows that there are more male respondents compared to the females, thereby depicts the societal norm of more male engineers than the female engineers.

The Table further shows that practicing engineers in Lagos State Construction firms are more professionally inclined than being academia, however the majority of the respondents possess HND/B. SC (77.1%) which shows that the respondents have a foundational training in the field.

Lastly, the Table also revealed that the majority of the respondents are construction/project managers, while there are few environmental/supply managers which explained and buttress that Supply chain management is new in Lagos state construction firms.

The data obtained from section B of the research questionaires which is Research focused is presented in Tables 2 to 6

<table>
<thead>
<tr>
<th>Table 2: Implementation and maintaining environmental standard by Supplifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Valid</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Missing</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The result shows that construction firms in Lagos state require the supplier to implement and maintain environmental standards. This can be attributed to the fact that the firms knows the importance of environmental friendly materials in construction works.

<table>
<thead>
<tr>
<th>Table 3: Construction firms face environmental pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Valid</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Missing</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Only 8 respondents agreed that their company is facing environmental pressures while 26 stated that their company is not, this may be due to the fact that others did not really understand what environmental pressure is.

The results show that acquisition of right of way, flooding, office location, pollution and rain are environmental pressures facing Lagos state construction firms as indicated by the respondents, however from the literature(www.oecd.org/env), it could
be affirmed that acquisition of right of way and office location are not environmental pressures. Flooding, rain and pollution are some of the environmental pressures faced by the construction firms in Nigeria. Flooding is the most rampant environmental pressure in Lagos state as shown in the result.

<table>
<thead>
<tr>
<th>Table 4: Environmental pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valid</strong></td>
</tr>
<tr>
<td>Acquisit</td>
</tr>
<tr>
<td>of right</td>
</tr>
<tr>
<td>way</td>
</tr>
<tr>
<td>Complaint</td>
</tr>
<tr>
<td>of flooding all our Lagos State</td>
</tr>
<tr>
<td>Flooding</td>
</tr>
<tr>
<td>Office location</td>
</tr>
<tr>
<td>Pollution</td>
</tr>
<tr>
<td>Rain</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Missing | 2          | 25.0    |              |                   |
| Total   | 8          | 100.0   |              |                   |

<table>
<thead>
<tr>
<th>Table 5: Pressures creators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valid</strong></td>
</tr>
<tr>
<td>The government</td>
</tr>
<tr>
<td>Contractors</td>
</tr>
<tr>
<td>Other stakeholders</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Missing | 1          | 12.5    |              |                   |
| Total   | 8          | 100.0   |              |                   |

Out of the 7 respondents that stated the entity responsible for the pressures, 4 respondents accrued it to other stakeholders. The result pointed out that other stakeholders who could be external stakeholders such as environmental regulations could be responsible for the pressure facing Lagos State Construction firms.

Out of the 35 respondents, 33 responded to this question and it was found that they sometimes engaged in the GSCM practice. The table shows that construction firms in Lagos State expect the suppliers to be environmentally compliant and certified to a recognised body like ISO 141, but they are not investing in ensuring the compliance. The result answers the research question that environmental regulations have a significant impact on adopting Green Supply Chain management practices in Lagos Nigeria.

**CONCLUSION**

This paper adopted GSCM practice to check the level of compliance to regulations by the Lagos State construction firms. Results showed that GSCM is still new in the industry as seen in the low response. Though literature and results confirmed that
GSCM regulations exist in Lagos State, the construction firms are lacking behind as they expect the suppliers to conform to it while they are not investing in it.

<table>
<thead>
<tr>
<th>Does your company purchase construction materials with environmentally friendly attributes, such as recycled materials, and those with non-toxic ingredients?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>15.6%</td>
<td>3.1%</td>
<td>18.8%</td>
<td>34.4%</td>
<td>28.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do suppliers disclose information about their environmental practices and pollution discharges?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>3</td>
<td>14</td>
<td>4</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>22.6%</td>
<td>9.7%</td>
<td>45.2%</td>
<td>12.9%</td>
<td>9.7%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you audit suppliers to evaluate their environmental performance?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>12.1%</td>
<td>21.2%</td>
<td>27.3%</td>
<td>33.3%</td>
<td>6.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you require suppliers to implement and maintain environmental management?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>8</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>3.1%</td>
<td>6.3%</td>
<td>37.5%</td>
<td>25.0%</td>
<td>28.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you require suppliers to obtain certification of their environmental management systems to a recognized body?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
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<td>10</td>
<td>9</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>9.1%</td>
<td>9.1%</td>
<td>30.3%</td>
<td>27.3%</td>
<td>24.2%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you work with suppliers to help them reduce environmental impacts through changes in product design and materials use?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>5</td>
<td>13</td>
<td>7</td>
<td>6</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>6.1%</td>
<td>15.2%</td>
<td>39.4%</td>
<td>21.2%</td>
<td>18.2%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does your firm organize training programmes for suppliers to increase their knowledge of environmental implications of their product?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>24.2%</td>
<td>36.4%</td>
<td>21.2%</td>
<td>12.1%</td>
<td>6.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you inform suppliers of technological developments relating to their operations?</th>
<th>Count</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>5</td>
<td>19</td>
<td>3</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>12.1%</td>
<td>15.2%</td>
<td>57.6%</td>
<td>9.1%</td>
<td>6.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

In conclusion, there is need for awareness of Green Supply Chain Management in Lagos, Nigeria which is the addition of environmental thinkings into supply chain management which will bring about sustainability in construction and thereby give a competitive edge.

**RECOMMENDATIONS**

This study provided an insight where basic development can be done. The results showed that the Lagos State construction firms are not aware of adopting such strategic practices, but they might be in the early learning stage of such organization.
environmental practices and still there is a gap between awareness and adoption of such strategic practices. Based on the findings of this study, which shows that some respondents cannot identify pressures on adopting Green Supply Chain Management practices in the State construction firms, also they are not organizing training for the suppliers, there is a need for them to become better educated in developing co-operative relationship with their suppliers, customers, and the community of the stakeholders for the common environmental objectives. This study is one of the efforts to determine the drivers of GSCM adoption among Lagos State construction firms and our investigations are exploratory and future studies can also include investigation of longitudinal relationship identified in this research. In this research study, limited number of companies was included, as such; another survey with a larger set of companies is needed. In addition, there is a need to investigate further the pressures which may exist and also the effects of GSCM practices on organization economic, environmental and operational performance as well as the relationship between each driver on the organizational performance. Furthermore, the various relationships, such as mediating and moderating the relationship that may exist among the different factors should be investigated.

**ACKNOWLEDGEMENT**

This study is supported by the University of Johannesburg research fund.

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THE 10% STANDARD OR LUMP SUM - A STATISTICAL ANALYSIS OF ESTIMATING CONSTRUCTION CONTINGENCY ACCURACY

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Department of Quantity Surveying, Federal University of Technology, Akure, Nigeria

A budget estimate has two main components; the consultant estimate and contingency. Both components represent the sponsor’s estimated final cost of the project. Contingency is an amount set aside to cater for the uncertainty associated with the delivery of the project. It is important for project sponsors to know the level of accuracy being achieved in estimating construction contingency. The aim of this paper is to apply statistical techniques to estimation of contingency accuracy. In creating wide correlations, the paper generally sets aside crucial issues; how accurate are construction contingencies? Are there project variables that have relationship to the accuracy of project cost contingency? In order to answer the highlighted questions, the objectives of the paper are to quantitatively analyse cost data of completed building projects to attempt to answer these research questions. The cost data for 49 building construction projects completed by a Nigerian government organisation were statistically analysed using descriptive statistics to describe the characteristics of the sample, Standard variation, coefficient of variation and simple correlation to explore relationships between variables. It was found that the average construction contingency was 4.90% of the award contract sum while the average value of contract variations was 24.43%, which means that contingency is far less than the total approved variation by an average of 19.53%. The organisation used a traditional percentage approach for estimating construction contingency. In seeking an alternative estimating method of contingency, this paper proceeded to recommend and analyse statistically the correlation between selected project variables and contingency. It was revealed that there is a strong positive correlation between contingency and project location. A weak positive correlation exist between contingency and project size, gross floor area, project type and project duration. This indicates to the organisation that there is enough room for improvement in estimating construction contingency.

INTRODUCTION

One of the major problems facing the Nigerian construction industry today is the fact that almost all projects are being completed at sums much higher than their initial contract sums. The increase has also become excessive to the extent that the initial contract sums can hardly be relied upon by the clients (Achuenu and Gundiri, 1998). Unequivocally, construction by its nature involves certain unavoidable risks that threaten achieving set objectives as regards cost, time among others. Material costs change over time, markups and markdowns vary from job to job, field conditions arise that were unforeseen during design, and other factors add to the uncertain nature of these variables.
cost estimating. To address this problem, Cost estimation for construction projects traditionally involves development of an estimate of the project cost to which contingency is added to develop the total project cost estimate, that is, contingency reserves are included in projects base. A contingency reserve is an amount of money used to manage risks and uncertainties associated with a construction project. The contingency sum is an arbitrary amount decided by the client or the design team. It is not really part of the contractor’s tender but is an amount the contractor is instructed to add to his tender in order that they may be a cushion to absorb unforeseen extras. Traditionally, contingencies are often calculated as an across-the-board percentage addition on the base estimate, typically derived from intuition, past experience and historical data. The review of literature highlighted several serious flaws with this estimating method. This judgmental and arbitrary method of contingency calculation is difficult for the estimator to justify or defend. A percentage addition results in a single-figure prediction of estimated cost, which implies a degree of certainty that is simply not justified. According to (Thomson and Perry, 1992), all too often risk is either ignored or dealt with in an arbitrary way; simply adding a ten percent contingency onto the estimated cost of construction project is typical and unscientific. It does not encourage creativity in estimating practice, promoting a routine and mundane administrative approach requiring little investigation and decision. In recent years, the weakness of applying a percentage to the consultant’s estimate has been the subject of considerable discussion and research. The traditional approach does not provide decision makers with a clear indication of the likelihood that the project will be completed for the budgeted amount. This approach does not allow managers to budget more money to accept less risk. And this approach tends to either overstate the costs, in a fairly typical project where there is little uncertainty, or understate the costs, in a project where there is significant uncertainty. In Baccarini’s (2004) analysis of 48 road projects; the construction contingency averaged 5.24 % while the average variation for all projects was 9.92% of actual contract value respectively. He concluded that estimation of contingency is not fully reflecting the variability of contract variation. Similarly, Bello and Odusami (2012) revealed in their research that 0-5% contingency is mostly applied followed by 5-10% and an application of contingency above 10% is rare. Nevertheless, recognising that contingency reserves will remain an important means of managing uncertainty in a project, it is obvious that a more informed means of allocating contingency reserves is needed. Consequently, this white paper seeks to investigate the accuracy of contingency reserves in construction projects and also to apply statistical techniques in creating a predictive model for estimating contingency by determining correlation between project variables and construction contingency selected. This research will improve the skills of the estimators, specifically stated the skills of Quantity Surveyors (Cost experts) whose prime task is to ensure that project costs are kept within the agreed budget. The improvement in skills will ensure quality estimates that can be relied on. Thus, improve the professional image of the Nigerian Quantity Surveyors. The proceeding sections discuss the definitions, types and key attributes of project cost contingency as summarized by.

CONTINGENCY – definition

People give different meanings to Contingency. Meanwhile, there is no specific definition of contingency. Contingency is not really part of the contractor’s tender but is an amount the contractor is instructed to add to his tender in order that they may be a cushion to absorb unforeseen extras. According to Patrascu (1988) contingency is
Contingency estimation

the “most misunderstood, misinterpreted and misapplied word in project execution. The contingency sum is an arbitrary amount decided by the client or the design team. Generally, contingency is defined as the source of funding for unexpected events. PMI (2004) estimated cost to be used at the discretion of project manager to deal with anticipated but not certain events. The Association for the Advancement of Cost Engineering (AACE) defines contingency as, “An amount added to the estimate to (1) achieve a specific confidence level, or (2) allow for changes that experience shows will likely be required.

CONTINGENCY – types

Parsons (1999) identified project contingency and process contingency as the two types of contingency.

PROJECT CONTINGENCY

Project contingency is based on the degree of project definition available at the time of making the estimate. However, it is expected to cover for omissions and unforeseen costs caused by lack of complete engineering (Bello and Odusami, 2009). As stated earlier, Parsons (1999) identified two major categories of project contingency for construction projects. They are design contingency and construction contingency.

DESIGN CONTINGENCY

Design contingency takes care of changes during the design process for factors such as incomplete scope definition and inaccuracy of estimating methods and data (Clark and Lorenzoni, 1996).

CONSTRUCTION CONTINGENCY

This is for changes during the construction process. Under a traditional procurement arrangement, the project sponsor procures professionals to produce the design before competitively selecting the construction contractor. A contract is signed between the project sponsor and the contractor, which typically contains a variations clause to allow for changes and provide a mechanism for determining and valuing variations (Staugas, 1995). Construction contingency exists to cater for these variations allowable under the contract between the sponsor and contractor. Mak and Picken (2000) state that contingency can be compared with the total approved value of contract variations to assess the accuracy of the contingency

CONTINGENCY – characteristics

An analysis of the literature identifies the following key attributes of the concept of project cost contingency:

*Reserve* – Cost contingency is a reserve of money (PMI 2004). A reserve is a provision in the project plan to mitigate cost risk (PMI 2000).

*Risk and Uncertainty* – Contingency is a make-up-for risk. There is a range of risk treatment strategies for managing risk in projects such as risk transfer, risk reduction, and financial treatments for retained risks for example, a contingency reserve. So contingency is used in conjunction with other risk treatment strategies. The need and amount for contingency reflects the existence of risk and uncertainty in projects (Thompson and Perry 1992). Consequently, the provision of project contingency is a risk management tool.
Total Commitment - The inclusion of contingencies within a budget estimate means that the estimate represents the total financial commitment for a project. Contingency should avoid the need to appropriate additional funds and reduces the impact of overrunning the cost objective.

Project Behaviour – The under listed indicate that contingency can have a major impact on project outcomes for a project sponsor;

Large contingency reserves eat into the available budget might encourage sloppy cost management, cause the project to be uneconomic and aborted,

Consultant’s fees are calculated based upon the anticipated contract price plus contingency, meaning an artificially large contingency reserves also artificially inflate Consultant’s fees, further eroding the budget available for ‘bricks and mortar’

A low contingency may be too rigid and set an unrealistic financial environment, and result unsatisfactory performance outcomes (Dey et al 1994).

METHODOLOGY

The focus of the research reported within this paper is construction contingency. This paper used a case study research methodology. A case study method is a technique by which individual factor whether be it an Institution or just “an empirical inquiry that investigates a contemporary phenomenon within its real-life context” (Yin, 1991). The case study uses quantitative research to measure aspects of a phenomenon (Kumar, 1996). It is a method of study in depth rather than breadth. The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations. case study method is a form of qualitative analysis where in careful and complete observation of an individual or a situation or an institution is done; efforts are made to study each and every aspect of the concerning unit in minute details and then from case data generalisations and inferences are drawn. (Kothari 2011). The case study for this research is an organisation and the phenomena being researched is construction contingency for public construction projects. The organisation is a Nigerian government agency managing a network of public construction projects with a value of more than $20 billion with staff strength of 1320 full time staff. Its project cost management guidelines for infrastructure projects refers to cost contingency as an amount of money set aside to cater for the uncertainty associated with the delivery of the project. The organisation uses a traditional percentage approach to calculate contingency.

Sample

The total number of completed projects collected from the case study was eighty three (83). The selection of a research sample of 49 projects was derived based on the following criteria:

The time span for the sample was from 2005 to 2010, the sampling size for this research was determined using the Yamane’s theory having the formulae \( N = N \div (1 + N (e)^2) \) at a level of precision of 5%.

2. After the selection of 68 projects using the Yamane’s formulae, a review of the sample selected identified 19 projects as outliers that would distort the analysis. Therefore, the overall sample size of 49 was obtained.

3. All sample projects had reached practical completion.
4. All sample projects used traditional procurement with open competitive tendering using the Joint Contract Tribunal, JCT (1998 edition).
5. Sample projects included areas in all regions that are covered within the mandate of the organisation.
6. The range of dollar value was from $35,000 to over $170,000

The following information was obtained for each project in the sample:
- Award Contract Value
- Final Contract Value
- Project Duration
- Variations Value
- Gross floor area
- Location
- Contingency

The data obtained were statistically analysed using SPSS (Statistical Package for the Social Sciences) software. Two forms of statistical analysis were undertaken:
- Descriptive statistics - This provided general statistical information such as the mean, standard deviation and co-efficient of variation of variables.
- Correlation - Karl Pearson’s coefficient of correlation otherwise known as simple correlation to examine the relationship between two variables.

THE ANALYSIS AND FINDINGS

According to Baccarini (2004), comparison of Contingency Accuracy (CA) is measured by comparing construction contingency and approved contract variations, expressed as a percentage of Award Contract Value.

Measurement of accuracy of construction contingency

Contingency (%)

Contingency Accuracy (CA) is measured by comparing construction contingency and approved contract variations, expressed as a percentage of Award Contract Value:

\[ CA = \frac{\Sigma V\% - \Sigma C\%}{\Sigma ACV} \]

Where:
- ACV = Award Contract Value (successful construction tender, expressed in $)
- C\% = Construction Contingency, expressed as % of ACV
- V\% = Variations, expressed as % of ACV

In order to measure Contingency Accuracy, variables C\% and V\% need to be calculated.

Contingency (C\%)

Contingency (C\%) is the ratio of the construction contingency to the ACV, expressed as a percentage:

\[ C\% = \frac{\Sigma C}{\Sigma ACV} \times 100 \]
ΣACV

Where:

C = Construction contingency, expressed in $

TABLE 3.1: CONTINGENCY (C %)

<table>
<thead>
<tr>
<th>CONTINGENCY</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5.00 %</td>
<td>37</td>
</tr>
<tr>
<td>5.01 - 10.00 %</td>
<td>10</td>
</tr>
<tr>
<td>10.01 - 15.00 %</td>
<td>1</td>
</tr>
<tr>
<td>15.01 - 20.00 %</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 20.00 %</td>
<td>0</td>
</tr>
</tbody>
</table>

4.90% MEAN

2.75% STANDARD DEVIATION

56.12% COEFFICIENT OF VARIATION

Table 3.1 displays the range of contingency of the sample projects. The analysis revealed that construction contingency averaged 4.90% of ACV, the standard deviation is 2.75% and the coefficient of variation is 56.12%. This revealed that 5% is the most applied percentage followed by 5.01% to 10%. The variability is relatively limited, this suggested that the traditional percentage approach to estimating results in conservative estimates, anchored around 0-50%. The next step represented table 3.1 using a histogram with a normal curve showing the distribution of percentage contingency on estimate for forty-nine project data.

Figure 3.1 Histogram with normal curve showing the distribution of percentage contingency on estimate for forty-nine project data.

Variation (v %)

Variation (V %) is the ratio of the value of contract variations to the Award Contract Value (ACV), expressed as a percentage:
Contingency estimation

\[ V(\%) = \frac{\Sigma V}{\Sigma ACV} \times 100 \]

Where:

\[ V = \text{approved contract variations, expressed in } \$ \]

**TABLE 3.2: Variation (V %)**

<table>
<thead>
<tr>
<th>VARIATION</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5.00 %</td>
<td>1</td>
</tr>
<tr>
<td>5.01 - 10.00 %</td>
<td>0</td>
</tr>
<tr>
<td>10.01 - 15.00 %</td>
<td>11</td>
</tr>
<tr>
<td>15.01 - 20.00 %</td>
<td>20</td>
</tr>
<tr>
<td>20.01 - 25.00 %</td>
<td>2</td>
</tr>
<tr>
<td>25.01 - 30.00 %</td>
<td>0</td>
</tr>
<tr>
<td>30.01 - 35.00 %</td>
<td>3</td>
</tr>
<tr>
<td>35.01 - 40.00 %</td>
<td>4</td>
</tr>
<tr>
<td>40.01 - 45.00 %</td>
<td>0</td>
</tr>
<tr>
<td>45.01 - 50.00%</td>
<td>0</td>
</tr>
<tr>
<td>50.01 -55.00 %</td>
<td>7</td>
</tr>
<tr>
<td>55.01 - 60.00 %</td>
<td>0</td>
</tr>
<tr>
<td>60.01 - 65.00 %</td>
<td>0</td>
</tr>
<tr>
<td>65.01 - 70.00 %</td>
<td>1</td>
</tr>
</tbody>
</table>

24.43% \[= \text{MEAN} \]

15.53% \[= \text{STANDARD DEVIATION} \]

63.57% \[= \text{COEFFICIENT OF VARIATION} \]

Table 3.2 displays the results for variation (V%). The average variation (V%) for all projects was 24.23% of ACV, while standard deviation and coefficient of variation of ACV are 15.53% and 63.57% respectively. There is a difference between the variability for variations (V%) and the variability for construction contingency (C%), as measured in terms of standard deviation which is 2.75% and co-efficient of variation which is 56.12% is not much. This indicates that the estimation of contingency is reflecting the variability of contract variations. The next step represented table 3.2 using a histogram with normal curve showing the distribution of percentage variation on estimate for forty-nine project data.

![Histogram with normal curve showing the distribution of Percentage Variation on estimate for forty-nine project data.](image)

**Figure 3.2:** Histogram with normal curve showing the distribution of Percentage Variation on estimate for forty-nine project data.
Contingency Accuracy (CA)

As stated previously, Contingency Accuracy can be expressed as the difference between Contingency and Variation, thus:

\[ CA = \Sigma V\% - \Sigma C\% = 24.43\% - 4.90\% = 19.53\% \]

The smaller the difference between these two values then the more accurate the contingency. A positive percentage shows that Variation exceeded Contingency while a negative value shows that Contingency exceeded Variation.

Table 3.3 shows that variation of all the 49 projects exceeded contingency as indicated in the positive percentage. Overall construction contingency was an average 4.90\% of Award Contract Value, while variation was 24.43\% of Award Contract Value. This shows that there was an increase in the Award Contract Value of 19.53\% not covered by construction contingency. Furthermore, result revealed that none of the projects was contingency and variation within 5\% of each other.

Another way of measuring contingency accuracy, which provides similar information, is to express contingency (C\%) and variation (V\%) as a ratio:

\[ CA_2 = \frac{C}{V} \times 100 = \frac{4.90\%}{24.43\%} \times 100 = 20.01\% \]

**TABLE 3.3: CONTINGENCY ACCURACY (CA)**

<table>
<thead>
<tr>
<th>CONTINGENCY ACCURACY</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0 %</td>
<td>2</td>
</tr>
<tr>
<td>0.01 - 5.00 %</td>
<td>2</td>
</tr>
<tr>
<td>5.01 - 10.00 %</td>
<td>5</td>
</tr>
<tr>
<td>10.01 - 15.00 %</td>
<td>21</td>
</tr>
<tr>
<td>15.01 - 20.00 %</td>
<td>4</td>
</tr>
<tr>
<td>20.01 - 25.00 %</td>
<td>0</td>
</tr>
<tr>
<td>25.01 - 30.00 %</td>
<td>1</td>
</tr>
<tr>
<td>30.01 - 35.00 %</td>
<td>4</td>
</tr>
<tr>
<td>35.01 - 40.00 %</td>
<td>2</td>
</tr>
<tr>
<td>40.01 - 45.00 %</td>
<td>2</td>
</tr>
<tr>
<td>45.01 - 50.00 %</td>
<td>3</td>
</tr>
<tr>
<td>50.01 - 55.00 %</td>
<td>2</td>
</tr>
<tr>
<td>55.01 - 60.00 %</td>
<td>0</td>
</tr>
<tr>
<td>60.01 - 65.00 %</td>
<td>1</td>
</tr>
</tbody>
</table>

**19.53\% MEAN**

**16.33\% STANDARD DEVIATION**

**83.61\% COEFFICIENT OF VARIATION**

This shows that construction contingency covered only for 20.01\% of approved contract variations, that is, it did not cater for 79.99\% of total value of contact variations.

In order to appraise the accuracy of results of relationship between contingency and variation, the next step tested one of the hypotheses as formulated in this paper.

**TEST OF HYPOTHESIS**

The paper uses a paired t-test for judging the significance of mean difference between contingency and variation having the hypothesis stated below:

\[ Ho = \text{There is no statistical significant difference between contingency and variation.} \]

\[ Hi = \text{There is statistical significant difference between contingency and variation.} \]
Table 3.4: Paired Samples Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>CONTINGENCY</td>
<td>4.8961</td>
<td>49</td>
<td>2.77784</td>
</tr>
<tr>
<td></td>
<td>VARIATION</td>
<td>24.4349</td>
<td>49</td>
<td>15.68625</td>
</tr>
</tbody>
</table>

Table 3.5: Paired Samples Correlations

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>49</td>
<td>-0.210</td>
<td>0.147</td>
</tr>
</tbody>
</table>

Table 3.6: Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Paired Differences</th>
<th>95% Confidence Interval of the Difference</th>
<th>Std. Error Mean</th>
<th>Lower</th>
<th>Upper</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>VARIATION - CONTINGENCY</td>
<td>19.53878 - 16.49601</td>
<td>14.80057</td>
<td>24.27698</td>
<td>8.291</td>
<td>48</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

In summary, the analysis of construction contingency shows that it is more often than not insufficient to cater for contract variations and that, in the case study, it should be increased in future projects. This is an extremely useful piece of information for the organization to instigate consideration of its approach to estimating construction contingency. It highlights the inaccuracy inherent in the traditional percentage approach to estimating contingency and stimulates the search for more accurate estimating approaches. One approach is to identify any variables that have a relationship to the accuracy of project cost contingency that may provide a basis for a predictive model for estimating contingency. This is carried out in the next step.

PREDICTIVE MODEL – VARIABLES

It is useful to identify if any project variables have a relationship to the accuracy of project cost contingency, for example project size or location. The paper selected some project variables to ascertain a relationship to contingency accuracy. The selected project variables are: project location; project duration; project type; gross floor area and project size. Any variables that are found to have a relationship might then be used to predict a more accurate project cost contingency; or simply highlight
to estimators that when these variables are present there is a need to pay particular consideration to them when estimating contingency.

**TABLE 3.7: PROJECT LOCATION**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPLAND</td>
<td>27</td>
</tr>
<tr>
<td>RIVERINE</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 3.7 shows the location of the projects. The case study for this research has projects both in upland and riverine areas. The upland projects is 27 which covers about 55.10 % of the overall projects while that of riverine is 22 projects which is about 44.90 % of the projects total. It might be expected that riverine projects cover a vast area of varying conditions, then location may influence the amount of risk and therefore the level of contingency and variation.

**TABLE 3.8: PROJECT DURATION**

<table>
<thead>
<tr>
<th>PLANNED PROJECT DURATION (WEEKS)</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>0</td>
</tr>
<tr>
<td>&gt;= 20</td>
<td>43</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 3.8 shows the planned project duration in weeks from contract award to practical completion. The duration ranged from 20 to 24 weeks. Result indicated than none of the projects was planned less than 20 weeks. About 87.76 % of the projects were planned for exactly 20 weeks while just 12.24 % of the projects were planned above 20 weeks. It might be expected that the longer the project, the greater the potential significant risks to eventuate and therefore higher values for contingency and variation.

**TABLE 3.9: PROJECT TYPE**

<table>
<thead>
<tr>
<th>PROJECT TYPE</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 CLASSROOM BLOCKS</td>
<td>20</td>
</tr>
<tr>
<td>6 CLASSROOM BLOCKS</td>
<td>20</td>
</tr>
<tr>
<td>HEALTH CENTRE</td>
<td>6</td>
</tr>
<tr>
<td>STAFF QUARTERS</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3.9 shows that classroom blocks covered 81.64% of the entire projects. While 12.24 % of the projects analysed were health centre and only 6.12 % of the projects were staff quarters.

**TABLE 3.10: GROSS FLOOR AREA**
Contingency estimation

Table 3.10 shows that the projects are of different sizes measured in square metres. The highest number of projects which is 19 falls within the range of 301 – 350m$^2$ of about 38.78% of the project, followed by 8 projects within the range of 601 – 650m$^2$ of about 16.33% of the projects. Next are 4 projects within the range of 701 – 750m$^2$ of about 8.16% of the projects. It might be expected that the bigger the gross floor area of projects, the higher the values of contingency and variation.

<table>
<thead>
<tr>
<th>SIZE (m$^2$)</th>
<th>NR. OF PROJECTS (49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 300</td>
<td>2</td>
</tr>
<tr>
<td>301 - 350</td>
<td>19</td>
</tr>
<tr>
<td>351 - 400</td>
<td>0</td>
</tr>
<tr>
<td>401 - 450</td>
<td>1</td>
</tr>
<tr>
<td>451 - 500</td>
<td>1</td>
</tr>
<tr>
<td>501 - 550</td>
<td>3</td>
</tr>
<tr>
<td>551 - 600</td>
<td>5</td>
</tr>
<tr>
<td>601 - 650</td>
<td>8</td>
</tr>
<tr>
<td>651 - 700</td>
<td>3</td>
</tr>
<tr>
<td>701 - 750</td>
<td>4</td>
</tr>
<tr>
<td>751 - 800</td>
<td>0</td>
</tr>
<tr>
<td>801 - 850</td>
<td>0</td>
</tr>
<tr>
<td>851 - 900</td>
<td>1</td>
</tr>
<tr>
<td>901 - 950</td>
<td>0</td>
</tr>
<tr>
<td>951 - 1000</td>
<td>2</td>
</tr>
</tbody>
</table>

The project size is measured in terms of financial value. Table 3.11 shows the project estimate in Nigerian naira. Results revealed that none of the project’s estimate falls less than 5,000,000. Also, majority of projects (42.86%) falls within the range of 5,010,000.00 – 10,000,000.00 and the mean ACV was #11,331,000.00.

The next step tested the second hypotheses as formulated in this paper which is stated below:
Test of Hypothesis

Ho = There is no statistical significant relationship between project variables (Project location, project duration, Project type, gross floor area and project size) and construction contingency.

Hi = There is statistical significant relationship between project variables (Project duration, project location, Project type, gross floor area and project size) and construction contingency.

The table below shows the correlation between contingency and select project variables, it also incorporates the result from testing the hypothesis.

*Dependent variable: Contingency

\[ r = \text{Pearson Product Moment Correlation Coefficient}; \ Ho = \text{null hypothesis}; \ p = \text{probability that rejects the null hypothesis, significant at the 0.01 and 0.05 level (2 - tailed).} \]

Table 3.12: Correlation between Contingency and Selected Project Variables Incorporating Test of Hypothesis

<table>
<thead>
<tr>
<th>PROJECT VARIABLES</th>
<th>R</th>
<th>SIGNIFICANT (2 TAILED)</th>
<th>RESULT, REJECT Ho?</th>
<th>P- VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project size</td>
<td>0.365</td>
<td>0.010</td>
<td>Yes</td>
<td>Significant, &lt;0.05</td>
</tr>
<tr>
<td>Project Location</td>
<td>0.527</td>
<td>0.000</td>
<td>Yes</td>
<td>Significant, &lt;0.01</td>
</tr>
<tr>
<td>Gross floor area</td>
<td>0.479</td>
<td>0.000</td>
<td>Yes</td>
<td>Significant, &lt;0.01</td>
</tr>
<tr>
<td>Project type</td>
<td>0.261</td>
<td>0.070</td>
<td>No</td>
<td>Not significant, &lt;0.05</td>
</tr>
<tr>
<td>Project Duration</td>
<td>0.102</td>
<td>0.485</td>
<td>No</td>
<td>Not significant, &lt;0.05</td>
</tr>
</tbody>
</table>

Table 3.12 shows the result of the correlation analysis. The relationship between contingency and project location, project duration, project type, gross floor area and project size was investigated using Pearson product moment correlation coefficient. Preliminary analysis was performed to ensure no violation of the assumption of normality and homoscedastically. There was a positive relationship between contingency and the five project variables which means that as contingency increases, the five project variables also increases and vice versa. Result also shows that a strong positive correlation exist between contingency and location \( (r = 0.527, N = 49, p < 0.01) \) meanwhile, weak positive correlation exist between contingency and project size \( (r = 0.365, N = 49, p < 0.01) \), gross floor area \( (r = 0.479, N = 49, p < 0.01) \), project type \( (r = 0.261, N = 49, p > 0.01) \) and project duration \( (r = 0.102, N= 49, p < 0.05) \). Project type and project duration are shown to be above the 2 – tailed significant levels.
CONCLUSION AND RECOMMENDATION

The study used archival cost data of building projects from a Nigerian government agency to quantitatively analyse the estimation of construction contingency. The study revealed that construction contingency averaged 4.90% of the actual contract value and variation averaged 24.43% which means that there is a shortfall of in contingency of 19.53%. The amount of estimated contingency was significantly inadequate to cater for the total value of contact variations, by an average shortfall of 79.99%. Thus, it indicated that contingency allocated is not producing the result it was intended for on project delivery. Also the study established a statistical significant difference between contingency and variation. In looking for correlation between project variables and construction contingency, the study identified some selected project variables that have a relationship in predicting a more accurate construction cost contingency. It was revealed that there is a strong positive correlation between contingency and project location. A weak positive correlation exist between contingency and project size, gross floor area, project type and project duration. A weak correlation would indicate that the estimating methods for contingency needs to be evaluated for ways to improve accuracy. The study recommends a more proactive and scientific estimating and managing a defendable and reliable contingency that records a reasonable savings at completing of the project should be embraced.

REFERENCES


PMI [Project Management Institute] (2004), *A guide to the project management body of knowledge*. PMI.


THE INFLATION HEDGING POTENTIAL OF COMMERCIAL PROPERTY INVESTMENTS IN IBADAN, NIGERIA

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The study examined the inflation hedging characteristics of commercial property investments in Ibadan metropolis in Nigeria. A random sample of 38 (75%) of the 51 estate surveyor firms in Ibadan was carried out to obtain data on rental and capital values of commercial property in the city over the study period (2000 to 2010). Actual inflation was calculated from percentage changes in the Commodity Price Index (CPI) over the study period (2000 -2010). Expected inflation was calculated from data on three month Treasury bill rates in CBN Statistical Bulletins and Official Reports covering the study period. Unexpected inflation was calculated as the difference between actual and expected inflation. The results showed that property returns were a poor hedge against actual inflation, a partial hedge against unexpected inflation and almost a complete hedge against expected inflation. These results suggested that commercial properties may not offer as much protection against inflation as is usually expected by investors.

Keywords: inflation hedging, commercial property investments

INTRODUCTION

Real estate is considered as having inflation hedging potential where the growth rate of its rental and capital cash-flows match the growth rate of commodity prices. Investors are usually interested in ensuring that the cash-flows from real estate are inflation-indexed, so that the ownership of this asset would insure against inflation (Demary and Voigtlander, 2009). Traditionally, real estate has been regarded as one of the best inflation hedges (Sing and Low, 1998). It is noteworthy however, that despite this widespread belief which is reinforced in some financial newspapers (see for instance Whiskey and Gunpowder, 2008; Business Today, 2011; The Economic Times, 2012), international empirical evidence has suggested an unstable relationship (Stevenson, 2001).

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Individual or portfolio Investors who do not give careful consideration to the inflation hedging characteristics of their investments risk inflation eroding their investments’ real income streams. While investors should be concerned with whether their assets’ expected incomes are secured, appreciating and diversified, ignoring asset inflation hedging characteristics could be dangerous. In this regard, Sing and Low (1998) observe that all investors who hold assets for long-term returns must of necessity evaluate the inflation hedging characteristics of their assets because of the potential for real returns to be significantly eroded by unexpected surges in inflation, even if nominal returns appear to be increasing.

Thus, inflation hedging is a characteristic that should ideally be possessed by an asset’s returns to protect it from the risk of losing purchasing power as a result of the rising price of commodities. An asset is a complete inflation hedge if and only if its nominal returns match or exceed the rate of inflation (Fisher, 1930). Fama and Schwert (1977) provided an operational definition that is widely used in the empirical tests of inflation hedging hypotheses: an asset is a complete hedge against inflation if the nominal return of the asset varies in a one-to-one relationship with both expected inflation (inflation that is anticipated) and unexpected inflation (sudden inflation jumps).

This paper aimed at determining the inflation hedging characteristics of commercial real estate with a view to providing information for efficient investment decision making. The time scope of the analysis was the period between 2001 and 2010 which was the immediate ten year period preceding the time of study. The geographic scope was Ibadan metropolis, to avoid the hitherto exclusive preoccupation with Lagos metropolis of prior Nigerian studies. The property scope of the study was commercial property investments. Commercial property returns within this time and geographic scope were related to inflation rates, both anticipated and unanticipated, using regression analysis.

The paper is arranged into five sections. The first section is introductory. The second section reviews relevant literature while the third section describes the methodology used in the paper. In the fourth section, the paper’s focus is on the data analysis and findings while the last section provides comments by way of summary, recommendation and conclusion.

LITERATURE REVIEW

Most studies on the inflation hedging attributes of assets originated from the work of Fisher (1930). The Fisher (1930) hypothesis (also known as the Fisher effect), states that real interest rates depend on nominal rates and inflation such that nominal rates less inflation result in real interest rates. The Fisher hypothesis can be interpreted to mean that expected nominal interest rates should move in a one-to-one relationship with expected inflation.

Fama and Schwert (1977) expanded on the Fisher hypothesis and demonstrated that the Fisher hypothesis could be used to test the inflation hedging characteristics of investment assets. Fama and Schwert accordingly tested the inflation hedgeability of residential real estate assets, treasury bills, corporate bonds, government bonds, common stocks and labour income over the period of 1953-1971. Inflation hedgeability was tested by means of a regression model which has since become a prototypical model to test the relationship between asset (financial or real estate) return, expected inflation and unexpected inflation. Fama and Schwert’s regression
model employed three-month Treasury bills as a proxy for expected inflation. Regression results were obtained for monthly, quarterly and half-yearly returns. The results showed that coefficients for both expected and unexpected inflation were statistically indistinguishable from unity. The authors concluded that private residential real estate was a complete hedge against both expected and unexpected inflation.

Later, in the US, Hartzell, Hekman and Miles (1987) examined the inflation hedging ability of commingled real estate funds (CREF). They used the Fama and Schwert (1977) model in two tests which employed Treasury bill rates as the basis for expected inflation. As in the Fama and Schwert (1977) study, this study established that commercial real estate funds completely hedge against inflation.

In the same country (the US), Ruben, Bond and Webb (1989) examined the inflation hedging ability of three types of indirect real estate assets (residential, commercial, and farmland) and four types of financial instruments (as individual assets and as parts of portfolios). They found that all the three types of real estate assets had at least partial inflationary hedging ability and that portfolios which include real estate experienced increased inflation hedgeability. The study accordingly established that including direct real estate assets in a diversified portfolio helps to strengthen the return-risk profile of the portfolio, making such portfolios more inflationary proofed.

In Australia, Newell (1996) examined the inflation hedging characteristics of Australian commercial property and property trusts over 1984 – 1995. Using the Building Owners and Managers Association property indices for Australian office, retail and industrial property, they assessed the role of actual, expected and unexpected inflation. They found strong evidence of inflation hedging for Australian office, retail and industrial property. After adjusting for differences in market balance using vacancy rates, slightly less evidence of inflation hedging by Australian office property was evident.

In Singapore, Sing and Low (1998) investigated the relative inflation-hedging characteristics of real estate and financial assets (stock and securitized real estate) using the Fama and Schwert (1977) model. They concluded that real estate provides a better hedge against inflation than stock and securitized real estate. They were of the opinion that when the inflation hedging characteristics of assets are tested in different inflation environments, residential property hedged effectively against unexpected inflation in the low inflation regime, whereas the hedging performance of industrial property against both types of inflation was better in the high inflation regime.

In Nigeria, Bello (2004) adopted the Fama and Schwert (1977) methodology of static regression analysis to assess the inflation hedging performance of investment in residential property, ordinary shares and savings account over 1996 – 2000. Inflation was split into its three component parts: actual, expected and unexpected. The results showed that the extent of hedging against actual inflation was highest for ordinary shares and very weak for savings accounts. Residential property investments did not hedge against actual inflation but hedged against expected inflation. This result is consistent with other prior studies by Fama and Schwert (1977); Limmack and Ward (1988); Newell and Boyd (1995); Hoesli, et al. (1997); Liu, et al., (1997); and Stevenson (1999, 2000). However, this study focused only on residential investments, excluding consideration of commercial investments.

Amidu, Aluko, Nuhu and Saibu (2008) compared investment characteristics of real estate securities and other investment assets in the Nigerian Stock market. Their
findings suggested that while real estate securities outperformed the market on a nominal basis, it underperformed the market stock on a risk-adjusted basis over the time period of analysis. The study further established that real estate securities did not provide a good protection against inflation. However this study did not investigate the inflation hedging potential of direct real estate investments.

Tenigbade (2011) examined the relative inflation hedging capacities of prime commercial properties in various locations in Lagos, Nigeria between 1999 and 2010. The author also employed the Ordinary Least Square model of Fama and Schwert (1977) to regress real estate rates of returns against actual, expected and unexpected inflation rates. The study established that commercial real estate investments in the study area for prime locations around Victoria Island and Ikoyi, provided a perverse hedge against actual inflation, whereas, commercial properties around Ikeja presented a complete hedge against actual inflation. However, this study and the earlier Bello (2004) study were focused only on Lagos, excluding other cities in Nigeria like Ibadan which also have significant direct real estate investments.

In South Korea, Park and Bang (2012) examined whether direct commercial real estate were inflation hedges in the Korean market. They found that Korean commercial real estate shows short run positive co-movement with both expected and unexpected inflation indicating that commercial real estate serves as a short run inflation hedge. They also found that inflation and commercial real estate prices move in the same direction over the long run, indicating that commercial real estate served as a long run positive inflation hedge. On the other hand, they found that listed equity is a short run negative hedge and a long run positive hedge.

Reflecting on the papers reviewed, we must observe that the results in the papers generated in the US, Australia, Singapore and Korea are not necessarily applicable to the African region and to Nigeria in particular; each region/country evinces its own peculiar investment characteristics. Certainly, equivalent studies are required in Africa. A few studies have been conducted in Nigeria, but these studies have focused only on Lagos, excluding other cities in Nigeria like Ibadan which also have significant real estate investments. This study would address this gap in literature.

**RESEARCH METHODOLOGY**

This study followed the Fama and Schwert (1977) model of regressing real estate returns on actual, expected and unexpected inflation (as was done in most previous studies on the inflation hedging attributes of real estate assets). The data requirement for the use of this model comprises first, of data on commercial property capital and rental values and second, data on actual, expected and unexpected inflation.

Actual inflation was calculated from percentage changes in the Commodity Price Index (CPI) over the study period (2000 -2010). Expected inflation was calculated from data on three month Treasury bill rates as obtained in CBN Statistical Bulletins and Official Reports on the Internet covering the study period. Unexpected inflation was calculated as the difference between actual and expected inflation.

Commercial property values (rental and capital values) were obtained from records of firms of estate surveyors and valuers. A list of firms in Ibadan was obtained from the Nigerian Institution of Estate Surveyors and Valuers (Oyo state branch) which showed that there are fifty-one firms operating in the city. A random sample of 38 (75%) of these firms was carried out to obtain data on rental and capital values of commercial property in the city over the study period (2000 to 2010). The rental and capital values
of commercial property obtained from the survey of Ibadan estate surveyor firms were converted into estimates of income, capital and holding period returns. The income return was derived from the observed rental values and capital values of commercial properties in the study area (see equation 1). The capital return for the properties was in turn derived from the observed capital values of commercial properties in the study area over the study period (equation 2). The total return on commercial properties in the study area was determined by the addition of the income and capital returns (equation 3).

The income return of an asset is the net income received over the measurement period divided by the beginning capital value.

\[ IR_t = \frac{NI_t}{CV_{t-1}} \]  \hspace{1cm} (1)

Where:

\( IR_t \) = income return for period \( t \)

\( NI_t \) = Net income (or rent) received in period \( t \)

\( CV_{t-1} \) = CV at the end of period \( t-1 \) or the beginning of period \( t \)

It should be noted that capital value is used as a proxy for price in the above equation. This is because unlike the stock market, properties are infrequently sold and property indices are not obtainable in Nigeria.

Unlike the income return, the capital return measures the increase/decrease in capital value (capital appreciation) over the measurement period divided by the beginning portfolio capital value and any net contributions (additional investments) made during the period.

\[ CR_t = \frac{CV_t - CV_{t-1}}{CV_{t-1}} \]  \hspace{1cm} (2)

Where:

\( CR_t \) = Capital return for period \( t \)

\( CV_t \) = CV at the start of measurement period = \( CV_{t-1} \)

\( CV_{t-1} \) = CV at the end of period \( t-1 \) or the start of period \( t \)

The total return or holding period return is the addition of the income return and the capital return.

\[ Holding \ Period \ Return = \frac{NI_t + (CV_t - CV_{t-1})}{CV_{t-1}} \]  \hspace{1cm} (3)

Where:

\( NI_t \) = Net income received in period \( t \) (rent)

\( CR_t - CV_{t-1} \) = total changes in CV

\( CV_{t-1} \) = CV at the end of period \( t-1 \) or the start of period \( t \)

As a first step to clarify the inflation hedging effectiveness of commercial property returns over the study period, a correlation analysis was conducted to test the direction
of association of property returns with changes in inflation rate. A strong positive correlation would be some indication of co-movement suggesting inflation hedging possibility, while a negative correlation would be suggestive of perverse inflation hedging ability.

Following from this, the regression model of the Fama and Schwert (1977) was employed, and property income, capital and holding period returns was regressed against the various components of inflation rate. These regression equations were of the following form:

\[ R_t = \alpha + \beta (AI_t) + e_r \]  \hspace{1cm} (4)

\[ R_t = \alpha + \gamma (EI_t) + e_r \]  \hspace{1cm} (5)

\[ R_t = \alpha + \gamma (EI_t) + \delta (AI - EI)_t + e_r \] \hspace{1cm} (6)

Where:

- \( R_t \) is the mean nominal return on commercial properties at time \( t \);
- \( \alpha \) is the intercept term in the regression model, which also reflects the real rate of return on the property asset;
- \( \beta \) is the coefficient for actual inflation for the property asset, with respect to income return, capital return or total return;
- \( AI_t \) is the observed inflation rate from period \( t-1 \) to \( t \);
- \( \gamma \) is the coefficient for expected inflation
  - \( EI_t \) is the expected inflation estimate for period \( t \);
- \( \delta \) is the coefficient of unexpected inflation for the property asset with respect to income, capital or total return;
  - \( (AI - EI)_t \) is the unexpected inflation estimate for period \( t \);
- \( e_r \) is an error term.

Provided that, if:

- \( \beta \) is greater than or equal to 1, then commercial property is a complete hedge against actual inflation;
- \( \beta \) is between 0 and 1, then commercial property is a partial hedge;
- \( \beta \) is equal to 0, then there is no relationship between commercial property and inflation;
- \( \beta \) is less than 0, this indicates a perverse relationship, that is, poor inflation hedge.

What this means, in other words, is that for property returns to be inflation proofed, the regression beta coefficients for the expected and unexpected inflations must be greater than 1 otherwise, the returns would be only a partial or poor hedge against inflation.

**DATA ANALYSIS AND FINDINGS**

Primary and secondary data were collected early in 2012. Secondary data was obtained from the websites of the Central bank of Nigeria while primary data on rental and capital values were obtained from the records of 38 firms of estate surveyors and valuers.
As a first step in analysis, correlation coefficients were calculated to provide a preliminary assessment of co-movement. The correlation coefficient (R) values obtained are provided in Table 1:

Table 1: Correlation Coefficients of the Relationship between Property Returns with Actual, Expected and Unexpected Rate.

<table>
<thead>
<tr>
<th>Inflation</th>
<th>Income return R</th>
<th>Capital return R</th>
<th>Total return R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual inflation</td>
<td>-0.563</td>
<td>-0.528</td>
<td>-0.529</td>
</tr>
<tr>
<td>Expected inflation</td>
<td>-0.115</td>
<td>-0.057</td>
<td>-0.062</td>
</tr>
<tr>
<td>Unexpected inflation</td>
<td>-0.323</td>
<td>-0.348</td>
<td>-0.344</td>
</tr>
</tbody>
</table>

The results in Table 1 show that the relationship between commercial property returns (income, capital and total return) and inflation (actual, expected and unexpected inflation) were invariably negative and largely weak. The weak negative relationships are a preliminary pointer to property returns actually falling (albeit marginally) as actual inflation rate rose throughout the period. Similar results were obtained for expected and unexpected inflation, although as the correlation coefficients were not much different from zero, there is the suggestion of no relationship between the variables.

Regression analysis was employed to provide more definite hedging information. The dependent variable (commercial property returns) were related to independent variables (inflation rates), with the hedging measured as explained earlier, through the beta coefficient of the independent variable. Three regression equations were used to test the inflation hedging attributes of commercial properties in Ibadan metropolis. Inflation rates were decomposed into actual, expected and unexpected components. The two earlier Nigerian studies compared property total return with these components of inflation. The present study goes further to compare not only total return but also income return and capital returns on the inflation components. This was to permit an understanding of which type of property return hedges more effectively against inflation.

Using equation 4, the beta coefficients of regressing income, capital and total returns against actual inflation are presented in Table 2 below.

Table 2: Hedging Character of Commercial Property Income, Capital and Total Returns Against Actual Inflation.

<table>
<thead>
<tr>
<th>Return</th>
<th>β Coefficient</th>
<th>Standard Error of Estimate</th>
<th>$R^2$</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Return</td>
<td>-0.023</td>
<td>0.012</td>
<td>0.317</td>
<td>-1.925</td>
</tr>
<tr>
<td>Capital Return</td>
<td>-0.533</td>
<td>0.303</td>
<td>0.278</td>
<td>-1.757</td>
</tr>
<tr>
<td>Total Return</td>
<td>-0.556</td>
<td>0.315</td>
<td>0.280</td>
<td>-1.763</td>
</tr>
</tbody>
</table>

From Table 2, it is manifest that for the income return, the β coefficient is less than 0, meaning that the income return from commercial properties during the study period provides a very poor (perverse) inflation hedge. The coefficient of determination ($R^2 = 0.317$) indicates that only 31.7% of the variation in property returns is explained by inflation. Apparently there were other factors significantly influencing commercial properties apart from the inflation. The income and capital returns also evinced negative beta coefficients ($β = -0.533$ and -0.556 respectively), indicating perverse hedging abilities against actual inflation. The coefficients of determination
(R-squared of 0.278 and 0.280) show that only 27.8% and 28% variation in commercial properties return are explained by inflation respectively.

The inflation hedging abilities of income, capital and total returns against the expected inflation are presented in Table 3.

Table 3: Hedging Character of Commercial Property Income, Capital and Total Returns Against Expected Inflation

<table>
<thead>
<tr>
<th>Return</th>
<th>β Coefficient</th>
<th>Standard Error of Estimate</th>
<th>$R^2$</th>
<th>$T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Return</td>
<td>0.037</td>
<td>0.204</td>
<td>0.322</td>
<td>0.181</td>
</tr>
<tr>
<td>Capital Return</td>
<td>0.944</td>
<td>5.111</td>
<td>0.291</td>
<td>0.185</td>
</tr>
<tr>
<td>Total Return</td>
<td>0.964</td>
<td>5.315</td>
<td>0.291</td>
<td>0.181</td>
</tr>
</tbody>
</table>

In the results documented in Table 3, we observe positive beta coefficients of 0.037 (for income return), 0.944 (for capital return) and 0.964 (for total return). These beta coefficients are positive and total return varies on almost a one for one basis with expected inflation indicating almost a complete hedge against expected inflation. The coefficients of determination in the three cases indicate that only about thirty percent of the variation in property returns is explained by expected inflation. These results are consistent with results obtained in an earlier study in Lagos, Nigeria – (Bello, 2004) which evinced near complete level of inflation hedging of residential property returns against expected inflation.

The results of hedging against unexpected component of inflation by commercial properties are presented in Table 4.

Table 4: Hedging Character of Commercial Property Income, Capital and Total Returns against Unexpected Inflation

<table>
<thead>
<tr>
<th>Return</th>
<th>β Coefficient</th>
<th>Standard Error of Estimate</th>
<th>$R^2$</th>
<th>$T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Return</td>
<td>0.034</td>
<td>0.197</td>
<td>0.322</td>
<td>0.173</td>
</tr>
<tr>
<td>Capital Return</td>
<td>0.830</td>
<td>4.945</td>
<td>0.291</td>
<td>0.168</td>
</tr>
<tr>
<td>Total Return</td>
<td>0.850</td>
<td>5.144</td>
<td>0.291</td>
<td>0.165</td>
</tr>
</tbody>
</table>

In the above results, the beta coefficients are 0.034, 0.830 and 0.850 for income, capital and total returns respectively. The coefficients are positive but below one, meaning commercial property returns provided a partial inflation hedge against unexpected inflation. However, total return evinces better inflation hedging than either capital return or income return. The coefficients of determination ($R^2 = 0.322, 0.291$ and 0.291) indicate that 32.2% of variation in income, capital and total returns respectively are explained by expected and unexpected inflation.

The above results are largely consistent with the findings in the Bello (2004) and Tenigbade (2011) studies based in Lagos.

**CONCLUSION**

The results obtained from the regression analyses have pointed to commercial property income, capital and total returns in the study area being a poor hedge against actual inflation, a near complete hedge against expected inflation but only a partial hedge against unexpected inflation. The total return on commercial property hedged on almost a one for one basis with expected inflation (beta = 0.964) but to a lower
Inflation hedging

degree with unexpected inflation (beta = 0.850). Since actual inflation is a composite of expected and unexpected inflation, we infer that the unexpected component of inflation is what makes commercial property returns to be a poor hedge for actual inflation.

The conclusion of the study is accordingly that commercial property returns in the study area are expected to largely adjust to protect an investor against expected inflation, they are not likely to systematically adjust to protect an investor against sudden inflation jumps (unexpected inflation). The advice for prospective investors is that if they invest in Ibadan commercial property assets, they may expect erosion of their investments’ purchasing power since the assets are not likely to increase in value in line with unexpected surges in inflation. This result runs contrary to the traditional impression that all real estate investments are an all-time hedge against actual and unexpected inflation.

These results should not be treated in isolation and should not necessarily stifle commercial property investment in Ibadan. Recent studies examining the diversification potential of commercial property investments in this city (for example Oyewole, 2011) have shown that Ibadan commercial real estate possess significant diversification potential in mixed asset or property portfolios. Prospective portfolio investors may therefore wish to balance the lack of for inflation hedging potential of Ibadan commercial real estate against their significant diversification potential in portfolio selection decisions.

We would close with the observation that there are significant opportunities for further studies in this area. First, though the present study demonstrates that commercial real estate is a perverse unexpected inflation hedge in Ibadan, such findings may not necessarily be generalized to all Nigerian sub markets; more studies are required in sub markets all over the country. The Tenigbade (2011) study for example found that commercial property investments in the Ikeja area of Lagos did provide a complete hedge against all the inflation components. Second, it remains to be seen whether commercial and other property assets are a better hedge in periods of low inflation vis-à-vis by high (double digit) inflation. Studies would accordingly be required spanning and different time periods.

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THE MISSING LINKS BETWEEN CONSTRUCTION SECTOR AND DEVELOPMENT IN NIGERIA: A POLYCENTRIC PLANNING PERSPECTIVE

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This paper uses the Institutional Analysis and Development (IAD) framework in tandem with Knowledge Management (KM) tools to analyze the missing links between construction industry and socio-economic development in Nigeria. The paper found that KM tools are not properly utilized to transform raw materials into building/construction materials. This is because the stakeholders in construction sector operate on parallel lines as against collegial interactions. Though raw materials that are used in producing building materials are available in large quantity in the country, they have to be exported to other nations where they are transformed into products for construction industry. This, invariably, places the country as a technology consumer rather than a producer, thus, making the country vulnerable to external shocks. The central argument is that: it is what people are doing at home that should form the basis of development in the built environment and construction industry. It is not enough to learn from abroad; development cannot be imposed from above or from outside. This requires a rethink on the current methods, approaches and strategies of operation in the built environment. This paper charts courses of actions that scholars and professionals in the built environment could take in tandem with public officials to become “organic” in their operations and use endogenous knowledge as agents of change to reform the construction industry and thereby impact positively on their communities. Consequently, the paper adopts: (1) African Education Reform Model (AERM) for reforming higher education system; (2) African Development Institutional Mechanism Model (ADIM) for ensuring smooth working relations between public officials and scholars; and (3) African Development Brain-Box (ADBB) that will influence turning knowledge to reality for consequent utilization of local resources for the benefit of the construction sector.

Keywords: missing links, construction, polycentric planning, development, Nigeria

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INTRODUCTION

This paper uses the Institutional Analysis and Development (IAD) framework in tandem with Knowledge Management (KM) tools to analyze the missing links between construction industry and socio-economic development in Nigeria. This becomes necessary because in spite of the existence of abundant natural resources in Nigeria, over 80% of building materials are still imported (Okereke, 2006:13). Knowledge and its application are acknowledged as key sources of growth and development in the global economy, especially if they are adapted to specific circumstances and effectively utilized to generate significant opportunities for reducing poverty and promoting sustainable development. Nonetheless, lack of adequate attention to institutional mechanism to effectively adapt knowledge to the construction industry has engendered persistent gap between theories and realities in Nigeria. While scholars in developed societies have responded to their exogenous variables for the development of their respective countries, Nigerian leaders and scholars are yet to understand and apply it to their developmental drive (Akinola 2010f).

One of the three factors that is important in understanding how a society functions, as identifies by Tocqueville (1966), is “the peculiar and accidental situation, which providence” places people. This could refer to the environmental and material conditions that are available to people in fashioning their lives. The type of resources within an environment, to a large extent, determines the fortunes of the people in that environment. This factor deals with the relationship between construction sector and development. In sustainable development discourse, there is a consensus among scholars, practitioners and policy makers on the critical role that locally-sourced construction materials play in development. Construction industry in Nigeria depends on certain materials – sand, granite, gravels, iron, steel, glass, cement, wood, etc. and machines/plants for construction. The question is: How many of these materials and plants are manufactured in Nigeria? Though raw materials are available in large quantity in the country, they have to be exported to other nations where they are transformed into products for construction industry. This, invariably, places the country as a technology consumer rather than a producer, thus, making the country vulnerable to external shocks.

The availability of raw materials and knowledge on the utilization of the materials are at the roots of technological transformation of such materials into products of building materials and consequently development in the construction industry and socio-economic development. The paper posits that knowledge on local raw materials should be applied for processing the materials into building materials. This will not only reduce the cost of building materials but will also generate employment opportunities for citizens. The central argument is that: it is what people are doing at home that should form the basis of development in the built environment. It is not enough to learn from abroad; development cannot be imposed from above or from outside. This requires a rethink on the current methods, approaches and strategies of operation in the built environment.

This paper is concerned with analysis of interface between stakeholders in construction sector - public officials, scholars, professionals and the local people/grassroots. Ideally, research findings and knowledge from scholars and universities should generate responsive policy on the part of public officials and governments on rational utilization of raw materials that will engage citizens.
productively for infrastructural provision, houses, machines, equipment and installations. Unfortunately, the stakeholders operate on parallel lines as against collegial interactions and consequently, the problem of disconnect emerged; thus fuelling extractive economy and dependency syndrome.

Using polycentric planning, this paper analyses how professionals in the built environment and other stakeholders as groups (public officials, scholars and the local people/grassroots) in development in Nigeria respond(ed) to their environmental and material conditions that are available in fashioning their lives. Polycentric planning is a deliberate act of setting up multilayered and multicentred institutional mechanism that regards self-governing capabilities of local communities as foundation for reconstituting order from the bottom up. It can also be described as the process of ordering the use of physical, human and institutional resources as well as engaging the citizens in contractual relations with the public authority (Akinola 2009b, 2010a,i, 2011a).

This paper designs institutional mechanisms to bridge the gaps between professionals, public officials, scholars, private sector, people-centred institutions and the citizenry on the one hand, and between construction materials and development on the other hand. The paper charts a course of action that Nigeria can take in order to achieve development, specifying the role of governments, scholars, the private sector, civil society and the citizenry. It is in this light that the paper suggests the need to restructure the socio-economic and techno-environmental landscape for the emergence of a new working relation between professionals, public officials, scholars, private sector and citizens in Nigeria. Consequently, the paper adopts African Education Reform Model (AERM) for reforming higher education system in Nigeria so that professionals in the built environment in tandem with public officials can become “organic” in their operations and use endogenous knowledge as agents of change to reform the construction industry and thereby impact positively on their communities.

NIGERIAN UNIVERSITIES, KNOWLEDGE MANAGEMENT REGIME AND THE PROBLEMATICS OF DEVELOPMENT IN THE CONSTRUCTION SECTOR

Underdeveloped countries should not accept the inherited Western economic theory uncritically but remould it to fit their own problems and interests (Myrdal 1957: 99). …no two communities are ever the same and people always bear some marks of their origin (Tocqueville, 1966). The fact that a model worked in the West does not suggest its workability elsewhere (Akinola 2008p:174).

The theories of collective action suggest that individuals under certain institutional arrangements and shared norms are capable of organizing and sustaining cooperation that advances the common interest of the group in which they belong (E. Ostrom 1990). This line of thought recognizes that human beings can organize and govern themselves based on appropriate institutional arrangements and mutual agreements in a community of understanding. This is the fundamental of the Institutional Analysis and Development (IAD) framework. The IAD believes in institutional arrangement designed by people who cooperate based on rules of their choice, and thereby are able to resolve problems which other people (external to their conditions) are not capable of doing for them. Since society is a system of human cooperation, people in any
society should collectively relate to and deal with their exogenous variables. Exogenous variables are those conditions that affect human livelihoods and which humans have to work upon through appropriate institutional arrangements to better their conditions of existence. If we share with the collective action theories that institutions matter in terms of their influence on cooperation in utilization of knowledge and natural resources, then the problems of cost and quality of construction/building materials as well as unemployment can be addressed if appropriate institutional arrangements are put in place for synergy.

Unfortunately, knowledge application that translates natural resources to productive products and development is lacking in Nigeria, while extractive activities predominate in the continent (Akinola, 2010i). For instance, while innovative ideas are generated by Nigerian scholars in construction industry, there have not been sufficient incentives on the part of Nigerian governments to harness these potentials for the development of the construction industry (Fagbohun, 2005). Rather, Nigerian governments, industrialists and to certain extent, the private sector patronized imported technology and development paradigm which are usually at variance with Nigerian realities (Akinola, 2002, 2007f). The construction industry is so strategic to the general economic development of any country so much that the tempo of construction activities in any nation has been accepted worldwide as the barometer of overall development in any country (Okereke, 2006:13). In Nigeria, it accounts for over 6% of the GNP, employing not less than 40% of the labour force (CBN, 2000 cited in Okereke, 2006:13).

The construction industry requires KM tools to be able to tailor locally available resources to the needs of the country. Otherwise, resources will be exploited to the advantage of external investors and economies. This has led to the persistent exploitation and expropriation of Nigerian resources – human, natural, intellectual – within the last five decades – a situation that has engendered developmental crises. It is against this backdrop which recognizes knowledge as the key factor in wealth creation and production processes for Africa rebirth and renewal (DBSA 2006:ix). However, within KMA structure, the institutional mechanism and technical know-how of how to take knowledge to the streets in Africa have not been adequately developed (Akinola 2008p). This is one of the important areas this paper intends to make some contributions.

Examining the role of knowledge in economic development, the World Bank has created a Knowledge Economy Index (KEI). This benchmarks countries’ performance on four pillars of the knowledge economy – the favourability for knowledge development within the economic incentive and institutional regime; education and training; innovation and technological adoption; and information and communications technology. Knowledge Economy Index (KEI) 2007 and 2009 reports show that most African countries crowdedly languish near the bottom of the ranking table that consists of 140 countries (World Bank, 2009). This confirms that African governments do not put enough priority on knowledge application to real life situations that concern the welfare of their citizens and development of their societies. For example, most West African countries are found within the range of 109th to 137th positions of KEI rankings – Senegal (109th), Ghana (113th), Nigeria (115th), Mauritania (117th), Benin (118th), Cote D’Ivoire (120th), Mali (127th), Burkina Faso (132nd), Sierra Leone (137th) (World Bank, 2009).
It is apposite at this juncture to bring to the fore recent findings by Higher Education Research and Advocacy Network in Africa (HERANA) (2011) on the role of universities in economic development in eight African countries. HERANA (2011) shows that: None of the eight countries has a clearly articulated development model or strategy per se, although Mauritius is moving in that direction. Even what Mauritius has is without the requisite coordination, implementation and monitoring powers. While there is an ‘emerging awareness’ about the importance of a knowledge economy approach to development, it is stronger at the national government level than it is in universities. What these countries have are often based on “best practice” policy-borrowing from first world countries, particularly from the World Bank.

For example, many scientific ideas with intended results are lying fallow in many of Nigerian higher institutions waiting for implementation. It has also been discovered that some aspects of the curriculum needed to transform the design ideas to a marketing piece to create employment for youths are missing in tertiary institutions curricula (Fagbohun, 2005). Innovations without implementation, invariably, result into manufacturing bankruptcy. That probably explains reasons for the decline in productivity and low growth rate in manufacturing sector in Nigeria and Ghana (Adejuyigbe, 2005). Unlike in Europe and Asia, where Knowledge Management (KM) tools and techniques have been deployed to distribute essential information and know-how in public and private sectors for efficiency, productivity and information (see DBSA 2006:ix), Nigerian government has not fully realized the potentials and capabilities of KM.

The argument is that universities and scholars should be concerned with how to take knowledge to the streets to prove and test the knowledge. Adaptive education requires critical attention on how to resolve challenges in the built environment. In this era of problem-solving knowledge regime, the onus rests on scholars to think in a new way i.e. add value to their disciplines or fields to solve specific problems in the construction industry. It is on this note that this paper raises five fundamental questions which are: (1) Are there research findings and knowledge generated on the processing of raw materials to building materials in Nigerian universities? (2) If they exist, what happens to the knowledge? (3) Are they conceptualized as an end or as a means to an end? (4) How do we translate the knowledge to reality in meeting the needs and aspirations of the country? (5) What role should professionals in the built environment play in bridging the gaps between theory/knowledge and reality in the country?

**Research Methodology**

The paper is derived from both primary and secondary data. Primary data were collected between January and February 2013 from merchants/traders that engage in building materials. This is to measure the degree of usage of, or dependence on local and imported building materials in Osun State of Nigeria. Secondary data were derived from research findings of scholars within the built environment. Seventy (70) merchants/traders in building materials were randomly selected from the central business districts of two of the major cities in Osun State of Nigeria. The cities are:

9 Botswana, Ghana, Nairobi (Kenya), Mauritius, Eduardo Mondlane (Mozambique), Dar es Salaam (Tanzania), Makerere (Uganda) and Nelson Mandela Metropolitan (South Africa).

10 Mauritius, the Indian Ocean island state is one of Africa’s most developed nations and is set firmly on a knowledge and higher education growth path.
Osogbo, the state capital (42 questionnaires) and Ilesha (28 questionnaires). The respondents were requested to indicate the percentage of local building materials and that of imported materials they normally buy and sell. The thinking is that materials that merchants/traders buy and sell are a reflection of the prevailing demand and availability of building materials. The data were analysed using simple frequency distribution and percentile method. The results are extracted from several frequency distribution tables and then summarized and presented in Table 1 for discussion. The next section discusses empirical data on utilization of, and reliance on local and imported building materials in construction industry vis-à-vis research findings and knowledge generated by scholars in construction industry in Nigerian universities.

### RESULTS

#### Table 1: Statistics on Local and Imported Building Materials in Osogbo and Ilesa

<table>
<thead>
<tr>
<th>S/ N</th>
<th>Local Materials</th>
<th>Imported Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;50%</td>
<td>50-79%</td>
</tr>
<tr>
<td>1</td>
<td>Roofing Sheets</td>
<td>11.5</td>
</tr>
<tr>
<td>2</td>
<td>Keys and Locks</td>
<td>27.1</td>
</tr>
<tr>
<td>3</td>
<td>Door</td>
<td>17.1</td>
</tr>
<tr>
<td>4</td>
<td>Ceilings</td>
<td>10.2</td>
</tr>
<tr>
<td>5</td>
<td>Nails</td>
<td>8.6</td>
</tr>
<tr>
<td>6</td>
<td>Wood</td>
<td>2.8</td>
</tr>
<tr>
<td>7</td>
<td>Cement</td>
<td>1.4</td>
</tr>
<tr>
<td>8</td>
<td>Granite</td>
<td>5.7</td>
</tr>
<tr>
<td>9</td>
<td>Gravels</td>
<td>1.4</td>
</tr>
<tr>
<td>10</td>
<td>Sand</td>
<td>1.4</td>
</tr>
<tr>
<td>11</td>
<td>Iron</td>
<td>7.1</td>
</tr>
<tr>
<td>12</td>
<td>Steel</td>
<td>14.3</td>
</tr>
<tr>
<td>13</td>
<td>Glass</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>122.9</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>9.45</td>
</tr>
<tr>
<td></td>
<td>Grand Average</td>
<td>70.9</td>
</tr>
</tbody>
</table>

Source: Survey, January – February, 2013 (Figures were extracted from several frequency tables).

From Table 1, the grand average shows that the use of locally sourced building materials for construction is higher (70.9%) than the imported materials (40.7%). However, examining the data critically, it is evident that locally sourced materials were prominent simply because of the high figures scored by roofing sheets (52.1%), ceilings (55.7%), nails (65.8%), wood (57.2%), cement (65.8%), granite (83.8%), gravels (55.7%) and sand (57.1%). These figures were derived from respondents that indicated between 80 and 100 per cent sale of locally sourced materials (see Column 5, Table 1). It is, however, worrisome to discover that 32.8%, 21.4%, 8.5%, 7.1% and 5.8% of wood, cement, gravels, granite and sand respectively are still being imported for construction industry in the study area.

For manufactured construction materials such as roofing sheets, keys and locks, door, ceiling materials and glass, the percentages for importation are very high: (1) roofing sheets (46.7%), (2) keys and locks (74.3%), (3) doors (78.5%), ceiling materials
(62.9%) and glass (68.7%). All the raw materials used for the production of these building materials are available in Nigeria. For example, granite can be found in major parts of Nigeria most especially in the rocky areas such as Ogun State (Abeokuta), Plateau State (Jos) Enugu State (Enugu), Ondo State (Idanre) etc. Similarly, Nigeria is rich in iron ore deposit, which is the backbone of industrialization. There are over 3 billion tonnes of iron ore found in Kogi, Enugu, Niger, Zamfara and Kaduna states. Iron is currently being mined at Itakpe (Kogi state) which is more or less at the centre of the region of crystalline iron deposit. The large deposit of iron ore of Kogi and Enugu states are yet to be fully explored.

When using the 40.7% grand average for imported materials, roofing sheets (46.7%), keys and lock (74.3%), doors (78.5%), ceilings materials (62.9%), steel (48.6%) and glass (68.7%) are considered to be building materials deficits to the economy. Using the IAD framework, the above data confirms that Nigeria is neither responding nor dealing with its exogenous variables in development. Since it is difficult for individuals to change certain exogenous variables (physical environment in particular), individuals usually adopt and adapt institutions (rules-in-use) based on their life exigencies by adaptation strategy through community attributes – (culture and habits of hearts). Culture and habits of hearts determine the way development actors conceptualise the universe, which in turn influences decisions on material conditions and consequently development.

For example, the Israelis, though in the desert, used their culture and habits of hearts in causing agricultural revolution and now one of the outstanding agricultural innovationist across the globe. Similarly, South Korea took palm fruits from Nigeria in 1960 and now one of the leading exporters of palm oil, while Nigeria is importing palm oil. Industrial wastes from rice and timber productions have been noted for production of building materials in countries such as Thailand, Malaysia and India (Columa 1970 cited in Okereke 2006:15). Whereas studies by Nigerian scholars show that waste materials can be recycled for construction industry (Okereke and Obeng 1985; Okereke 1988; Edeh et. al., 2012a; Edeh, et. al., 2012b), they are bunt away in Nigeria only to cause air pollution. This confirms that Nigeria is not applying knowledge generated by its scholars to solve problems of daily existence.

It is on record that civilization started in Egypt, one of the African countries. This historical fact is confirmed by the existing pyramids in Giza, Cairo, Egypt. The structures at pyramids of Giza were foremost among the wonders of the world. The complex houses the Pyramid of Khafu (230m x 146m, base and height), Pyramid of Khafe (215.5mx 143m), Pyramid of Menkare (108.5 x 66.5). The unending fascination with the Giza pyramids is due to two factors: their sheer size and the precision with which they were built. When Napoleon sat at the foot of the pyramids, he reportedly calculated that there was enough material in the three to build a wall 3 meters high and 1 meter thick around the whole of France. To appreciate the accomplishment one must remember that the Egyptians used only tools of wood, stone and copper and employed no wheeled vehicles (they adopted the war chariot only after 1750 B.C (Roth, 2007:199).

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11 http://www.indexmundi.com/minerals/?country=ng&product=iron%20ore&graph=production
The question that borders one’s mind is on the source of the technology that was used in the construction of pyramids several centuries ago. What happened to that technology? Why was it not sustained for Africa’s development? It is important, however, to note that there are sundry cases of talents, innovations and inventions in science and technology that had been killed in Nigeria due to government apathy and inertia (see for details, Adeyemi 2011:22-24).

Examples of creative innovations from Nigeria that can be replicated to enhance the development of the construction sector abound:

Scholars at the Department of Civil Engineering, Universities of Ibadan and Lagos, Nigeria have come out with series of innovative works on: (1) The use of Palm Kernel Shell, Sawdust and Rice Husk Ash as partial/full replacement for gravel sand and cement in concrete (Olutoge, 1995, 1999, 2000, 2009, 2010); (2) Structural characteristics of Bamboo (Bambusa Vulgaris) as reinforcement in concrete slabs (Alade and Olutoge, 2004; Alade, Olutoge and Alade, 2004; Olutoge, 2006; Olutoge, 2009; Alade, and Olutoge 2002; Alade and Olutoge, 2004; Alade, Olutoge and Alade, 2004); (3) The Production of concrete using Rice Husk Ash as a partial substitute for cement (Olutoge, 2009, 2010); (4) The Production of concrete using palm kernel shell and sawdust as partial/full substitute for fine and course aggregates (Olutoge, 2000, 2010); (5) Bonding characteristics of oil palm stem in concrete matrix (Alade and Olutoge, 2002) and the structural characteristics of oil palm stem as reinforcement in concrete slabs and beams (Olutoge, 2009).

Scholars in the Department of Civil Engineering, Ahmadu Bello University, Zaria and University of Agriculture, Makurdi, Nigeria evaluated the characteristics of palm kernel shell ash (PKSA) stabilized reclaimed asphalt pavement (RAP) and found that 90%RAP/10%PKSA mix can be used as sub-grade material in flexible pavements. This saves cost as recycling of asphalt pavements is a beneficial approach from technical, environmental and economical perspectives. The use of stabilized RAP as sub base and base materials of pavement leads not only to economic solution but also offers a potential use of the RAP treated with cemented materials like sawdust ash, thus reducing the amount of waste materials requiring disposal and providing construction materials with significant savings over new materials (Edeh et. al., 2012a; Edeh, et. al., 2012b).

Scholars in the Department of Civil Engineering, Ahmadu Bello University, Zaria shows that investigation into the strength and durability of soil blocks when mixed with Makuba (extract from Locust Beans Tree) and bitumen established that Bitumen-Makuba stabilized soil blocks are strong and durable and are more economical than the conventional sandcrete hollow blocks (Salisu and Jibrin, 2011).

When rice rice husk is properly burnt, the resultant ash (RHA) can be used as a pozzolana to stabilize laterite soil (Okereke and Obeng 1985; Okereke 1988). Tests results on bricks produced from resultant ash (RHA) – cement stabilized soil bricks were quite satisfactory in terms of compressive strength and rate of water absorption (Okereke 1988, 2006:15).

Scholars in the Department of Mechanical Engineering in University of Lagos, Nigeria had designed a pyrolysis reactor for the treatment of municipal solid waste and for resource recovery. The machine has the potential to achieve a waste volume reduction of about 65% (Ojolo and Bamgboye 2005).
Adopting the principle of ‘turning waste to wealth’, some scholars in University of Lagos used palm kernel shells as raw materials in a laboratory scale downdraft biomass gasifier, designed to deliver a mechanical power of 4kW and thermal power of about 15kW (Ojolo and Orisaleye 2010).

Local people in Saki, Oke-Ogun area of Oyo State in Nigeria are transforming inherited indigenous knowledge (blacksmiths) to intermediate-technology – iron-smelters, iron-benders and welders for construction works (Akinola 2007f:229).

The Burnt Bricks Association, an indigenous occupational institution in Makurdi, Benue State, Nigeria is another example of local technology that has potential for the development of the construction sector. The process involved in the production of burnt bricks is very tedious but the entrepreneurs are improving the technology by surmounting obstacles that are confronting them. The enterprise constitutes the engine of industrial growth in Benue State as the products are stronger, more durable, readily available and cheaper than the regular cement block. In addition, houses built with burnt bricks are cooler than those built with cement blocks. Most houses in Makurdi, the state capital, in the past 12 years were built with burnt bricks. The institution provides employment opportunities and mobilises small savings in the economy for industrial growth. Consequently, various governments of Benue State, over the years, have become appreciative of its significance and, thus introduced policies to encourage the institution – for example, tax concessions (Agbo 2003).

In spite of the relevance of the intermediate-technology, there has been virtually no attempt by the Nigerian government to establish small scale industries where adapted technological skills can be used in the construction/building industry. The goal is to empower these local innovators so that their skills and potentials can be harnessed towards national and continental development. Locally produced building materials are one of Nigeria’s greatest challenges. They require widespread and continual invention and adoption of new technology in the form of improved method of production. Yet vast local materials and resources are wasted because appropriate technologies for processing materials are not made available.

If civilization started in Egypt, which is correct, the question we should be asking is: What actually went wrong with us in Africa? What type of technology did Egyptians used in the construction of pyramids such that these structures exist till today? (Plate 1). When one considers the height of the researcher in relation to the height of the blocks, one can imagine the type of technology the Egyptians used in the construction of the pyramids (Plate 2).

The intellectual predicaments and challenges that are facing Nigerian universities reinforce the notion that educational curriculum is not relevant to Nigerian needs. Problem-solving knowledge and ideas that are capable of addressing Nigerian challenges are imperatives at this stage. The required thing is that Nigerian universities should develop innovative ideas for the consumption of the larger community in Nigeria on a pilot scale, which can be regarded as experiments. The result of such experiments can then be used to design Nigerian models and also for redesigning school curriculum.

For Nigerian/African universities to be organic, they have to learn how to be problem-solving and solution-seeking; constantly operating in synergy with the people at community level and public authorities. We need to promote the integration of physical sciences and social sciences to solving problems that are confronting our society today (Akinola 2012i). For example, much of socio-economic development in
Construction and development

Germany is attributed to the development path undertaken by the country’s universities:

Plate 1: Picture of Pyramids in Cairo, Egypt with Researcher in suit in the middle.

Plate 2: Picture of Pyramids in Cairo, Egypt with Researcher standing beside the blocks.

The German Democratic Republic has become one of the leading industrial nations in the world. Its success is due, in no small part, to its ability to produce a large, highly trained technical elite through a sophisticated education system closely tailored to the needs of the society (Giles 1978).

It has been found that “socialization” of the university (relating their work more closely to the requirements of the state) or the doctrine of social adaptation of university education is a pre-condition for the technological survival of nations. No modern university can exist in isolation from the society on which it thrives (Aderinto, 1985). Given this caveat, the impact of Nigerian universities must be measured by
their abilities to improve the well-being of the society and offer practical solutions to intractable problems of development in construction sector. Currently, Nigeria has 207 universities. There are 129 legal universities (40 federal, 38 state and 51 private) and 78 legal polytechnics (21 federal, 38 state and 19 private). In addition, there are several research institutions with a lot of research findings and innovations in all sectors of the economy, especially, on the processing of raw materials into construction materials and recycling of wastes. All these higher institutions exist without any visible strategic development plan for the country. The greedy and visionless politicians have left Nigeria’s largely youthful population with an uncertain future (Oyekan 2013:20).

The above cases confirm that these innovations and knowledge generated on the processing of raw materials to building materials are not utilized to address real life situations in the construction sector. They only exist as an end instead of as a means to an end in developing the construction industry. Thus, the discussions, so far, have clearly demonstrated the missing links between and among the stakeholders in construction sector - public officials, scholars, professionals and the local people/grassroots. The abundant raw materials in the country have not been rationally utilized and productively engaged for infrastructural provision, houses, machines, equipment and installations not only for the construction industry but also for the society at large.

It is on the basis of the above that this paper attempts at addressing these challenges in the construction sector through polycentric planning and problem-solving scholarship. The paper, therefore, presents models, methodologies and strategies on how to translate the knowledge to reality in meeting the needs and aspirations of the country, by specifying the role that public officials, scholars, professionals in the built environment should play in bridging the gaps between theory/knowledge and reality in the country.

ADDRESSING THE CHALLENGES OF DEVELOPMENT IN THE CONSTRUCTION SECTOR THROUGH POLYCENTRIC PLANNING AND PROBLEM-SOLVING SCHOLARSHIP

In order to address the challenges of development in the construction sector in Nigeria, African Development Institutional Mechanism (ADIM) is recommended (see Akinola 2007f, 2008p). ADIM provides enabling environment for the key stakeholders in development – universities, governments, industries, professionals and community institutions to operate in synergy. This model suggests that scholars should view Nigerian realities with intellectual lenses through exogenous variables by factoring the variables into their study and understanding of Nigerian realities, otherwise, such studies will be repeating the error of the past – illusion. Similarly, scholars should generate knowledge through relevant applied research and analysis of existing scholarship focused on overcoming Nigeria’s problems in the construction sector. Then they should pass the knowledge on to the political sector (public officials). At the same time, public officials, along with scholars, should implement policies to addressing challenges that are associated with the processing of local resources into building/construction materials.

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12 Oyekan, Rotimi Lawrence is a journalist from the Guardian, who was present at the 13th General Conference of Association of African Universities (AAU), held in Libreville, Gabon that attracted some 300 delegates, many of who were Vice Chancellors from 30 African countries.
Linking the work of the university to the needs and requirements of the state is viewed by some as a pre-condition for the technological survival of nations. This will serve as an alternative means of using knowledge-based economy to initiate Nigerian socio-economic and technological rebirth and renewal for development. It is in the light of the above that this paper charts a possible course of action that can be taken at reforming higher education system, making it organic, problem-solving and solution-seeking. In this wise, African Education Reform Model (AERM) is adopted.

African Education Reform Model (AERM)

African Education Reform Model (AERM) (Akinola, 2010i, 2011l) (Fig. 1a) is adopted for reforming higher education system and making it organic, problem-solving and solution-seeking (innovation) in construction sector. This becomes necessary in the light of attendant effects of colonial intellectual syndrome with its consequence of intellectual poverty.

This model identifies the missing link in African educational system, especially, at the university level. The university system trained scholars to generate knowledge alone; while expatriates were heavily relied upon by governments in problem-solving. This probably leads to low incentives for funding of education in Africa. The consequence of this is at two levels: At the first level, expatriates were used. Expatriates did not understand African realities, while reliance on them did not yield positive results. Consequently, societal challenges emerged which are beyond the capability of public officials, and scholars were aloof from these challenges. At this stage, the situations and challenges were still redeemable if both public officials and scholars found a mix of their operations and work together as colleagues with equal standing. However, the separation between the two groups resulted into sharp criticism of public officials (kings) by scholars (philosophers). On the other hand, public officials accused scholars of being theoretical without policy consideration. This resulted into deep gulf and threats between the two groups. Consequently, community exclusion became heighten, thus leading to the second level when we have diverse and complicated societal challenges and problems that are experienced in African economy.

The problematics call for a rethink and paradigm shift in the orientations of both the king and the philosopher. It is in the light of this exigency that African Education Reform Mechanism is designed for deliberation and deliberateness/action. The model suggests that political leaders and scholars should work together when there is a problem to resolve rather than apportion blame when things have gone wrong. In essence, leaders and scholars as well as governments and universities should find a mix of their operations so that their threats can be converted into opportunities.

Training programmes in ministries of science and technology, commerce and industry, works, education, etc., should be executed in the field, in conjunction with working associations on the ground. The trainees should identify specific sites of interests where trainers will demonstrate new ideas to them. Civil servants should spend less time in offices so that their presence can be felt in communities where they are connected with the people. Experiences on recycling of wastes for construction gathered through these contacts with academics should be shared with the community members. Invariably, the locals can be able to generate money from wastes – thus turning wastes to wealth. ADIM will enable scholars and public officials to operate in synergy (as demonstrated in 5 steps – Akinola 2007f, 2010i).
Adopting African Development Brain-Box (ADBB) (Akinola 2008p:186-187; 2010i) and African Innovation Center (AIC), which plays moderating influence for knowledge utilization (Fig. 1b) will enable knowledge to be adapted to reality through experimental stations and pilot projects for the construction sector. AIC will have strong community relations such that any innovation coming to it will be quickly fixed up in relevant or demand communities where the idea is needed and can be demonstrated.

In order to implement these ideas, the first thing that Nigerian government should do is to increase funding of education. Apart from the general funding that covers salaries and emolument, and capital projects, task specific funding in forms of incentives should be directed at scholars who are assigned specific tasks to find solutions to specific problems in the construction sector. The findings and experiences gathered from these exercises would, invariably, be useful to the reform of educational curriculum. At the university level, revised curriculum will enable Nigerian universities to take appropriate decisions on their programmes, especially on how to use local resources to the benefit of the construction sector.
CONCLUSION

This paper concludes that the neglect of KM tools and dis-articulation between stakeholders in transforming raw materials into construction/building materials in Nigeria has led to dependency syndrome. It is not enough to learn from abroad; development cannot be imposed from above or from outside. It is what people are doing at home that should form the basis of development in the built environment. This paper argues that Nigerian leaders have the responsibility of investing Nigerian resources in providing enabling environment for their citizens, especially in the application of knowledge to construction industry. This paper charts courses of actions that professionals in the built environment could take in tandem with public officials to become “organic” in their operations and use endogenous knowledge as agents of change to reform the construction industry and thereby impact positively on their communities. Consequently, the paper adopts African Education Reform Model (AERM) for reforming higher education system in Nigeria. The application of knowledge in construction sector depends on robust institutional arrangements that can be operationalized in Nigerian/African Innovation Center (NAIC) through African Development Brain-Box (ADBB) for enhancing the utilization of local materials knowledge in turning knowledge to reality. The findings and experiences gathered from these exercises would invariably, be useful to the reform of educational curriculum. Revised curriculum will enable universities to take appropriate decisions on their programmes, especially on how to use local resources for the benefit of the construction sector.

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THE OROWA HOUSE: A TYPOLOGY OF TRADITIONAL YORUBA ARCHITECTURE IN ILE-IFE, NIGERIA

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Beyond generic descriptions of Nigerian traditional architecture as ‘adobe walls, domes, courtyards and overhanging hipped roofs’, or in response to the oft-posed question: What exactly is Indigenous Nigerian Architecture? This paper presents a spatial typology from Ile-Ife town core area. The study identified the distinctive features of the traditional Ile-Ife Orowa House; key function spaces e.g. the Orowa (central hall), a comprehensive pattern of space use in the dwelling, the organizational (spatial) criteria, and morphological characteristics using Hillier and Hanson (1984) Space Syntax methods. Key spatial relationships between the core functional spaces in the Orowa house that define its morphology were identified, which extend beyond the descriptive studies of Yoruba traditional domestic architecture more regularly found in existing literature. The use of space syntax allowed for measurable analyses of the twenty-four houses surveyed, and contributes to the documentation of traditional dwellings in Nigeria. While differences in space use pattern exist between the Orowa house and contemporary houses found in the larger sample from which this paper is derived, some space use patterns persist in both; indicative of a ‘Nigerian’ or at least a Yoruba way of living that survives in newer architectural forms.

Keywords: traditional Yoruba architecture, domestic space, space syntax, Orowa house.

THE IDEA OF INDIGENOUS ARCHITECTURE

Several researchers have studied what many consider ‘indigenous’ architecture in many African cultures, but most of these have been from a socio-ethnographic position, in which architectural perspectives are often oblique to the focus of such studies, and are often by non-Africans. Osasona (2007) asserts that the process of documenting the architecture, meaning and the use of space in Africa is far from being well established by African architects, and queries the existence of an ‘African’ or a national type as a result of the myriad of cultures, and influences on the continent. Consequently, this study adopts the position that exploring the idea of traditional Nigerian architecture is best achieved by identifying typologies within each ethnic context due to the existence of over 400 different ethno-linguistic groups in Nigeria.

This paper presents a traditional dwelling type from Ile-Ife town in South Western Nigeria, and it adds to a small but growing body of work focussed on in-depth analyses of traditional (Nigerian) domestic architecture from a specifically morphological perspective similar to (Isaac-Sodeye, 2012; Ekhaese, 2011; and Muhammad-Oumar, 1997).

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Traditional or post-traditional architecture according to Amole (2000) is the ‘brand’ of architecture that results from the traditional form, morphology and material technology evolving via a process of selective borrowing from external sources, and the ‘core’ of the original traditional dwelling is likely to endure, as the process of modification is gradual and community generated. Bearing in mind the subtle differences between the traditional and the vernacular (post-traditional), this research has identified the Orowa house as a traditional Ile-Ife ‘type’, for a number of reasons. The Orowa house presented distinct differences in morphology and space use in comparison with contemporary and more recent vernacular examples in Ile-Ife, and is essentially one of its earliest surviving models of domestic architecture despite some changes in material technologies. It is argued that these ‘innovations’ to material technology and evidence of external architectural influences have not resulted in major changes to the morphology. To analyse morphology and space use, this research adopted the use of Space Syntax theories and methodologies developed by Hillier and Hanson (1984). It also includes an inventory of the domestic activities in each functional space as found in the twenty-four traditional Orowa dwellings.

The space ‘label’ refers to spaces where distinct functions identified by the respondents coincide with fully or partial enclosure by walls, as well as spaces that are only articulated spatially by furniture arrangements, although the function label often did not adequately describe the diversity of activities in the room.

**ILE-IFE: YORUBA TRADITIONAL ARCHITECTURE**

Gugler and Flanagan (1978) identified that the compounds were the most important elements in the traditional Yoruba town. These traditional domestic buildings have thick mud walls (cob structures between 6-12 inches), bamboo rafters or other termite-resistant timber with thatched roof construction, and room sizes based on a standard module of 10 feet (ese bata mewa) (Osasona, 2007). Some modifications were found in most of the traditional houses sampled; mainly in the use of corrugated roofing sheets instead of thatch, and occasionally, cement: sand plaster to mud walls. The traditional multi-generational family compound (agbo’le) comprises of a group of Courtyard-type or Orowa-type houses or both. The courtyard house with its inward focus of small rooms around a large courtyard/impluvium or a series of interconnected small courtyards/impluvia was more common among the chiefly ranks and often developed in an agglomerative way, while the Orowa house is usually without courtyards. The case study town; Ile-Ife is in a hot and humid forest region, and the effect of the weather is that open shaded spaces are more comfortable, particularly in the daytime. As such, thick adobe walls, coupled with small windows, the sloping roofs with eave overhangs, are commonly found in response to the weather. This architectural form of small rooms around a communal space is common in West Africa, as seen in Bini architecture (South-West Nigeria) and further afield in Ashante architecture (Ghana).

**The Orowa House Introduced**

The key distinguishing feature of the Orowa house is that spaces are linked to each other through other spaces or through the Orowa - a central large hall that serves as the main connective and activity space for each dwelling. The main entrance into the house is usually directly into the Orowa or into a small lobby connected to the Orowa or through a front veranda, which then leads into the Orowa (see figure 1). Typical activities that take place in the courtyard (e.g. cooking, laundry, livestock rearing, and storage) are often found in the orowa, in the Orowa-house.
The toilet and shower areas are always separate from the main building within the compound or family land. Each bedroom, or suite of two/three rooms, belongs to an individual and their nuclear family, but in a polygamous set-up- each wife and her offspring has a room or suite of rooms, while the husband has a separate bedroom.

The bedroom is the only real ‘personal’ space available to the nuclear family, or to each wife and her offspring, and contains personal belongings. Bedrooms tend to be small (about 2.8m x 3m), and are frequently without windows, and until recently without door locks, and is used mainly for sleeping and for storage. The combination of small cell-like spaces/rooms around a large communal space has the effect of drawing members of the extended family into prolonged daily contact in the courtyard or veranda where the bulk of family life and household tasks take place. Consequently, many of the communal domestic activities are ‘pushed’ into the orowa/outdoor spaces, and items for regular use are often stored in the Orowa.

![Figure 10: Examples of Orowa House](source)

**LITERATURE REVIEW**

The decision to analyse physical spaces, and the objects and activities together, was supported by the challenges of understanding the nature of physical space. Giddens (1984) (in his critique of Foucault on timing and spacing in educational space) describes space as a ‘complex’ “whereby its most important aspect is not any particular part of a building but its relational form”. The complexity attributed to educational space portrayed above, is even truer of the domestic space, hence its study is likely to benefit from a combined approach. Therefore, to understand physical space it is necessary adopt methods ‘that analyse not things in space, but space itself with a view to uncovering the social relationships embedded in it’ (Lefebvre, 1974,1991; p 89). The process of explaining physical (domestic) space, and space use required spatial theories/methodologies that recognise space as possessing built-in social and contextual meaning, and measures its fundamental connectivity patterns. Space syntax theory and methodologies developed by Hillier and Hanson (1984) specifically addresses these issues and also provided a means of objectively comparing a set of buildings.
Space Syntax Theory Introduced

In Hillier (1996) and Hillier and Hanson (1984), space is a primary element of buildings and their work draws the above ideas together; that the configuration of (internal) space is a direct expression of social relations, and its key focus being the ability to move from one space to another (permeability), as well as the co-presence of people within a space. By analysing configurational relationships between specific functional spaces, apparently disparate plans can be compared. Hillier and Hanson (1984) have developed analytical tools for predicting consequences of design interventions in the built environment, and these techniques have gained wider use by archaeologists to interpret configurations of ancient ruins; by law enforcement agencies for crime prevention; and by academicians in the study of society and space (Isaacs-Sodeye 2012). The discussion on the configuration of space in space syntax focuses on the basic nature of connections between two spaces/rooms considered via the existence of a third space in a building. A space is one step away when spaces are directly accessible from each other, and each intervening number of spaces that separates one space from another increases the number of steps/depth between these spaces. Figure 2 shows four visually similar floor plans, but, when the connection between each space is mapped out, by representing each space/room as a circle, we see that internal spaces in the plans have different connectivity patterns, described in space syntax theory as the Justified Accessibility Graph (J-Graph). In each J-graph, the doorways, or points of accessibility where a person can walk through from one space to another are represented as lines/links connecting the circles. The circles are arranged showing the increasing depth/steps from the outside world, which is represented by a circle circumscribing a cross. The J-graph reveals the number of steps required to reach all other rooms in the building from a specific room/space.

The J-graph of Plan 1 reveals a ‘tree-like’ arrangement of spaces and plan 2 has a ring-like structure allowing more than a single option of movement between the internal spaces. Plan 3 shows a single sequencing of spaces and only a single option to the movement pattern within the plan. Minor changes in the four plans above seem to have resulted in real differences in the movement patterns of each plan; repercussions which may result in what Hillier and Hanson (1984) describe as either symmetry (along a vertical axis as shown in the j-graphs for plans 1 and 2), or asymmetry along the vertical axis as indicated in plan 4; unique characteristics inherent in the configuration of any plan. A second characteristic of the relationship between interior spaces identified in space syntax is the existence of one or more locus of control. Empirical research based on space syntax has shown in some situations, that a few spaces exert strong control over other spaces in the plan which results in non-distributedness defined as the existence of fewer routes or a tree-like choice as seen in the j-graphs of plans 1 and 3, while other plans manifest greater choice of independent routes resulting in what is described in space syntax terms as distributedness. Distributedness also refers to the existence of ‘rings’, which describes the option of moving through a series of spaces/rooms, commencing from a room and ultimately ending in the same room. The j-graph of plan 2 shows an example of a ring that is formed by moving from room A to room B to room C and back to room A.

Another space syntax technique developed to express the connections/permeability patterns of a 2-dimensional plan as an abstraction is shown in Figure 4. The process involves identifying the fewest and widest distinct convex spaces on the floor plan, and establishing doorways, and other openings that allow thro-movement between spaces. This form of representation is called a convex break-up map in space syntax theory. Each room/space is represented with a convex shape (usually rectilinear) and the doorways or points of movement between each convex space are represented by a
thin box connecting the two convex spaces (compare Figure 3 and Figure 4). According to Hillier and Hanson (1984), a convex space is any cell/space label that is fully bounded by walls and encloses all the surface area that may be connected by any two points within the cell, but this was further expanded in this research, to include the coincidence of geometric distinction with functional differentiation. The connectivity pattern between all spaces in a system is analysed mathematically to provide a measure- the Integration value- that captures non-local properties of spaces critical to the movement dynamics and potential of a system (Hillier, 1999). Each space has a specific set of connections to a number of spaces in each plan, and each space is compared in terms of its degree of connectivity to all other spaces in the plan to develop an integration value for each space in a building, reflecting its relative connectivity within the whole building. The integration value as such, is a calculation of how close each space is to all other spaces in the building. Each space has an integration value based on its relationship to the whole, and integration values reported in this paper were generated by transcribing the number of connections that each space has in a specific floor plan using NetBox software. This was then imported into software (NewWave) that analyses the connections of each space in comparison to all the spaces in a building, to calculate the integration value of each space; a process that is now easier using more recent software such as DepthMapX. The integration value can be seen as a measure of relative asymmetry or relative depth (Hillier and Hanson, 1984; pp108-109). The higher the integration value of a space, the fewer steps required to traverse each room in the building from such a space.

Figure 11: Basic Spatial Configurations of floor plans with Justified Graphs
Source: adapted from Hillier and Hanson (1984)

Figure 12: Floor plan of Orowa house 1

Figure 13: Convex break-up map of Orowa House 1
The convex integration map (see Figure 5) is an extension of the convex break-up map, and is a visual representation of the range of integration values using an 8-interval scale (based on the lowest and highest integration value derived for an individual plan). The spaces with high levels of connectivity are those with the highest Integration value, which are defined as the most integrated spaces, and are indicated in red in the convex integration map. The spaces with the least numbers of connections, will have lower integration values, and are described as segregated spaces (indicated in violet in Figure 5).

The unequal relations in the connectivity of spaces also results in a tendency for different weightings in the way activities are disposed around the building and each floor plan expresses a specific pattern of connection, symmetry/asymmetry, choice of movement between the spaces and ranking of key domestic activities that Hillier and Hanson (1984) describe as a phenotype. For example, the relationship of key domestic spaces in Orowa house 1, shows that the Orowa is the most integrated (connected) space, and the shower room is the least connected (segregated).

The rank order of integration pattern of key spaces in Orowa house 1 is as follows:

(Most integrated) Orowa > bedroom > shower room (segregated)

Patterns of ranking of integration values for key space functions (Orowa, parlour, kitchen, bedroom and shower room) in individual dwellings have been found to be a culturally potent template that is often recreated regardless of variations in floor plans (e.g. Taher and Brown, 2003; Bafna, 2001; Amorim, 2001; Hanson, 1998; Bustard, 1999; Monteiro and Hillier, 1987). It is this template that Hillier and Hanson (1984); Hillier and Graham (1987) refer to as the inequality genotype, and it is in its relatively stable nature, that cultural knowledge resides. It is the genotype template that is adjusted when creating individual (floor plan) phenotypes, and as such, a substantial amount of social information can be retrieved from the genotype. The existence of such a genotype or template can only be established by analysing a sample of floor plans to see if the pattern of the ranking of integration values of the key spaces remains consistent, despite variations in floor plan layouts.

Some of the criticisms raised previously about space syntax - its lack of focus on the geometry (Ratti, 2004), its use of 2-dimensional abstraction (Allison, 1999), and the need to incorporate more phenomenological aspects (Seamon, 2003), - are not as critical as may initially seem. Space syntax measures relational elements of a system rather than properties (e.g. size, distance) because configuration of space is considered a fundamental, but not the sole role of bounded space, and seems to account for spatial

Figure 14: Convex integration map of Orowa houses 1, 2, and 3

Source: Researcher’s fieldwork
and functional relationships without direct reference to geometry with high predictability rates [Bafna (2003), Amorim (2001a)]. This Hillier (1999) claims, is not to say that geometry is not significant; only that the justified graph (and other space syntax methodologies) seems to account for certain aspects of geometry (e.g. distance) without expressly measuring it. In any case, some level of abstraction is always required in most methodologies to make discussion and comparison feasible. Qualitative analyses can certainly be incorporated into space syntax analyses, which this study does by combining it with the analysis of object and activity locations.

METHODOLOGY AND SURVEY DESIGN

The results presented here constitute part of a larger study of both traditional and contemporary houses in Ile-Ife (160 plans). The twenty-four Orowa houses presented here were almost restricted to the Enuwa sample area which is in the oldest existing quarter in Ile-Ife and is mostly occupied by extended families with many dwellings dating to the 1890s. The majority of these dwellings are owner occupied by traditional titled chiefs whose lifestyles are more focussed on traditional customs and religion. A structured interview and the preparation of a floor plan were done by 2 bilingual interviewers.

The Depth measure utilised here is based on the J-Graph described in the preceding section that summarizes the overall isomorphic distance away from a root cell, (usually the outside world) as well as the total number of links or steps that separates each space/room in the domestic plan from the outside world defined as step depth. Each of the plans was analysed in this manner to see how ‘deep’ or ‘shallow’ each plan is from the outside world. For example, the j-graphs of the four floor plans in Figure 3 show that plan 1, 2 and 4 have all their spaces/room at a maximum of 2 steps away from the outside world, while floor plan 3 is deeper with the spaces at a maximum of 3 steps away from the outside. The J-graph makes the syntax of the plan clearer, because the number of steps between cells, and the way the dwelling performs in terms of circulation options are easier to identify.

In addition to the assessment of step depth, the J-graph also reveals that each cell/space has four topological possibilities identified by Hillier (1996) as: -

A-spaces; that is, cells/rooms with a single connection, that are terminal/dead-end in nature,

B-spaces; cells/rooms with two or more connections that lie in a sequence that allows a complete linear procession through a series of cells to terminate at the starting point/cell,

C-spaces; that is, cells/rooms that have two or more connections, and lie on a ring,

D-spaces- Cells with more than two connections and lie on at least two rings.

A higher proportion of ringy spaces (C and D-spaces) usually correspond to reduced step depth, and a higher proportion of terminal (A-space) or thoroughfare spaces (B-space) to higher step depth (Hillier, 1998). As such, a space label can also be compared across separate plans because of the measure of relative depth, which is the mean depth of a cell in a given plan in relation to all other spaces in the plan from the outside world, and this helps overcome stylistic or geometrical differences in the plans. The actual depth of a space from the outside world was used in comparing the location of various domestic activities, objects, similar to (Dursun and Saglamer, 2003; Seo, 2003; Amorim, 2001; Monteiro, 1997).
The pattern of integration is the second syntactic measure of connectivity that was of interest. As discussed earlier, it assigns a numeric value for each space label based on algorithms in the software calculating the connection of each cell in relation to all other cells in the domestic space. Integration values can be expressed in a table form (with the integration values of all the spaces/rooms in a building listed), or as an 8-interval colour-coded range expressed as a convex integration map as utilised in this research. Different plans were assessed by checking the rank order of the integration values of key spaces/rooms arranged from the most segregated to the most segregated, to identify the inequality genotype - the consistent pattern of the ranking of the integration values of the key spaces across the plans.

In addition, the mean integration of each space for the genotype was derived from the integration value of each space from the 24 floor plans surveyed. A similar mean step depth value for each key space/room was calculated from the 24 plans to arrive at a mean value of each space for the genotype. This mean integration and step depth allowed for comparisons of different genotypes as well as comparison across house plans.

**The Orowa House- Space Syntax and Space Use Analyses**

The Orowa house was almost totally restricted to Enuwa, with all but one of the examples in the total sample found there. The integration values of key spaces - Parlour, Kitchen, the Orowa (or corridor), Bedroom, and Toilet (or shower room) - for each plan were ranked in order form integrated to segregated, and those sharing a similar sequence of integration of spaces were identified as belonging to the same genotype. Of the twenty four Orowa house in the sample, two main patterns of the ranking of integration values for the key spaces were identified; that is, two genotypes. The Orowa genotype accounted for 70% (17 nos) of the houses, and the Double-loaded (DL)-Corridor (with segregated kitchen) Genotype, accounted for five of the other seven Orowa houses. The two genotypes are described below.

**The Orowa Genotype**

The Orowa genotype was assessed based on the availability of either a shower or toilet, since not all the floor plans sampled had both. Also, only nine of the Orowa houses had principal corridors/lobbies, so the corridor was not a key feature in the morphological assessment of the Orowa Genotype. The Orowa was the most integrated space in the dwelling followed by the living room, which sometimes had the same integration value as the bedroom, or was slightly less segregated (see Figure 6). The kitchen and the shower/toilet were the most segregated spaces (see Figure 7 for Mean Integration of the key spaces in the Orowa genotype).

The mean depth for the key space labels was based on the step depth of each space label in each dwelling, that is, the number of intervening spaces between each space label and the outside world, and based on this, the shower was the shallowest from the outside world since it is almost always connected directly to the outside, and the Orowa is the shallowest interior space (see Figure 8). Overall the Orowa genotype had a mean step depth of 3.588 making it the shallowest in the total sample and the exterior was also quite integrated (Mean integration=1.240).
Figure 15: floor plans, convex integration maps and J-graphs of examples of the Orowa Genotype

Total no of step depth = 3

Figure 16: Line Chart of Mean Integration of Key spaces in Orowa Genotype

Figure 17: Line chart of Mean step depth of key spaces in Orowa Genotype
Orowa Genotype Space Label Typologies

Thirteen of the seventeen floor plans were ringy structures, but often involved using an external door to maintain continuity of the ring. (Mean number of rings = 1.0). A high proportion of all the space labels in the genotype were in dead-end A-spaces (56.7%), with 14.4% of B-spaces, 20.6% of C-spaces and 8.2% of D-spaces. In summary, the Orowa genotype was one of the shallowest found in the larger sample, and the Orowa space itself being very shallow in the domestic complex, and often occurred on an ring connected to the outdoor space, but with no purely internal rings found in the Orowa genotype. It is a genotype that is strongly dominated by function spaces with very few purely transition spaces occurring in most floor plans demonstrated in a very low ratio between the transition space (T) and function space (F). This ratio; the T: F ratio = 0.139 highlights the low use of transition spaces or mediator spaces in linking key spaces to each other, and function spaces connect directly to each other. Amorim (2001) defined mediator spaces (based on his study of Brazilian pre-modern and modern houses), as transition spaces which create a ‘buffer’ between the three sectors fundamental to most domestic complexes- the living, service and sleeping areas/sectors. The orowa spaces were usually a C or D-space, that is, usually with several connections or lying on a ring (11 of the 17 were of these types). The parlour was either on a ring or off it (evenly split between A, B, C, and D-spaces), while the kitchen and bedroom were predominantly dead-end terminal spaces; that is, A-spaces.

The Double-loaded Corridor (with segregated kitchen) Genotype

Only five of the Orowa houses belonged to this genotype; hereby referred to as the DL-Corridor (seg. Kit) Genotype, but it was the most frequently occurring genotype in the larger sample of 160 households. It is typified by the corridor being the most integrated space, although the Orowa in this type was also strongly integrated in the few floor plans where they occurred. The corridor in this genotype is usually central with double rows of rooms on either side of it, and serves as the main connective space. As such, the longer, narrower corridor was invariably slightly more integrated than the Orowa in this case. The corridor, sitting room and kitchen were shallow in comparison to the bedroom and bathroom, and the overall mean step depth of the genotype was 4.308, which was relatively shallow in the larger sample, but deeper than the Orowa genotype. Many of the houses had a predominance of dead-end A-spaces, reflected in the overall pattern 55% A-spaces, 12% B-spaces, 27.4% C-spaces and just 5% of D-spaces. Overall, the parlours and kitchens had a mixture of C and A/B spaces, and the kitchens were usually directly linked to the exterior. Bedrooms were mainly A-spaces, though a significant number of C-Spaces also occurred.

Activity Patterns and Space Use in the Orowa House

Both genotypes had a relatively small functional core in comparison with newer housing types, that is, only a few space labels were found to be common to the majority of the plans; at least 66% of the floor plans. The more traditional genotype seems to be the Orowa Genotype, as it also had the smallest functional core with just the parlour, bedroom, and Orowa as its functional core (see Table 1). The DL-Corridor (seg. Kit) Genotype with its slightly larger functional core (parlour, bedroom, corridor, verandah, bathroom and orowa), includes transition spaces (corridor, veranda) which is almost completely absent in the Orowa Genotype (see Table 2). The idea of the functional core is about the level of functional complexity normative in a genotype. It was noted that the integration value of a space label increased as a
space moved from group III; being of peripheral importance in the genotype, to group I and becoming more mainstream to a particular way of life. The converse also occurs, as the Orowa space; a core functional space in the Orowa genotype becomes a group III space label in the DL-Corridor (seg. Kit.) Genotype.

Table 4: Functional Core Space Labels in Orowa Genotype

<table>
<thead>
<tr>
<th>Orowa Genotype (17 floor plans)</th>
<th>Space labels that occur in at least 66% of the floor plans</th>
<th>Space labels that occur in btw 33% - 66% of floor plans</th>
<th>Space labels that occur in less than 33% of floor plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARLOUR</td>
<td>Kitchen</td>
<td>Toilet</td>
<td></td>
</tr>
<tr>
<td>BEDROOM</td>
<td>Shower room</td>
<td>Main bedroom</td>
<td></td>
</tr>
<tr>
<td>OROWA</td>
<td>Corridor*</td>
<td>storeroom</td>
<td></td>
</tr>
<tr>
<td>verandah</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Functional Core space labels in DL-Corridor (segregated kitchen) Genotype

<table>
<thead>
<tr>
<th>DL-Corridor (segregated kitchen) Genotype</th>
<th>Space labels that occur in at least 66% of the floor plans</th>
<th>Space labels that occur in btw 33% - 66% of floor plans</th>
<th>Space labels that occur in less than 33% of floor plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARLOUR</td>
<td>Toilet</td>
<td>Dining room</td>
<td></td>
</tr>
<tr>
<td>KITCHEN</td>
<td>Main bedroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEDROOM</td>
<td>Storeroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORRIDOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERANDAH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A review of the functional core shows that the kitchen is not part of the functional core in the Orowa genotype, principally because most of the kitchen related activities are often done in the Orowa space. Also, water supply was often from wells, collected rainwater, public taps or streams, lacking the fixity of pipe-borne water. The activities that take place in the functional core spaces are discussed below.

**Convention of Space Use:**

An inventory of twenty activities was built up from the respondents’ answers, and a profile of the use(s) found in each of the functional core space in both genotypes shows a wide range of uses in the overall sample and at the individual household level, that is indicative of relatively low specialization of space use.

The parlour was found in a smaller number of the dwelling in the two genotypes. It is typically used for family living and relaxation, reading, studying, eating, and occasionally for activities incompatible with the reception of guests, e.g. cooking, in the DL-Corridor (seg. Kit.) genotype. In the Orowa genotype, the use of the parlour is more often restricted to use by the head of the household for receiving his (male) guests, whilst it is more of an everyday space in the DL genotype. It is very generic in use; with seventeen object categories found in the parlour (e.g. furniture, electronic gadgets, fridge/freezer, crockery, print material, fan, unused items, bowls etc), and eight different activities also occurring in the space.

The bedroom is often allocated to each wife and her young children, or as a separate room for the husband/head of a household. It is the most common space label in the Orowa house as well as in the total sample. Apart from using it for sleeping, dressing and storage of clothes and shoes, the bedroom was sometimes also used for eating, for storage of non-perishable food, cooked food, and other personal effects (clothing,
Traditional Yoruba architecture

religious objects (amulets), jewellery, valuables). Seven different activities were found in the bedroom in the two genotypes, and 13 different objects categories were found in the Orowa genotype, and 19 object categories in the DL-Corridor (seg. Kit.) Genotype makes it quite non-specialised for both activities and objects. The bigger object arrays in the DL-Corridor (seg. Kit.) Genotype is most likely due to the fact that the dwelling is occupied by non-related multi-households hence fewer things are likely to be kept in the communal areas due to a lower level of trust.

The Orowa space is almost exclusive to the traditional genotype, and is usually between 3.5 to 4.5 metres wide. It serves as the circulation link to many rooms in the dwelling, as well as being an important activity space for cooking, relaxation, and storage, despite the fact that it is shared with other related households. It is a hub of activity with fourteen different activities found in the space in the twenty-four dwellings. Eighteen object categories were also found in this space- regular furniture, space furniture, culinary related items, keeping the animals being reared (at night), portable water storage, fuel, motorcycles/bikes etc. Table3 the activities that constitute at least 5% of the total responses highlighted in grey.

Table 6: Activities found in the Orowa space and the frequency of each activity.

<table>
<thead>
<tr>
<th>Activities found in the Orowa Space in both Genotypes</th>
<th>Cooking</th>
<th>Eating</th>
<th>Family living</th>
<th>Food preparation</th>
<th>Reading</th>
<th>Sleeping/dressing</th>
<th>General storing</th>
<th>Entertainment</th>
<th>Storage of reared animals</th>
<th>Ironing</th>
<th>Washing clothes</th>
<th>Retailing</th>
<th>Toiletting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>frequency</td>
<td>13</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Discussion: Syntactic and Spatial features of the Orowa house.

The general trend in the genotypes is a lower mean integration in the older examples, of which the Orowa genotype is the oldest. The enduring genotype: - the DL-Corridor (seg. Kit) Genotype was in-between. The mean overall depth pattern follows an opposing trend: - the orowa genotype is the shallowest, and the DL-Corridor (seg. Kit) Genotype in-between. There was also a major change from function-space integrators to transition-space integrators from older to newer genotypes, again with the enduring genotype, that is, the DL-Corridor (seg. Kit.) Genotype found in-between. These shifts also correlate with an increase in the popularity of single household dwellings and an enlarged waged economy. The by-product of this is the separation of certain functions from the domestic space, but in the multi-household dwellings studied here in which the households are related, there is less emphasis on privacy, and the lack of transition spaces as a connective tissue is an aspect of the lower emphasis on privacy in the interaction between the households. The Orowa genotype is completely devoid of internal rings, while according to Hillier (1998), a higher proportion of C and D-spaces usually corresponds to reduced step depth, which is consistent with the two genotypes analysed here. The lack of rings in the Orowa genotype is also less of an issue since all the households are related to each other and have a close interaction. Table 4 shows a comparison of space types in both genotypes.

Generally the parlour, bedroom and kitchen are in A-spaces (dead-end spaces) in both genotypes, though there were a slight change of bedrooms being of a mixture of A and B-spaces in some of the newer genotypes. The parlour, kitchen and bedroom are
Adeokun

segregated in both genotypes, but the parlour and kitchen are less segregated in the newer genotypes from the total sample. This shift is a result of social changes in the form of new activities and objects, new technology (pipe-borne water etc) and new ideas about social norms such as the kitchen becoming slightly more of a place where socialization can also take place. The two genotypes also had the lowest ratio of habitable rooms (HR) to the mean number of cells/convex spaces (C) in the total sample, signifying the small proportion of the domestic complex that was available to the households surveyed (Table 5), as well as low T: F ratios (see Table 6) partly as a result of the absence of mediator spaces.

Table 7: Genotypes and nature of spaces

<table>
<thead>
<tr>
<th>genotype</th>
<th>A-spaces</th>
<th>B-Spaces</th>
<th>C-Spaces</th>
<th>D-Spaces</th>
<th>C&amp;D-spaces</th>
<th>A&amp;D-spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orowa</td>
<td>57%</td>
<td>14%</td>
<td>21%</td>
<td>8%</td>
<td>29%</td>
<td>65%</td>
</tr>
<tr>
<td>DL-Corridor (seg. Kit.)</td>
<td>55%</td>
<td>12%</td>
<td>27%</td>
<td>5%</td>
<td>32%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 8: Genotypes and Spatial Variables (HR:C ratio)

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>DL-Corridor (seg. Kit.)</th>
<th>Orowa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean no of cells/convex spaces (C)</td>
<td>17.42</td>
<td>11.7</td>
</tr>
<tr>
<td>Mean no. of bedrooms</td>
<td>2.21</td>
<td>2.12</td>
</tr>
<tr>
<td>Mean no. of habitable rooms (HR)</td>
<td>3.44</td>
<td>2.88</td>
</tr>
<tr>
<td>HR:C ratio</td>
<td>0.20</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Hence there is less reliance on the use of transition spaces to mediate between different ‘sectors’ in the genotype, and less emphasis on the need to separate inhabitant and visitor access in these types of living styles. In other words, the definition of privacy is less about separation between inhabitant and visitor, as most of the respondents in Orowa houses stated in the questionnaire that most space labels in their homes were accessible to a visitor. Although the Orowa is very much the centre of social activity in the Orowa genotype, and cooking was the most common activity mentioned by respondents, cooking was not segregated into a pure service space until the advent of the DL-Corridor (seg. Kit.) genotype, which is in response to changes such as the incorporation of water and drainage into a kitchen space.

The Orowa House and space use characteristics

There was very little spatial distinction between personal, sacred, and communal ‘zones’, in the domestic space and similarly, there was less emphasis on the separation of inhabitant-visitor circulation: - the bedrooms are generally accessible to close friends, but since most of the rooms are quite small, most of the socialising with non-inhabitants takes place in the orowa, or outside on the front porch/verandah. This was evidenced in both genotypes. Very few personal and habitable spaces exist in the Orowa house as evidenced in the HR: C ratio as well as the low T: F ratio which
indicates a lack of mediator space, but which is compatible with communal living that is not incompatible with related families sharing space(s). Access for non-residents, was mediated not by spatial zoning, but by a combination of individual and cultural regulations that are usually known to the household and to the community. Most spaces are accessible to both genders except in a few cases where some religious shrines are barred from female access. There was also a lack of focus on individual privacy, or privacy as a spatial condition in both genotypes, invariably a consequence of the compatible aspect of extended family living in the Orowa house. Very few of the respondents in this house genotypes complained about being affected by the lack of privacy, supporting the notion that there is little demand for privacy amongst the different parts of the extended family. Household privacy was perhaps seem along the lines of inside (extended family) versus outside (community beyond), and any concerns about individual privacy seemed to develop mainly around the performance of bodily functions.

The Orowa is a very important location of the majority of domestic activities and also for the storage of many everyday objects as seen in the activity profile and the list of objects enumerated in the preceding section particularly in the Orowa genotype. Many of the activity functions and objects that are usually kept in the Orowa, in the Orowa genotype were mostly transferred to the central corridor in the DL-Corridor (seg. Kit.) genotype when occupied by related families. While personal objects and valuables like are mostly kept in the bedroom, this does not necessarily translate into a public/private distinction, as the bedroom is often accessible to close friends, but comprised of a slightly less varied object and activity array in the Orowa house. The concept of public/private zoning seems different from that indicated in many western cultures. The Orowa, Corridor and Bedroom- constitutes the main focus of the activity and object arrays in the domestic domain in the traditional Orowa house, though the size of the object array in these spaces in the traditional houses were smaller in comparison to the newer middle class homes, while the converse was the case for activity arrays in these three key space labels. On the whole, the functional core spaces were non-specialised for both use (activity) and content (objects) in the two genotypes. Finally, outdoor space (front and back yards, front porches, and verandahs) were an important aspect of traditional Yoruba domestic life, dictated in part by climactic conditions, and the lack of indoor plumbing. The yard/outdoor space was used heavily for food preparation and processing, doing and hanging laundry, small-scale planting, outdoor shower and toilet functions, animal husbandry and occasionally for religious activities (e.g. pouring of libations to the ancestors and festivals). Ceremonial cooking (and sometimes regular household cooking) small retail endeavours, and parties almost always took place outside; enabling interaction with other families and passers-by.

**CONCLUSIONS**

Many of the syntactic and spatial properties of the Orowa house as exemplified in the orowa genotype were compatible with the reliance on the use of exterior spaces. The following properties : - a) the preponderance of dead-end rooms (A-spaces), b) the non-distributedness of many of the plans, characterised by tree-like J-graphs coupled with the strong integration of the Orowa, which is the main interaction space for the extended family, c) the relatively shallowness of all interior spaces from the exterior, and d) less variation in the mean integration values of most of the key spaces (apart from the Orowa space and the Corridor); indicative of less syntactically differentiated spaces- all enhance the role of the exterior for many domestic activities. The minor
variations in the integration values of the bedroom and the parlour also suggest that the space functions can be easily swapped.

Although many of the sample houses have actually been demolished to make way for more ‘modern’ interpretations, it is suggested that any attempt to develop or update this type must continue these relative shallowness, and the use of a strongly integrating space which can be the locus of the dwelling; a model that can be modified to suit non-related multiple households. The relative low T: F ratio is a distinctive feature of the extended family Orowa house; coupled with the absence of mediator spaces, is quite compatible with the co-habitation of extended family members. Mediator spaces were found to be important features of modern Brazilian houses as opposed to the pre-modern forms, and served important social roles as ‘boundaries’ between sectors. When the sectors are strongly isolated via the use of mediator spaces as was the case in the modern Brazilian houses, the different categories of users were easily prescribed, but when sectors are more permeable, interactions between differing categories of users in the dwelling becomes less controlled, unless social rules are put in place (Amorim, 2001). Understandably, the Orowa houses are occupied by extended family members hence a great deal of flexible use of spaces is usually acceptable. It is noted however, that mediator spaces can be integrated into a family house, to accommodate further separation between individual nuclear households in this system, and this seems to be the case in other newer genotypes that serve the middle class nuclear family households that were also part of the total sample, mainly for the creation of some isolation between the living, service and sleeping sectors.

FURTHER RESEARCH

An immediate point for further study would be to replicate the study in the new dwellings in Enuwa town core, to see how the syntactic and spatial features have either been modified or eradicated in those houses which have often been built by more affluent and educated members of the extended family.

REFERENCES


Traditional Yoruba architecture


THE PROBLEMS AND PROSPECTS OF THE TAGWAI DAM, MINNA, NIGER STATE, NIGERIA

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Department of Urban and Regional Planning, Federal University of Technology, Minna, Nigeria

Water, it is said, is life; but unfortunately, the fresh water needed by man for his development and well being is not evenly distributed globally. And where it is available, it, depending on the season, varies in quantity. Thus, one of the ways of ensuring an all-year round availability of water for human usage is through dam construction. But the damming of water is noted for the problems and dangers it poses on the people living downstream of the dam as well as on the environment. Therefore, it was as a result of the need to undertake its statutory responsibility by providing the residents of Minna with potable water that the Niger State government constructed the Tagwai dam in 1978 to augment the Chanchaga dam. This paper thus set out to assess the problems and prospects of the Tagwai dam; and in order to achieve this, both the primary and secondary sources of data collection were employed to obtain useful data and information for the study. The data obtained from the field was thereafter analyzed and presented using descriptive statistics. The result of the research revealed that the Tagwai dam is facing some pollution-related problems owing to the numerous human activities taking place around the dam, thus dead fishes can be found lying on the bank of the river and it is as well, experiencing incidences of algal bloom. The paper therefore recommended the development of a comprehensive plan for the operation, maintenance and rehabilitation of the dam in order to mitigate the negative effects of the dam as well as regulating human activities around it.

Key words: prospect of dam, downstream, human activities, immediate environment, potential benefits

INTRODUCTION

Nations, the world over, strenuously strive for the effective planning, development and management of their naturally endowed resources in order to meet the basic needs of their people. This is with the aim of improving and enhancing the citizenries’ standard of living, health and well being. One of the resources needed to be effectively developed and managed by man is water; this is because of its importance as a basic human need and also, an essential life supporting system needed by both plants and animals. Owing to this, access to water was declared as a basic human right by the United Nations (UN) through Resolution 64/292 on July 28, 2010 (United Nations Department of Economic and Social Affairs, 2012).

Therefore, the need for the effective development and management of water resources has become apt especially due to its finiteness and unavailability in some parts of the world. Thus the UN as cited in Turner, (2000) predicted that water shortages could retard the economic growth of some countries and lead to food shortages and, possibly to international conflicts. Consequently, countries jostle for fresh water resources

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Tagwai dam

through large scale dam construction in order to meet their water needs. A dam, according to Balouch, (2012) is “a hydraulic structure of fairly impervious material built across a river to create a reservoir on its upstream side for impounding water for various purposes”.

Dams have long history of existence and they are basically built to impound flowing water, but unfortunately, they usually have negative effects on the environment and the people downstream. The oldest known human-made dams according to Jackson, (2009) were built more than 5,000 years ago in the arid parts of the Middle East to divert river water to irrigate crops. He further stated that there are presently more than 500,000 dams worldwide, with the vast majority of them small structured i.e. less than 3 m high. In the opinion of Arthur (n.d.), dams are an integral part of human infrastructure and have been used throughout the world in “collecting, storing and managing water needed to sustain civilization”. Dams, as viewed by Jackson (2009) are:

“structures that block the flow of a rivers, streams, or other waterways. Some dams divert the flow of river water into a pipeline, canal, or channel. Others raise the level of inland waterways to make them navigable by ships and barges. Many dams harness the energy of falling water to generate electric power. Dams also hold water for drinking and crop irrigation, and provide flood control.”

Despite these accruable benefits of dams to a nation and its people, they are associated with a lot of problems ranging from health, socio-economic to ecological. In view of this, Campbell-Hyde (2011) opined that by the construction of the ‘Three Gorges Dam’ in China, “humanity has created what may be one of the single most significant alterations to the natural world”. Also, according to the 2006 WWF Living Planet Report as cited by www.panda.org (n.d.), the global freshwater species populations plummeted by 50% between 1970 and 2000 as a result of dam construction which have peculiar problems of environmental degradation due to: the generation of climate-changing greenhouse gases particularly in tropical areas through the release of carbon dioxide and methane; the reduction in water quantities which increases its salinity and thereby making it unfit for human consumption and irrigation; and the decomposition of organic matter and the leaching of mercury from the soil which often introduce toxins in the water body. Dams are also affected by the problem of sedimentation; therefore International Rivers (n.d.) stated that about 1100 km³ of sediments had accumulated in global reservoirs as at 1986, consuming almost a-fifth of global reservoir capacity. The report further stated that a study by the United Nations showed that as at 1987, around 50 km³ of sediments –nearly 1% of global reservoir storage capacity- were being trapped behind the world’s dams every year; thus, “sedimentation is the still probably the most serious technical problem faced by the dam industry.”

Therefore, owing to the inherent benefits and problems associated with dams, this paper set out to undertake a study of the Tagwai dam in Minna, Niger State, Nigeria, with a view to assessing its negative effects on the environment as well as enhancing its economic viability. This has become necessary in order to stimulate the economic growth of the State through employment and revenue generation (especially in the face of the current economic fortunes) while at the same ensuring the sustainability of the environment. The Tagwai basin, according to Busari, Mohammed and Ajibola (2013) has a catchment area of approximately 110km², with the zone earth filled dam having a design capacity of 28.7million cube metre, a height of 24m and an embankment length of 1.80km.
In order to achieve the aim of the study, an attempt was made at answering the following questions:

What are the potential and real threats posed to the dam by human activities around it?
Can the government increase its revenue generating capacity through harnessing the potentials of the dam?
What are the effects of the dam on its immediate environment; and
How can these effects be mitigated?

AIM AND OBJECTIVES

The aim of this paper is to assess the problems and prospects of the Tagwai dam in order to ensure its development and sustainability. The specific objectives are to:

Assess the effects of the activities of the residents of the neighbouring villages on the dam;
Assess the potential effects of the dam on its immediate environment and;
Identify the untapped potentials derivable from the dam.

RESEARCH METHODS AND MATERIALLS

This section is based on the general approach used in data collection, their sources and analysis; thus, both the primary and secondary sources of data collection were employed to obtain useful information needed for the study. The primary source of data was employed to obtain data from the field and it included an organised discussion with an official of the Niger State Water Board (NSWB) as well as the administration of 35 questionnaires on the locals residing around the dam; while the secondary source of data collection included information obtained from journals and the internet. The primary data were thereafter analyzed and presented using descriptive statistics while pictures were used as supporting instruments.

THE DEVELOPMENT OF MODERN MINNA: AN OVERVIEW

Minna, a cosmopolitan city in the present day Nigeria, lies on latitude 9°33’ N and longitude 6°33’ E. The town derived its name from two Gbagyi words which means “spraying fire”, and was originally on the hills of Sayako and had walls (Ganuwa) built around it. Minna has grown greatly, both in size and population since it was made the capital of Niger State upon its creation in 1976. This has also increased the complexity of the problems affecting the town e.g. inadequate infrastructural facilities and services, slum formation, crime and unemployment, etc. Minna has also been adjudged to be a fast growing town by virtue of its proximity to Abuja, thus it is presently witnessing an unprecedented urban sprawl. This is because some workers in Abuja have chosen to reside in Minna due to the shortage of accommodations in the FCT; this has thus exerted much pressure on existing facilities, utilities and services provided by the government.

TAGWAI DAM AND DOMESTIC WATER SUPPLY IN MINNA

Water services in the majority of urban areas, are provided by a centralized system operated by public agencies, and according to Calaguas and Roaf (2001), these agencies are unable to cope with the supply of water especially in the developing countries because of the rapid increase in population, growth in demand due to changes in lifestyles, the commercial growth of cities, ageing and deterioration of
Tagwai dam

Infrastructure, increasing degradation of surface and groundwater sources through pollution, over extraction, and the inability to recover the actual cost of operating and managing the water system. Thus, as a result of the need to provide the residents of Minna with water, the NSWB constructed in 1978 the Tagwai dam to augment the Chanchaga dam by supplying it with raw water. The channelization of the raw water was achieved by embedding two-wide steel pipes of about 250mm radius each (see plates I and II) in the earth, i.e. from the floor of the Tagwai dam to a point about 500m from the bank of the river. The channelized water therefore gushes out forcibly from the pipes and then flows naturally from that point under the force of gravity to its entry point at the Chanchaga dam. Thus, both dams have a common treatment plant which has been linked-up to the strategically located water reservoirs across Minna.

Fig. 1: Map of Nigeria showing Minna

Fig. 2: Locational map of Tagwai dam

Plate I: water gushing out from one of the pipes  Plate II: raw water flowing under the force to its transferring raw water from the Tagwai to entry point at the Chanchaga dam

Plate III: the spillway at the Tagwai dam  Plate IV: gully erosion ravaging the course of the spilled excess water
NEGATIVE HUMAN ACTIVITIES AROUND THE TAGWAI DAM

The name “Tagwai” according to the local was derived from the Hausa word “tagwaye”, which means twins; this is because the river was formed by the coming together of Rivers Jidua and Lumo (Akinrinmade, Ibrahim and Abdurrahman, 2012). The river is endowed with captivating and beautiful scenery, but it is plagued by the problem of pollution, which is thus the most prominent and conspicuous negative effect of human activities on the dam. This explains why the water body has different colouration and the presence of dead fishes on the bank of the river. In view of this, the management of the NSWB hoisted a signboard just beside the narrow path-way leading to the dam (see plate V) instructing the residents and visitors alike of the need, not to pollute the water.

Plate V: the signboard that ushers visitors to the dam site, warning against polluting the water

Plate VI: one of the researchers displays a dead fish found along the bank of the dam

Below are some of the negative human activities going-on unhindered at the dam sites despite their effects on dam and its environment:

Uncontrolled farming- both rainy and dry season farming activities are carried out on the bank of Tagwai dam (see plate VII). These farming activities would naturally help in the building up of sediments on the bed and embankment of the dam; this is because farming entails loosening up of rock materials. The loose sand materials are then transported into the river by the action of wind and rain, thereby reducing the storage volume of the river and also putting pressure on the wall of the dam. Also, traces of the organic and inorganic fertilizers used for the enhancement of the growth of the farm produce are eventually washed into the dam; consequently, the locals were asked to mention the type of fertilizers they use. A good number of them i.e., 65.7% of the respondents stated that they use organic fertilizer while 34.3% of the respondents stated that they use inorganic fertilizer. It is worth mentioning that both types of fertilizer can pollute the water body because manure contains coliform and the inorganic fertilizers could result in the concentration of nutrients like phosphorus in the dam, which encourages the growth of plants on the water (i.e., Algal bloom). In other words, the leaching of nutrients into the water body can lead to eutrophication which hinders navigation, fishing activities and also obstructs the intake of oxygen by the aquatic animals.
Grazing- owing to the availability of all-year round water supply in the dam and the lush vegetation that surrounds it, the fulani cattle breeders have made the dam’s environs their breeding ground. The herds of cattle contribute to the sedimentation of the dam, because their hooves do bear holes into the rock, thereby loosening up the rock materials around the river bank. The herds also contribute to the pollution of the water through their droppings which contains coliform, thus endangering the lives of the residents of the area whose source of domestic water is the raw water from the dam.

Bush burning- the residents of the dam site also engage in the burning down of surrounding bushes. This, according to them, are carried out by children of the area in pursuit of rodents; and this act of bush burning may cause the destruction of aquatic lives, repellence of water by the soil and erosion due to the instability of the soil.
Laundry and bathing- the only water source available to the locals is the Tagwai river, and thus, virtually all their activities that involves the use of water are carried out at its bank e.g. laundry, washing of kitchen utensils, motorcycles and even bathing. In all of these, the detergents (i.e., synthetic powder or liquid) used are eventually washed into the river and this can be devastating because it could result in water pollution and as well the destruction of aquatic lives.

Fishing- though the local claimed not to use chemicals in their fishing activities, but this once-thriving venture have been virtually destroyed, this is because of the pollution of the dam and the fishing method adopted by the locals. In their fishing method, small-boxed nets like mosquito nets are used; therefore even the fingerlings and juveniles are not spared (see plates XIII and XIV). This has led to the near extinction of aquatic lives in the river as the locals complained of lack of fishes in the water. Owing to this, 45.7% of the respondents stated that the low yield of fish production is as a result of over cultivation of the fishes, 31.4% stated that it is as a result of upstream fishing, while 22.9% stated that climate change is responsible for the decline in fish production.

![Fig. 2: Reasons for low yield in fish production (%)](image)

Plate XI: a lady washing her clothes at the bank   Plate XII: a local fishing boat used by the of the dam after bathing her younger ones fishermen
Discharge of human and domestic waste – during our numerous visits to the dam, none of the communities living around the dam was observed to have toilet facilities; the people therefore ease themselves in the surrounding bushes, and the excreta can easily be washed into the river by rain. And the human faeces is noted for its coliform content i.e. rod-shaped bacteria found in the colons of humans and animals, which is particularly a serious contaminant of food and water, thus the lives of the locals is endangered because the raw water of the dam is their only source of drinking water. Also, the domestic refuse of the locals are equally dumped just beside their residences and these are as well transported into the river; thus, all the respondents stated that they dispose off their solid waste in the open space within their immediate environment.

Gold mining- the Chanchaga-Tunga axis of Minna is noted for its high gold deposit, and as such, people recklessly engage in gold mining activities in the area, unhindered and unregulated. This could result in the transportation of lead or traces of chemicals like mercury, cyanide and arsenic that are illegally used in the breaking down of ore in the mining process by run-off or streams into the dam, and their effects are very debilitating on humans, plants and animals.

Sand mining and excavation- the locals largely live in mud houses, and its construction involves the excavation of clay materials which are used for block moulding. The result of this is also the loosening up of earth materials which can easily be transported into the river by rain or wind, thereby causing siltation. The locals also engage in sand mining for other purposes, thus 54.3% of the respondents stated that they excavated sand for the moulding of the blocks they used for their
houses, 28.6% stated that they do sell the excavated sand to would-be developers, while 17.1% of them stated that they had at one time or the other excavated sand to fill erosion-threatened sites.

![Fig.4: Reasons for sand mining and excavation (%)](image)

Plate XV: sand mining activity close to the dam Plate XVI: local block manufacturing by the dam

**POTENTIAL NEGATIVE EFFECTS OF TAGWAI DAM ON THE ENVIRONMENT**

**The collapse of the dam** - the pressure bore by the embankment of a dam is usually very enormous especially when the water is filled with silt. This is a situation whereby fine-grained sediments especially of mud and clay particles are deposited at the bottom and walls of the dam. If the silt is not removed, it will decrease the carrying capacity of the dam and also lead to its collapse. And with the array of activities going on upstream and around the dam, the rate of siltation will be unprecedented and thus regular de-siltation would need to carried out, else it would lead to the collapse of the dam which would result in the destruction of lives and properties downstream.

**Erosion and flooding** - dams are built to hold water, though its carrying capacity can be exceeded when it receives an unprecedented high amount of rainfall and high volume of water from its tributaries. As such, spillways are built alongside the dam in order to discharge the excess water; the spillway of Tagwai dam (see plates III and IV) is uncontrolled. Therefore, it excess water is discharged naturally whenever its maximum carrying capacity has been achieved (without the locals’ prior information). Consequently, the discharged water of the dam, which has caused gully erosion along its course, always threatens lives, farmlands and properties downstream.
Destruction of the ecosystem- the building of a dam changes the ecology of the surrounding area through the alteration of flood cycles and disruption of the movement of migratory fishes thereby threatening their reproduction and population. This factor amongst others, could account for the annual reduction in the number of fishes in the dam as stated by the fishermen.

**Breeding of bacteria and vectors**- reservoirs can create an environment, which is favourable for the transmission of water-related diseases. This holds true especially in tropical areas where mosquitoes (vectors for malaria) and snails (vectors for schistosomiasis) can take advantage of this slow flowing water to breed. Therefore, the locals who use the raw water of the dam directly without any form of purification are susceptible to attacks from bacteria like salmonella typhi causing typhoid fever and viruses like cholera vibrae causing cholera.

**POTENTIAL BENEFITS OF TAGWAI DAM**

Though arguments have been advanced by both the proponents and opponents of major environmental interactions like dam construction, it can be stated that despite the potential problems inherent in its construction, there are some benefits accruable from it as well. The benefits include its ability to support irrigation farming, supply of more water to an increasing urban population, serving as a recreational spot, aid in the transportation of goods and services as well as controlling of floods. Therefore, in addition to its present function of water supply, Tagwai dam could further be utilised for income generating ventures like commercial agriculture and recreation, which have the twin-advantages of job creation for the teeming youth as well as the enhancement of the economic base of the State. But achieving this needs a well coordinated planning, because according to Jackson (2009), it is impossible for a dam to operate at maximum efficiency when it is constructed for more than a purpose.

**CONCLUSION**

Though man has since time immemorial interacted with the environment, but it intensity and complexity has unfortunately been exacerbated by his crave for “development” and “modernization” which have resulted in the generation of some environmental problems especially in the 21st century. Among the major forms of man’s interaction with the environment is through the construction of dams. But as much as these dams are important to man, environmental sustainability should be the guiding principle in their construction. In order to achieve this therefore, concerted efforts aimed at reducing the effects of dams on the environment and thus enhancing the lifestyle of the people downstream needs to be holistically developed through the adoption of planning instruments like planning schemes, Development Control, and the Environmental Impact Assessment (EIA).

**RECOMMENDATIONS**

- The development of a comprehensive plan of operation, maintenance and rehabilitation of the dam in order to forestall or mitigate its negative effects;
- The regulation of human activities around the dam site;
- The development of a planning scheme that would guide planning activities along the upstream and downstream of the dam;
- Regulation of the silting of the dam in order to increase its carrying capacity and efficiency; and
The development of the dam as a tourist destination through the provision of recreational facilities

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TOWARDS EFFICIENT PROVISION OF PHYSICAL INFRASTRUCTURE IN RESIDENTIAL AREAS OF MAKURDI, NIGERIA

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One of the problems of urban development in Nigeria is the fragmentation of physical planning responsibilities. This situation has greatly affected the provision of physical infrastructure in residential areas in many parts of the country. Generally, the institutional framework, which is a critical aspect in the provision of physical infrastructure, appears to be weak. In a study carried out in Nyiman Layout, Makurdi, information was obtained from the agencies and individuals involved in the provision of physical infrastructure on their functions, level of involvement in the implementation of planning schemes and the method employed in the provision of infrastructure. The study found that about seven different agencies are involved in the provision of physical infrastructure in residential areas of Makurdi. This leads to duplication of functions, overlaps and role conflicts between the various participants involved. These service providers are virtually independent of each other and operate without consultations with one another. It was also discovered that there is no framework for the provision of infrastructure; and none of the agencies has the mandate to coordinate the activities of the others to ensure adequate and sustainable infrastructural provision. As a result, Makurdi town is growing without adequate provision for basic infrastructure. The culminating effect is unsatisfactory urban living conditions and the likelihood of the development of slum conditions in the area. The study recommends that a central coordinating machinery should be put in place to oversee the implementation of residential layouts and management of physical infrastructure in Makurdi.

Keywords: physical infrastructure, institutional framework, residential areas, urban service providers

INTRODUCTION

One of the problems of urban areas in Nigeria is inadequate infrastructure to service the growing population. Increasing urbanization in Nigeria has placed great pressure on cities especially in the areas of housing and the provision of infrastructure and social services thereby leading to environmental degradation and low standards of living for some urban residents (Oduwayne and Gamu-Kaka, 2007). In a bid to address this daunting challenge of inadequate infrastructure, city administrators have adopted several strategies ranging from state led, donor agency led and public–private partnerships in the provision of infrastructure. It has however been observed that these strategies have made little or no impact on the state of infrastructure in urban areas across the country. In some cities in Nigeria, urban development occurs in a laissez-faire manner according to the whims, caprices and inclinations of landowners. This

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compromises the functionality, attractiveness and viability of the town as a place to live and work. It need not remain so.

Makurdi, the Capital of Benue State of Nigeria is one of such towns where the urban development process appears to be faulty. Physical planning generally and residential development in particular have been reduced to layout preparation and plot allocation. Urban planning in Makurdi is presently handled by the State Ministry of Lands and Survey. The Ministry engages in individual layout preparation for different parts of the town, most of which are for residential purposes. The primary objective of the layout preparation exercise seems to be the demarcation and allocation of building plots. The town has developed and is growing and expanding without any apparent evidence of conscious overall planning and development. There is no clear vision for the overall future of the town and especially as regards the provision of infrastructure. The result is that new developments are springing up in uncoordinated patches with nonexistent or inadequate infrastructure. The culminating effect is a town without community, without a heart, visible character or strong image. At the neighbourhood level, the faulty development process results in unsatisfactory urban environmental conditions, low quality of life for the majority of urban residents, lack of amenity and inconvenience to users.

The existence of a general plan for the development of an area serves as a guide to the layout or subdivision plans prepared for that area. The layout or subdivision plans show an analysis of the proposed use of land for residential, commercial, industrial, institutional, open spaces, recreation, community facilities and so on; the alignment, dimensions and classes of streets in the hierarchy; the total number of plots, their sizes, the estimated population to be accommodated and the basic services necessary for living (Onokerhoraye and Omuta, 1994). In contrast, as Gyuse (2005) rightly observed, Makurdi has continued to expand not through intentional planning of whole communities but through individual layout preparation and plot allocation. Observations have shown that some of the layouts are designed without provision for basic facilities like schools, shops, recreational areas and without accompanying framework for the provision of infrastructure such as electricity, drainage, water supply and refuse management. Actors in urban development and researchers have called for increased funding and private or community participation as ways of providing infrastructure and improving on the condition of existing infrastructure (Akinyosoye, 2010; Okeola and Salami, 2012 and Sanusi, 2012). The primary objectives of this study are to assess the condition of physical infrastructure, assess residents’ level of satisfaction with the condition of physical infrastructure and examine the role of the various agencies involved in the provision of physical infrastructure in Nyiman layout. Drawing from the findings of the study, this paper argues for the development of an appropriate institutional framework as the key to efficient provision and maintenance of urban infrastructure in residential areas.

CONCEPT AND IMPORTANCE OF INFRASTRUCTURE

Infrastructures are public services and facilities needed to create an enabling environment for economic growth, support residential development, enhance the quality of life of people and aim to meet the needs of the community and businesses [Gold Coast City Council (GCC), 2005]. These include electricity, water supply, drainage, waste disposal, roads, sewage, telecommunications, health, education, recreation and institutional structures like police station, libraries, banks and post
office. Put succinctly, it is the engine needed to drive the city. Nubi (2003) outlined some of the salient characteristics of infrastructure to include:

it involves lump sum expenditure that are usually beyond the reach of ordinary citizens;
they are durable and capital intensive stocks that yield future incomes;
they have external effects and economies of scale;
they require regular maintenance and their provision cuts across various disciplines.

According to Kilford (1999), the provision of the necessary infrastructure to serve new development is an essential objective of the development process and is usually reflected in the physical plan of the area. Infrastructure is important in at least four ways namely: it directs urban growth and areas of population concentration, determines land and rental values, determines the quality of life of residents and influences income generation through property tax.

THE ROLE OF GOVERNMENT IN THE PROVISION OF INFRASTRUCTURE

Nigerian cities are generally characterized by the public provision of urban infrastructure and services. The Benue State Housing Policy of 1996 assigned the responsibility of facilitating the development of site and services scheme, ensuring easy access to land, collection and disposal of refuse and provision and maintenance of proper sanitary facilities to the state government. The state government through the relevant agencies was also to provide infrastructural facilities in government layouts prior to allocation and development, encourage public and private estate developers to plan and undertake development of residential layouts so as to make serviced plots readily available on specified terms and conditions and adopt layout designs that emphasize provision of infrastructure at reduced costs. Under the Benue State Housing Policy of 1996, local governments were to provide infrastructure through loans from the Infrastructure Development Fund (IDF), Urban Development Bank or any other similar source, maintain urban and rural infrastructure and assume full responsibility for environmental sanitation.

In reality however, local governments in Nigeria are not directly involved in urban development activities. It has been the responsibility of state governments through the various agencies to provide infrastructure in urban areas. The institutional framework to handle the provision and maintenance of infrastructure at the state and local government levels appears to be lacking. In Enugu State for instance, it was observed that neither the state nor local governments have taken their responsibility for providing and maintaining infrastructure seriously. For this reason, Ikejiofor et al (2004) argued that government alone lacks the capacity to handle the provision of infrastructure in urban areas since the public sector has failed to extend infrastructure to many areas of active urban development.

STRATEGIES FOR THE PROVISION OF INFRASTRUCTURE IN RESIDENTIAL AREAS

Yusuf (2004) identified four main strategies for the provision of infrastructure to include public ownership and operation through public enterprise, private ownership and operation, public ownership with private sector management and community provision and ownership. Though it has been argued that the public sector has failed
in the provision of infrastructure, the fact is that this sector will remain the major provider of infrastructure and services in most developing countries for the foreseeable future (Department for International Development-DFID, 2004).

On the other hand, the private sector is quite efficient in the provision and maintenance of infrastructure. According to the government of India (2006), dissatisfaction with the quality and reliability of services, the inefficiencies and corruption of public sector operators made private sector participation in the provision of infrastructure attractive. Nubi (2003) identified two basic approaches to community involvement, which are community participation and community management. In the first approach, control of the scheme remains with the relevant government authorities while the second devolves power and responsibility to the community. Government provides certain categories of infrastructure and grants loans to assist the community-led action groups to provide tertiary infrastructure. In West Sussex Council in the United Kingdom as an example, a supplementary planning guidance was adopted in which development costs (covering infrastructure) are to be met by the landowner or developer (Kilford, 1999). The site and service scheme opens up new land and subdivides it into serviced residential plots for distribution (Nwaka, 2005). Some of the services provided under this scheme were roads, drainages, water supply, electricity and other municipal services (Ajanlekoko, 2001). The site and service scheme is not solely a government affair. Dikko (2002) noted that private developers may be granted concessions to promote the schemes and sell the plots to the public on commercial basis. The major criticism of this scheme centres on affordability of such plots by the low-income group. On the other hand, it ensures the provision of infrastructure before the commencement of development as should be the case in an ideal situation.

Some of the challenges of providing infrastructure in Nigerian cities include inadequate funding (Sanusi, 2012; Okeola and Salami2012), political instability, negligence, corruption (Akinwale, 2010), lack of involvement of the private sector, misguided policies and political interference (Alabi and Ocholi, 2010).

CONCEPTUAL APPROACHES TO PROVIDING INFRASTRUCTURE

There are mainly two approaches to infrastructural delivery namely that practiced in western market oriented economies and that practiced in centrally planned economies such as the former Soviet bloc. In market oriented economies like USA and Canada, the city administration is responsible for the provision of mains services while individual developers handle the construction and distribution of such services to their properties as part of development costs. The maintenance of the services is then carried out by the city government and paid for through taxes. In socialist countries on the other hand, the city government were responsible for the provision and maintenance of infrastructure and the provision of housing to its citizens. In this case, housing units were serviced with basic infrastructure and given out to citizens on rent; this therefore implied that all the citizens were tenants to the government.

In Nigeria however, development occurs in a laissez-faire manner. No conscious effort is made to plan for the urban population and direct urban growth. Urban growth simply happens. As a result of these, infrastructure is provided in urban areas by the government or individuals as an afterthought and not part of a future oriented planned process. Maintenance of such infrastructure in most cases is neglected by the government. Kumar and Prasad (2004) argued that even where government provides
subsidies for public utilities, service is often poor and sections of the population largely unserved. In line with this observation, it appears that government cannot meet the continually growing demand for water, waste disposal facilities, electricity and other urban services on its own. One of the viable options is the involvement of the private sector in the provision of urban infrastructure. In Nigeria, some cities like Lagos, Ibadan, Benin and Makurdi have experimented with the public-private approach especially in solid waste management. However, without a well developed institutional framework for the provision and maintenance of physical infrastructure, increased funding and partnerships will not achieve the desired results

**STUDY AREA**

Nyiman layout covers about 70 hectares of land. It is located in the southern part of Makurdi town. Makurdi is the Capital of Benue State of Nigeria. Figure 1 shows the location of Makurdi and Benue State on the map of Nigeria while Figure 2 presents Nyiman layout and adjacent communities. Nyiman is bounded in the north west by HUDCO Quarters, in the north east by Idye village, in the east by Achusa and in the south by the rail line. The State Legislators’ Quarters in Nyiman served as the hub for attracting infrastructural development to the area. A tarred road was first constructed to the quarters and the quarters were serviced with water and electricity by the State Water Board and Power Holding Company of Nigeria. It is pertinent to note that Nyiman layout was prepared without a proper background environmental report necessary to provide information on site analysis, total population to be accommodated and without accompanying infrastructural plans. This is the practice in Makurdi to date.

![Figure 1: Map of Nigeria showing the location of Makurdi LGA in Benue State](image1)

![Figure 2: Nyiman Layout and Adjacent Communities](image2)
Physical infrastructure

RESEARCH METHODS

Nyiman layout is made up of about 75 street segments of different widths and lengths. Out of this number, 55 street segments were identified on ground while 20 are in the part of the layout that is undeveloped. A scoring system was adopted for the assessment of the condition of physical infrastructure on street segments in Nyiman layout. This was useful in street-by-street comparison using specified physical infrastructure and criteria. An ascending scale of 1-5 was used for the assessment. 1 represented Poor, 2 - Fair, 3 - Good, 4 - Very Good and 5 - Excellent. For each score, a descriptive criterion based on the worst and best case scenarios in the layout was developed to describe the aspect of the infrastructure being evaluated (Table 1). Street segments were chosen in this study because it was observed that in most cases, government intervention in the provision of physical infrastructure such as roads and drains are usually carried out on street segments. The infrastructural indicators were observed and assessed against the criteria developed by the researcher.

In computing the Street Development Index (SDI), scores allocated to the infrastructural indicators on each street are summed up and divided by the total number of infrastructural indicators assessed. This can be summarized as:

\[ SDI = \frac{\sum I_{1:n}}{n} \]

Where \( n \) = Number of infrastructural indicators.

A range was developed for the Street Development Index to aid interpretation of the results. Scores less than 1.0 indicate an extremely undeveloped street and scores greater than 4.0 are regarded as well developed streets as shown in Table 2.

<table>
<thead>
<tr>
<th>Table 1: Infrastructure and Criteria for Street Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructure Indicator</strong></td>
</tr>
<tr>
<td>Road Surface</td>
</tr>
<tr>
<td>Drains</td>
</tr>
<tr>
<td>Street Furniture (lighting, seating, litterbins, signage)</td>
</tr>
<tr>
<td>Access to public power supply</td>
</tr>
<tr>
<td>Access to water mains</td>
</tr>
</tbody>
</table>

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Table 2: Ranges of Street Development Index

<table>
<thead>
<tr>
<th>Range</th>
<th>Street Development Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1.00</td>
<td>Extremely Undeveloped Street</td>
</tr>
<tr>
<td>&gt; 1.00 - &lt; 2.00</td>
<td>Undeveloped Street</td>
</tr>
<tr>
<td>&gt; 2.00 - &lt; 3.00</td>
<td>Poorly Developed Street</td>
</tr>
<tr>
<td>&gt; 3.00 - &lt; 4.00</td>
<td>Developed Street</td>
</tr>
<tr>
<td>&gt; 4.00 - 5.00</td>
<td>Well Developed Street</td>
</tr>
</tbody>
</table>

A 5 - point bipolar scale representing different levels of satisfaction was developed to assess the level of satisfaction of residents with the condition of existing physical infrastructure. In this scale, 3 was considered satisfactory, 1 was extremely unsatisfactory while 5 represented extremely satisfactory. Satisfaction is an indicator for measuring perception. Residents of Nyiman layout were asked to indicate their levels of satisfaction with the condition of existing physical infrastructure. The questionnaire was used to elicit this information. In all 70 respondents participated in the study. The Satisfaction Index (SI) was obtained by multiplying each frequency by the scale of satisfaction it represents. Thereafter, the answers were summed up and divided by the total number of respondents who assessed the condition of the infrastructural index. The formula used is summarised as:

\[ SI = \frac{\sum f.s}{N} \]

where
- \( f \) ... is the frequency of responses
- \( s \) ...is the scale of satisfaction
- \( N \)... is the number of respondents

The Mean Satisfaction Index (MSI) was then obtained by adding up the Satisfaction Index (SI) values for each infrastructural condition and dividing by the number of indicators used in assessing that particular infrastructure.

\[ MSI = \frac{\sum SI}{N} \]

where
- \( SI \) ... is the Satisfaction Index
- \( 1-n \) ... is the Infrastructure indicators
- \( N \) .... is the Number of infrastructural indicators

The Mean Satisfaction Index values were interpreted using the ranges presented in Table 3 and these represent the level of satisfaction of the residents with the condition of each infrastructure.
Table 3: Ranges of Mean Satisfaction Index

<table>
<thead>
<tr>
<th>Range</th>
<th>Level of Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0</td>
<td>1.00</td>
</tr>
<tr>
<td>&gt; 1.00</td>
<td>&lt; 2.00</td>
</tr>
<tr>
<td>&gt; 2.00</td>
<td>&lt; 3.00</td>
</tr>
<tr>
<td>&gt; 3.00</td>
<td>&lt; 4.00</td>
</tr>
<tr>
<td>&gt; 4.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

The role of different agencies and individuals in the provision of infrastructure in Nyiman layout was also examined. The agencies include Ministry of Works and Housing, Power Holding Company of Nigeria, Benue State Water Board and Ministry of Water Resources and Environment. Information on agencies involved in the provision of physical infrastructure, their statutory functions, level of involvement of the agencies and individuals in the implementation of planning schemes and the method employed in the provision of infrastructure were obtained through interviews with officials of the agencies and early settlers in Nyiman layout. Information was also extracted from secondary sources such as edicts, laws and the Benue State Housing Policy. The information obtained through interviews was transcribed and presented.

RESULTS

A summary of the results of the street development assessment show that the level of infrastructural provision in Nyiman layout is low. This implies that there is inadequate planning for the provision of physical infrastructure in the area. In line with the Benue State Housing Policy of 1996 the state government is to provide infrastructural facilities in government layouts prior to allocation and development and adopt layout designs that emphasize provision of infrastructure at reduced costs while local governments are to maintain urban and rural infrastructure and be responsible for environmental sanitation. From the analysis presented in Table 4, it is clear that the provisions of the Policy have not been implemented.

Table 4: Results of Street Segment Assessment

<table>
<thead>
<tr>
<th>Level of Street Development</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Undeveloped Street</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Undeveloped Street</td>
<td>37</td>
<td>49</td>
</tr>
<tr>
<td>Poorly Developed Street</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5 presents the mean satisfaction levels of the residents of Nyiman layout with the infrastructural variables investigated. In all, six infrastructural variables namely roads, water supply, electricity supply, drains, refuse disposal system and sewage disposal system were assessed. The Mean Satisfaction Index (MSI) calculated for each of the variables shows that residents of Nyiman layout are dissatisfied with the condition of roads, drains and the method of refuse disposal while they expressed satisfaction with the condition of water supply, electricity supply and method of sewage disposal. The residents are satisfied with the method of sewage disposal. This is because sewage disposal in soak – away pits is the acceptable standard in Nigeria.
Table 5: Mean Satisfaction with Condition of Infrastructure in Nyiman Layout

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Mean Satisfaction Index</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>1.92</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Water Supply</td>
<td>2.48</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Electricity Supply</td>
<td>2.07</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Drains</td>
<td>1.79</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Refuse Disposal System</td>
<td>1.78</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Sewage Disposal System</td>
<td>2.23</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

According to the residents interviewed, their satisfaction with all the aspects of water supply is because they do not have an alternative source and the supply from the available source (hand dug wells) is regular. Inadequate finance to connect to the public source was also one of the reasons for residents’ satisfaction with the condition of water supply in the area.

Investigations show that in residential areas of Makurdi, different agencies are involved in some way in the provision of physical infrastructure. These include Power Holding Company of Nigeria (PHCN), Benue State Water Board, Ministry of Water Resources and Environment, Ministry of Works, Housing and Transport, Benue State Urban Development Board and other service providers. Non-Governmental Organizations, Community Based Organizations, Corporate Organizations and Individuals are also involved in the implementation of layouts when and where they have interests. It is pertinent to note that none of the aforementioned agencies is involved in the planning of residential areas in the State.

The Benue State Ministry of Lands and Survey handles the preparation of layouts to guide all forms of development. It was gathered from interviews with an official of the Ministry that the provision of infrastructure in residential areas is not their responsibility and so after allocation of plots, residents are left to their fate. It was also discovered that there is no framework for the provision of infrastructure in residential layouts. The Ministry only includes space allocation for roads and in some cases drains in the design of layouts. The Ministry of Works, Housing and Transport has statutory responsibility for the provision of roads, street lighting and electricity within the state. However, the officials of this Ministry argued that Ministry of Lands and Survey should have the requisite manpower to handle all aspects of layout and infrastructural design.

The construction of drains and opening up of some streets within urban areas of the state is handled by the Ministry of Water Resources and Environment as part of the flood and erosion control projects. Problem areas are identified either by officials of the Ministry or through complaints from affected members of the public and earmarked for intervention measures. The funding of such projects is mainly from ecological funds set aside for this purpose. Such intervention measures were carried
Physical infrastructure

out on some street segments in Nyiman Layout. The Benue State Edict No. 8 of 1986 highlighted the duties of the Benue State Urban Development Board to include the provision and maintenance of access roads in Makurdi township; the collection and disposal of refuse in the state capital and other urban areas and the provision of a workable master plan for Makurdi township and other urban centres under its jurisdiction. Presently, the Board only carries out development control activities. The Benue State Environmental Sanitation Authority is also responsible for refuse collection and disposal, sewage/sewerage collection and disposal and enforcement of other sanitation laws.

The Power Holding Company of Nigeria provides transformers in residential areas in some cases while the Government also provides in some areas. In Government Housing Projects however, the provision of transformers is mainly handled by Government Agencies while PHCN does the commissioning of transformer, connecting and metering of individual housing units. It was gathered that the extension of electricity attracts an excess service charge and individuals are required to pay a connection fee in addition to purchasing the number of poles and wires needed in the process. Water Board has statutory responsibility for the provision of pipe borne water to residents of Makurdi. To date, only few parts of Makurdi are connected to the public source. Connection to the public source entails interested residents applying to the Board and paying for pipes and services rendered. Maintenance of the main pipelines is strictly handled by the Board.

On the other hand, individual developers are not required by law to provide infrastructure to service their plots neither are they charged development fees of any kind. However, these set of developers play a major role in the provision of physical infrastructure as they virtually bear the cost of servicing residential neighbourhoods before and after development. They make the requests, purchase the materials needed and pay the requisite connection fees for electricity and water supply. Interestingly, the residents of the Nyiman layout are willing to contribute for the provision of infrastructure. However, the amounts they indicate as being willing to pay reveal a lack of perception of the cost of sustainable infrastructure. This means that a private-public partnership is possible but there must be education of the people and accountability on the part of public sector participants.

CONCLUSIONS

In Makurdi, various agencies handle different aspects of infrastructural provision. This system is saddled with overlaps in functions, duplication of duties and as Taylor (1993) rightly observed, fragmentation of planning responsibility. Because of the involvement of several agencies, it is no longer clear whose responsibility it is to provide what in residential areas of Makurdi. Oyesiku (1997) rightly observed that the proliferation of planning related agencies makes cities and especially residential areas more disorderly as a result of either role conflicts between the agencies or lack of coordination of their activities. Agencies act at will, whenever and wherever they want. It is interesting to note however, that there is no programme for the coordination of the activities of these agencies at the planning and implementation stages of residential layouts. These agencies are virtually independent of each other and operate without consultations with one another. Braimah (1993) clearly illustrates this point thus:
‘in Nigerian cities it is not uncommon to find a situation whereby a road that has just been constructed and tarred is being dug for laying of pipes by the Water Board a week or so later, whereas it should have been the latter preceding the former’.

In Nyiman layout, it is a common sight to find electric poles right in the middle of drains. There is inadequate planning for the provision of infrastructure in Makurdi. The development of the new areas is entirely through the efforts of individual plot owners who provide roads and services as and when desperately needed and when they are financially able. There is no coordination; on the contrary, later builders seek to take advantage of any effort by the older residents without compensation. The individual plot developers in Nyiman show a willingness to be involved in the provision of physical infrastructure. This willingness can be incorporated into a long term sustainable strategy for providing infrastructure in urban neighbourhoods. This will go a long way in creating satisfactory and liveable urban residential environments. Also, the involvement of various participants in the provision of infrastructure calls for inter-agency cooperation. It is pertinent to note that apart from Ministry of Lands and Survey, none of the other aforementioned agencies is involved in the planning of residential areas in Makurdi. The provisions of the Benue State Housing Policy of 1996 are also not applied. These allow for provision of infrastructure to residential neighbourhoods prior to allocation, making loans available to developers for the provision of infrastructure and preparation of layout plans that emphasize provision of infrastructure at reduced costs.

Within the last two years the Ministry of Lands and Survey has embarked on the preparation of ‘mega layouts’ which entail subdivision of large areas of land into plots. These plots have been allocated to individual developers without any attempt at providing physical infrastructure in the areas. Consequent upon these, Makurdi town is growing without adequate provision for basic infrastructure such as roads, drains, electricity, water supply, waste management facilities and recreational areas. The culminating effect is unsatisfactory urban living conditions and the likelihood of the development of slum conditions in Makurdi.

**RECOMMENDATIONS**

In line with the findings, the following recommendations are presented:

1. Infrastructural planning and provision should be handled by one agency to ensure efficiency in service delivery. Currently this can be handled by the State Urban Development Board. This Board should have the complement of professionals handling different aspects of development including infrastructural provision like roads, water supply, electricity, drains and refuse disposal in residential schemes.

   Alternatively, a central coordinating machinery should be put in place to oversee the implementation and management of layouts in Makurdi. For example, in Makurdi where the Ministry of Lands and Survey handles layout preparation, it should be given the coordinating function to oversee the activities of other agencies like Ministry of Water Resources and Environment, Ministry of Works, Water Board and Power Holding Company of Nigeria during the design, implementation and management phases of layouts. In the long term what may be needed is an urban governance structure that places planning of towns and sub areas under each municipal administration. State agencies can provide advice and compliance monitoring to ensure equity and sustainability but the planning and implementation under such a set up would be handled at the municipal level.
2. Also, all actors in the development process (including service providers) should be
involved at the conceptualization, design and implementation stages of the layout
development process.

3. Since some individuals are willing to contribute for the provision of infrastructure,
avenues of public-private partnerships could be explored in residential development
and the provision of infrastructure. This would include floating municipal boards to
finance development and charging this to plot owners as an instrumental plan over
time.

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URBAN DEGREENING, EROSIONAL IMPACT AND HOUSING QUALITY IN OSUN STATE, NIGERIA: MITIGATING FLOODING THROUGH POLYCENTRIC ENVIRONMENTAL PLANNING

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This paper uses the Institutional Analysis and Development (IAD) framework to analyse the missing links between urban development policy on the one hand and environmentalism and ecosystemic balance on the other hand with the intention of proffering possible solution to the problems of urban degreening, erosion and flooding in Nigerian cities. The study sampled 263 houses from the core, intermediate and new areas across the two major cities in Osun State - Osogbo and Ilesha. The paper found that, in spite of the deteriorating conditions of housing stock in Osogbo, the state capital of Osun State within the last fourteen years, there has not been any specific urban renewal programme that was carried out. Using specific housing indicators such as building conditions, waste disposal, water supply, electricity and open space conditions, analysis confirms that the quality of housing in the two cities is low. Buildings in the core areas of the two cities are exposed to erosional impact due to lack of green cover and paving. As a result, about 9,788.76 m³ of sand and top soil had been washed away over the years, thereby exposing foundations of most buildings, thus reducing their quality and stock, exacerbating dysfunctional infrastructure and inducing flood. Using Polycentric Environmental Planning Strategy, this paper adopts African Polycentric Sustainable Environment Model (APSEM) and African Polycentric Urban Renewal Model (APURM) for synergizing the efforts of three major groups - governments, financial organizations and community institutions in addressing the problem of urban decadence and slums. The adoption of the models would enable local people and professionals/practitioners in the built environment to have a robust dialogue with local government officials in order to reposition urban councils to effectively manage urban environment and improve housing quality.

Key Words: urban degreening, erosion, flooding, housing, polycentric planning

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INTRODUCTION

Several works have been done on slums and environmental degradation in Nigerian cities (Attoyebi, and Ijaiya, 2005; Koleosho and Adeyinka, 2006; Olotuah, 2010; Adejdeji, and Eziyi 2010; Ayoade, et. al., 2012; Oyefara, 2013), while urban degreening and erosional impact on open spaces in urban areas have been largely neglected. Unpaved and ungreened open spaces around buildings have been noted for sources of top soils, debris and silts that are washed by storm water during raining season with the consequence of siltation and sedimentation of Atlantic Ocean and Lagoon. The displaced water tends to cause coastal erosion and deforestation. For example, Lagos, as a coastal city, is at the receiving end of debris from the hinterlands (through erosion and rivers) and consequently, rising sea level and coastal flooding. This position is reinforced by the findings of the Nigerian Institute for Oceanography and Marine Research which show that annual erosion rates of 25 – 30 cm. between 1981 and 1985 occurred at Lagos bar beach (see Awosika and Folorunso 2000). With erosion links to siltation and sedimentation of sea bed, the recurrent flooding in Lagos is strongly connected with degreening activities and erosional impact on ungreened and unpaved open spaces in Nigerian cities. Besides, the impact of erosion in cities and towns has been linked to low housing quality as houses, drainage, access roads, soak-away, etc. have been negatively affected and, thus reducing housing stock and exacerbating dysfunctional infrastructure. The higher the quality of housing the lower the poverty level of the people and vice versa. When housing quality is low, slums result.

Nigerian cities have been noted for degreening activities. For example, indications from Ile-Ife, Lagos and Ibadan show that the three cities are experiencing degreening activities. For example, in Ile-Ife and Lagos, the green areas account for the least proportions, 24.1% and 27% of open spaces around buildings respectively, while 75.9% and 73.0% of the available open spaces are either paved or unpaved with the problem of heat radiation that demands additional energy for operating artificial cooling system and consequently increased global warming. In addition, degreening activities cause flooding. As more and more land is urbanised, and trees and grasses are replaced by asphalt and concrete, rainwater has less chance to be absorbed. Thus, storm water rushes down the streets while areas that were never flooded are now routinely under water (Akinola, 2013; Akinola and Adewale, 2013), thus leading to loss of lives and property and the displacement of people. Statistics confirms that between 2011 and 2012, more than 150 billion naira (about $1 billion) was lost in Lagos, while 2,105 buildings were flooded in Ibadan.

This paper uses the Institutional Analysis and Development (IAD) framework to analyse the missing links between urban development policy on the one hand and environmentalism and ecosystemic balance on the other hand with the intension of proffering possible solution to the problems of urban degreening, erosion and flooding in Osogbo and Ilesha. The paper found that about 9,788.76 m3 of sand and top soil had been washed away over the years, thereby exposing foundations of most buildings, thus reducing their quality and stock, exacerbating dysfunctional infrastructure and inducing flood.

Using polycentric environmental planning, this paper considered it imperative for the adoption of pragmatic and problem-solving strategies that can help in enhancing urban greenery and mitigating flooding in the two cities and other Nigerian cities. Polycentric environmental planning is a deliberate act of setting up multilayered and
multicentred institutional mechanism that regards self-governing capabilities of local communities as foundation for reconstituting order from the bottom up on environmental matters. It can also be described as the process of ordering the use of physical, human and institutional resources as well as engaging the citizens in contractual relations with the public authority on urban greenery. It regards community self-governing institution as a major player in urban development process (see Akinola 2009b, 2010a,i, 2011a).

This paper, therefore, adopts: (1) African Polycentric Sustainable Environment Model (APSEM) for inclusive decision making on urban environment to conserve and protect urban environment (Akinola 2008q, 2011e:68; Akinola and Adesopo 2011:259) and (2) African Polycentric Urban Renewal Model (APURM) for synergizing the efforts of three major groups - governments, financial organizations and community institutions in addressing the problem of urban decadence and slums (Akinola, Gasu, Adegoke and Simon 2013). The paper emphasizes, among other considerations, the use of traducture in reaching the grassroots for solution to the recurrent challenges of flooding. This, invariably, would produce a new urban governmentality that is polycentric, citizens driven and inclusive; thus, entrenching good urban environmental governance and citizens-centred planning.

**URBAN DEGREENING, EROSIONAL IMPACT AND HOUSING QUALITY**

Most environmental or ecological degradations came along with the birth of industrial revolution which also brought along with it mass exodus of people to urban areas. The industrial revolution with its complex technological and economic changes produced spectacular increases in world population and cities. According to Leitmann (2005), in the developing countries, the rural poor migrated to cities and accelerated urban population growth that usually led to the chaotic and repulsive urban atmosphere. Sub-Saharan Africa has long been one of the least developed and least urbanized regions of the world with most sub-Saharan African economies still heavily dependent on subsistence agriculture. Nevertheless, the region has absorbed relatively high rates of urban growth over the past 50 years. In 1950, only 15% of the Africa population was living in towns or cities, while 39.9% lived in urban areas in 2000 (United Nations 2002; Satterthwaite et. al. 2010:2812). By 2030, about 53% of Africa’s population is expected to be living in urban areas (Cohen 2004:39). The percentage of population residing in urban areas in Nigeria has been on the increase for some times, and probably will continue: in 1950 (10.1%); 1960 (14.4%); 1970 (20.0%); 1980 (27.1%); 1990 (35.2%); 1995 (39.3%); 2000 (43.3%); 2013 (49.8%)\(^9\); 2025 (62.0%) (United Nations, 1991; World Resources, 1997; GeoHive, 2013).

Nigerian cities have been noted for degreening activities. For example, indications from Ile-Ife, Lagos and Ibadan show that the three cities are experiencing degreening activities. For example, in Ile-Ife and Lagos, the green areas account for the least proportions, 24.1% and 27% of open spaces around buildings respectively, while 75.9% and 73.0% of the available open spaces are either paved or unpaved with the problem of heat radiation that demands additional energy for operating artificial cooling system and consequently increased global warming. In addition, degreening activities cause flooding. As more and more land is urbanized, and trees and grasses

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\(^9\) GeoHive – Urban/Rural Division of Countries. www.geohive.com/earth/pop/_urbanaspx
are replaced by asphalt and concrete, rainwater has less chance to be absorbed. Thus, storm water rushes down the streets while areas that were never flooded are now routinely under water. This confirms that the value of environmental health and beauty is being traded with economic considerations regardless of the fact that the loss in environmental value, health and beauty can offset the economic gains derived from degreening (Akinola 2000b; Akinola and Adewale, 2013).


All the components of the environment interact and change one another to maintain a balance over time. The activities of man seem to dominate those of other components of the environment, whereas “in the order of existence, humanity is a late comer to the natural environment” (Brenda, 1948:9). The interplay between the two actors (man and the natural environment) suggests that lack of planning and/or unchecked manipulation of the environment may lead to self-defeating of human race. The process of degradation of the earth’s surface has intensified in the recent times of human history all in the name of technological advancement and civilization. Calder (1970) opines that “irrational actions” of our global civilization which were dictated by greed or were the result of ignorance, have their serious consequences.

The spatial dimension of the growth of cities is not only associated with the increase in the number of structures and buildings and the general expansion in space but also the quality of such structures and buildings as determined by the availability of basic facilities in the buildings and the conditions of the buildings. In this paper, what determines housing quality includes the condition of the shelter (enclosure), availability of basic facilities (toilet, bathroom, electricity, water supply) and methods of waste disposal.

Akinola (1998) confirms that age of selected houses and non-availability of basic facilities in residential houses were highest at the core area and decreased with increasing distance towards the periphery of Osogbo. It was found that some of the symptoms of deterioration in the core area had spread to the intermediate section of the city (Sabo/Gbonmi) and is likely to continue to other parts of the city. Open dumping of wastes was most rampant in the core area and decreased with increasing distance to the newly developed areas.

Adedotun (2011) observed that the overall physical soundness of sampled dwellings in Osogbo need major repair. The work shows that about 69.3% of the building sampled need repair. The study also showed that mode of refuse disposal in the study area is still very poor with about 52.7% involved in open space dumping of refuse. This is in accordance with the previous work of Akinola, (1998) that open dumping of waste was highest in the core area of Osogbo. It was also observed by the same author that about 40%-60% of respondents in the study area cannot afford new, well built and well serviced housing in suitable locations.
Research Methodology

Data used for this paper was collected through the use of questionnaire and personal observation in February 2013. Osogbo and Ilesha were divided into three areas – the core area, the intermediate area and new area. The core area in Osogbo consists of Oja oba; the intermediate consists of Sabo/Gbonmi and Ayetoro while the new area consists of Dada Estate. The core area of Ilesha consists of Ereje and Adeti, the intermediate consists of Okesha and Isokun, while the new area consists of G.R.A., Omiru and Breweries area. The method of selecting the respondents was based on systematic random sampling where every fifth house was picked and a willing adult in the house was interviewed. Two hundred and sixty three (263) questionnaires were administered in the two cities. The questionnaire sought information on the socio-economic characteristics of the respondents, building conditions and facilities available in the sampled buildings. 32% of the questionnaires were administered at the core areas of the cities, 33.8% at the intermediate areas while the remaining 34.2% were administered in the new areas. Furthermore, the depth of the foundations exposed to erosion in the study areas were measured to determine the volume of sand that had been eroded and washed away. The data was analyzed using Statistical Packages for Social Sciences (SPSS) with the use of frequency distribution and cross-tabulation.

RESULTS

The study shows that 53.1% of the very good buildings were sampled at Osogbo, the state capital while the remaining 46.1% were sampled at Ilesa, all in Osun State Nigeria. Similarly, 70.6% of the poor buildings were sampled at Osogbo while 29.4% were sampled at Ilesa. Overall, 57.1% of the samples were selected from Osogbo while the remaining 42.9% were sampled at Ilesa.

One of the characteristics of the buildings examined in this study is the age of the buildings (Appendix 2). Analysis shows that 61.2% of the very good buildings are below the age of ten years (10 years), while 30.5% are between ages 11 and 20 years. 38.1%, 31.8%, 19.6% of sampled good buildings are between the ages of 1-10 years, 11-20 years and 21-30 years respectively. On the other hand, about 47% of the poor buildings are older than thirty years. In this case, they are old; and most of them are located at the core areas.

Table 1: Conditions of Buildings and the Study Areas

<table>
<thead>
<tr>
<th>Conditions of Buildings</th>
<th>Study Areas (Percentage in Parenthesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core (12.2%)</td>
</tr>
<tr>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>6 (24.3%)</td>
</tr>
<tr>
<td>Fair</td>
<td>36 (43.4%)</td>
</tr>
<tr>
<td>Poor</td>
<td>10 (58.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Work February 2013

Table 1 shows that 55.1% of the very good buildings are located in the new areas of the study areas, 32.7% in the intermediate area while only 12.2% of the buildings surveyed in the core area are good. Furthermore, the study shows that 39.2% of the good buildings are located in the new areas, 36.4% in the intermediate area. Most of
the fair and poor buildings are located in the core areas with about 43.3% and 58.8% respectively. The analysis shows that most of the poor buildings are located in the core areas while the good ones are located in the new areas and the intermediate areas. About fourteen years ago when Akinola (1998) noted this trend in Osogbo, it seems that there was no specific urban renewal project that has been carried out to address the problem of low housing quality.

Table 2: Conditions of Buildings and Drainage System

<table>
<thead>
<tr>
<th>Conditions of Buildings</th>
<th>Drainage System (Percentage in Parenthesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Very good (44.9%)</td>
</tr>
<tr>
<td>Good</td>
<td>16 (14.9%)</td>
</tr>
<tr>
<td>Fair</td>
<td>6 (7.1%)</td>
</tr>
<tr>
<td>Poor</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Work, February 2013

Table 2 shows that most of the very good buildings have very good drainage system (44.9%) while 32.6% have good drainage system. Only about 54.2% of the good buildings have good drainage system. The findings, however, show that the fair and the poor buildings have poor drainage as indicated by 41.6% and 70.6% respectively. Some 42% of the buildings surveyed have no good drainage, while only 17% claimed to have very good drainage and the remaining 40.8% claimed to have just good drainage system. The environments without good drainage system are exposed to erosion, while top soil is washed away.

Table 3: Conditions of Buildings and Mode of Refuse Disposal

<table>
<thead>
<tr>
<th>Conditions of building</th>
<th>Modes of Refuse Disposal (Percentage in Parenthesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By burning</td>
</tr>
<tr>
<td>Very good</td>
<td>23 (63.9%)</td>
</tr>
<tr>
<td>Good</td>
<td>48 (55.2%)</td>
</tr>
<tr>
<td>Fair</td>
<td>46 (56.8%)</td>
</tr>
<tr>
<td>Poor</td>
<td>10 (62.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>127</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Work, February 2013

One of the focuses of this paper is to examine the conditions of buildings in the study areas and their mode of refuse disposal. Table 3 shows that 63.9% of the very good buildings in the study areas engage in the burning of their refuse while 33.3% of them also involved in open space dumping of refuse. Similarly 55.5% of the people living in good building also burn their refuse, while 40.2% of them engage in open space dumping of refuse. 56.8% of the buildings ranked to be fair involved in the burning of their refuse, 39.5% of them engage in open space dumping of refuse. Furthermore, 62.5% of the building ranked to be poor engage in burning of refuse and 37.5% of the poor building are involved in open space dumping. The analysis, however, shows that there is no difference in the mode of refuse disposal in the study areas between the
poor buildings and the very good ones. The analysis shows that none of the building surveyed engage the services of private and public waste collectors and managers.

Appendix 1 shows that 87.8% of the very good buildings in the study areas have kitchen facility within their houses, only 4.1% of them use temporary structures for kitchen while about 8.2% of them use open space. Similarly, 80% of the good buildings have kitchen facility within the house, while 44% and 25% of the fair buildings and poor buildings have kitchen facility within respectively. The study also shows that about 44.9% of the very good buildings use open space in front of the buildings as car parks, 26.5% have garages while 22.4% have no parking facility at all. Some 49.5% of the good buildings also use open space in front of the buildings as parking facility, while 36.4% have no parking facility. On the other hand, 73.8% and 81.3% of the fair and poor buildings have no parking facility respectively.

Furthermore, Appendix 2 shows that 117 of 257 (45.5%) sampled houses in the two cities have no pipe borne water supply in the house. Some 54.5%, 83.7% and 64.5% of very good and good buildings respectively have water supply within, while 69% and 76.4% of fair and poor buildings respectively have no water supply system. The study also shows that 89.8% of the very good buildings have water closet toilet system. 72.9% of the good houses also enjoyed water closet toilet system. On the other hand, 54.7% of the fair houses make use of pit latrine while only 47.1% of the poor houses make use of water closet toilet system. Other poor houses definitely make use of pit latrine or nature.

Further analysis shows that most of the building walls were made up of mould block: 73.5%, 76.6%, 63.1% and 47.1% of the very good, good, fair and poor respectively were built of mould block. Since most of the walls were made up of mould blocks, their conditions are good. 85.7% and 77.6% of the very good and good buildings have no structural defect, but 50% of the fair buildings present evidence of cracks while 41% of the poor buildings show evidence of dilapidation. The study also shows that very good buildings in the area still maintain good roof condition (73.5%). 61.5% of the fair buildings present evidence of rusty roof condition, while 41.2% of the poor building condition shows evidence of roof leaking.

Analysis of road conditions of surveyed buildings in the study area shows that most of the very good buildings (57.1%) have good roads. Similarly 48.6% of the good buildings have good roads. The table also reveals that 43.4% of the fair buildings have fair roads while 53.3% of the poor buildings have fair roads and 40% poor roads. The study also shows that 69.4% of the very good buildings have access to tarred road, 48.8% of the good building have access to tarred roads, while only 36.1% and 41.2% of the fair and poor buildings respectively are accessible by tarred roads. In terms of accessibility, 83.7% of the very good buildings, 80.4% of the good buildings, 64.3% of the fair buildings and 47.1% of the poor buildings are accessible by roads. The study also shows that 94% of the buildings surveyed derived power supply from Power Holding Company of Nigeria (PHCN) irrespective of the conditions of the buildings. The remaining 6% derived their power from either generating plants or hurricane lamp.

Erosional Impact on Building Foundations and Top Soil Eroded

It needs be emphasized that unpaved and ungreened spaces are subject to erosional effect within the built-up areas. Foundations of buildings are gradually exposed and weakened (see Plates 1-4). The debris and soil washed many times blocked drainages
while large quantities of these materials litter the roads. This is environmental poverty. At the end, all these debris are washed down the streams and rivers with the consequence of silting. The problem of siltation of rivers and streams is complicated in the sense that rivers are susceptible to flooding and dams are affected too. Dredging of dam generates financial burden on government in the sense that resources which are meant for other social needs are diverted towards dredging. Also, the impact of flood on people, directly or indirectly, is poverty because properties are destroyed, job opportunities are reduced if not lost. Similarly, both paved and unpaved spaces cause flooding in the sense that paved surfaces allow storm water to rush down the street unregulated and unpaved open spaces give room to erosion and siltation of streams and rivers’ beds with the consequence of flooding.

The study in the two cities reveals that 6,980.68 m³ of soil and sand were eroded and washed away in Osogbo while 2,799 m³ were washed away at Ilesha. In totality, about 9,788.76 m³ of sand and top soil had been washed away in the study areas thereby exposing foundations of most buildings. The study shows that buildings in the core areas are mostly exposed to erosional impacts due to lack of green cover and paving.

Plate 1: Erosional Impact on Building Foundation in Aiyetoro, Osogbo.

Plate 2: Erosional Impact on Building Foundation in Ilesha
Plate 3: Street Erosion in Ilesha

Plate 4: Example of large quantity of soil and other debris dug out of a drainage in Oju-Ore, Ota, a suburb of Lagos, confirming that unpaved and ungreened open space around buildings in the community generated large quantity of soil that were being washed to rivers and Atlantic Ocean.

Summary of Findings

The study reveals that there has not been any specific urban renewal programme carried out in Osogbo, the state capital of Osun State since 1998 (fourteen years) when a similar study was conducted. This period happens to be democratic dispensation when dividend of democracy is expected to have trickled down to the people at the local level. Analysis shows that there is no difference in the mode of waste disposal system in the study areas between the poor building and the very good ones. Analysis confirms that 63.9% of the residents of very good buildings in the study areas burn their waste, while 33.3% of them were involved in open space dumping of refuse. Similarly 55.5% of the people living in good buildings also burn their refuse, while 40.2% of them engage in open space dumping of refuse. Furthermore, 62.5% of the buildings ranked to be poor engage in burning of refuse, while 37.5% of the same
category of buildings are involved in open space dumping of refuse with implication of inducing flood during rainy season. The analysis shows that none of the building surveyed engage the services of private and public waste collectors and managers. All these confirm that the quality of housing in the two cities is low.

Some 50% of the fair buildings present evidence of cracked walls while 41% of the poor buildings show evidence of dilapidation. The study also shows that very good buildings in the area still maintain good roof condition (73.5%), while 61.5% of the fair buildings present evidence of rusty roof condition, while 41.2% of the poor building condition shows evidence of roof leakage. It was also discovered that 117 of 257 (45.5%) sampled houses in the two cities have no water supply in the house. It was also found that the fair and the poor buildings do not have good drainage system but poor drainage as indicated by 41.6% and 70.6% respectively. The analysis further shows that most of the buildings enjoyed road accessibility with 48.6% of the good buildings having good roads, while 43.4% of the fair buildings present evidence of poor roads. Some 53.3% of the poor buildings in the study areas have fair roads and 40% poor roads.

The study found that buildings in the core areas are mostly exposed to erosional impact due to lack of green cover and paving. As a result, about 9,788.76 m$^3$ of sand and top soil had been washed away, over the years, in the study areas thereby exposing foundations of most buildings, thus reducing their quality.

**POLYCENTRIC ENVIRONMENTAL PLANNING AND URBAN GREENERY**

Using Polycentric Environmental Planning Strategy, this paper adopts: (1) African Polycentric Sustainable Environment Model (APSEM) for inclusive decision making on urban environment to conserve and protect urban environment (Akinola 2008q, 2011e:68; Akinola and Adesopo 2011:259) and (2) African Polycentric Urban Renewal Model (APURM) for synergizing the efforts of three major groups - governments, financial organizations and community institutions in addressing the problem of urban decadence and slums (Akinola, Gasu, Adegoke and Simon 2013). These models and the proposed new institutional mechanism would enable local people and professionals/practitioners in the built environment to have a robust dialogue with the local government officials in order to reposition urban councils to effectively manage urban environment, improve housing quality and conserve natural resources.

**African Polycentric Sustainable Environment Model (APSEM)**

African Polycentric Sustainable Environment Model (APSEM) (Akinola 2008q:66-67, 2009b:96) (Fig. 1) which derived inspirations and working mechanisms from: (i) African Polycentric Information Networking (APIN) (Akinola 2009b:94); and (ii) African Polycentric Forest Management Model (APFMM) (Akinola 2007i:126-127) is adopted for reducing vulnerability and flooding. As shown in the first part of Fig. 1, free riding on the part of some people is the main factor that is engendering environmental degradation in Nigerian cities. Consequently, urban degreening, forest depletion, global warming, erosion, flooding, environmental poverty, diseases, etc. become the order of the day.

The second part of the model, as shown in Fig. 1, attempts at synergizing the efforts of stakeholders/participants (government, industry, scholars, NGOs, youth and self-governing institutions) within environmental arena. By adopting African Polycentric
Information Networking (APIN), the restructuring process will commence with the design of polycentric sustainable environmental mechanism (PSEM) by scholars and public officials, and the setting up of self-governing community environmental assembly (SGCEA) where stakeholders through their institutions can operate in synergy (Akinola 2007f).

The first task before the assembly, SGCEA, is to share views and values of all the groups/interests. Among the issues to be discussed are: the importance of environmental resources and green cover to all the interest groups; the implications of environmental degradation; the contributions of each group towards urban greenery, waste management, resources regeneration and aforestation; and tasks and responsibilities that each group should carry out for effective environmental management.
Fig. 1: African Polycentric Sustainable Environment Model (APSEM)
Source: Adapted from Akinola (2007f, 2009b:96)
The stakeholders would operate using rules that are crafted by members at the SGCEA. Rule crafting takes place at three levels – constitutional, collective choice and operational. The outcome of the restructuring is emergence of new environmental institutional arrangements, which would reflect integrative order in environmental conservation and management. It is this joint action and synergy by these groups that would eventually determine how government policies on urban greenery, drainage, waste management, environmental resources and afforestation programmes are to be implemented. After the institutional arrangement has been designed, operational strategy for implementation of environmental matters would be fashioned out.

The application of these models would lead to sustainable environmental development. However, there is the need to set up a feedback system called cybernetics that would help in refining the operational strategies. This would be carried out from time to time (from 1<sup>st</sup> level to n<sup>th</sup> level). It is believed that if these suggestions are taken into consideration, a responsive policy on environmentalism would emerge and a shared community of understanding among the stakeholders necessary for laying good foundation for sustainable environmental management and flood mitigation.

**African Polycentric Urban Renewal Model (APURM)**

African Polycentric Urban Renewal Model (APURM) (Akinola, Gasu, Adegoke and Simon 2013) is adopted for synergizing the efforts of three major groups - governments, financial organisations and community institutions to addressing the problem of urban decadence. The model believes that urban decadence in the core area of cities constitutes the loci of agglutination of environmental ills, hideouts for criminals and housing shortage, the resulting implications of high cost of living, insecurity and low investment require that urban managers need to be pro-active, innovative and pragmatic rather than living things to chance. For instance, environmental ills in cities engendered health problem for residents and the larger society. These problems require brainstorming and concrete action among the stakeholders and interest groups on urban renewal programme. Brainstorming will consider cost implications – finance, social and temporary relocation/resettlement or temporary sharing of dwelling.

At the implementation level, the decision will lead to the formation of Self-Governance Community Assembly (SGCA). SGCA is designed for information networking (Akinola 2008p, 2009b) and synergy between and amongst the stakeholders in urban renewal. This would help in mainstreaming the citizens in decision making and implementation of renewal policies through traducture (wa Goro 2007; Akinola 2011b). According to wa Goro (2007), traducture can be defined as the explorations of several possible means of conveying knowledge-based development issues to stakeholders instead of relying on translation of words alone. In this sense, several avenues that the people are familiar with should be explored to discuss, convey and communicate ideas among stakeholders. Such avenues may include: radio, theatre, drama, artefacts, computer, IT, etc. that people can easily understand. For instance, ewi (poem/poetry) and ijala chants (Yoruba traditional hunters’ chants) could be used in various dialects, among the Yoruba of South-West of Nigeria, to reach the people of Egba, Egun, Ekiti, Ijebu, Ijesa, Igbonina, Ikale, Ile-Ife, Ondo, Offa, Osogbo, Owo, Oyo, etc. The same applies to the Hausa-Fulani of Northern Nigeria and Ijaw, Ibo, Edo languages, etc in the South-South of Nigeria. Similarly, religious clerics can also be involved in using religious platforms to convey the ideas.
to the people. It is translation and traducture that enable scholars to effectively tailor endogenous knowledge and innovations from university to real life situations (Akinola 2011h).

Similarly, SGCA will design triology of renewal programme and this will lead to concrete actions on renewal strategy by the three major groups (government institutions, financial institutions and community institutions). Here specific decisions will be taken on percentage of residents that will be temporarily relocated/resettled; percentage that will temporarily share accommodation; phasing of programme; repayment method; etc. The completion of the programme would lead to good urban environment.

It might be difficult to increase the quality of houses in the study areas because the houses were owned by private individuals who were not much concerned with the low quality of their houses. However, the government should make housing rehabilitation compulsory and give special loan to house owners for the exercise. Such loans can be repaid through rents payable by the tenants over a period of time. The only way whereby planning can have its influence is in the provision of public amenities such as drainage, and waste disposal probably through urban renewal programmes. The inner city contains some valuable cultural artifacts which should not be allowed to decay, hence, the need for government to give priority to the renewal of the city center and mobilize resources for the programme.

This section will not be completed without emphasizing the need for investment in urban infrastructure as a pre-condition for successful slum upgrading and as one effective mechanism for reversing the socio-economic exclusion of slum dwellers. In doing this, therefore, the paper highlights below some strategic measures that can be adopted in order to achieve the goal of urban renewal.

The need for constant up-scaling and upgrading of the cities periodically: Up-scaling and replication of slum-upgrading is among the most important of the strategies that have received greater emphasis in recent years, though it should be recognised that slum-upgrading is only one solution among several others.

Adequate policy formulation and implementation: Slums should not be awaited to emerge spontaneously or otherwise. In facing the challenge of slums, urban development policies should urgently address the issue of livelihoods of slum-dwellers and urban poverty in general, thus going beyond traditional approaches.

For slum policies to be successful, the kind of apathy and lack of political will that has characterised national, state and local governments in Nigeria needs to be reversed.

There is great potentials for enhancing the effectiveness of slum policies by fully involving the urban poor and those traditionally responsible for investment in housing development. This requires urban policies to be more inclusive and the public sector to be much more accountable to all citizens.

A more pragmatic approach in creating safer cities and improving urban living conditions through urban employment generation policies as well as strong community-based mechanisms for dealing with urban social ills.

Implementation of urban planning and management policies designed to prevent the emergence of slums, alongside slum-upgrading and within the strategic context of poverty reduction.
CONCLUSION

The paper concludes that, in spite of the deteriorating conditions of housing stock in Osogbo, the state capital of Osun State within the last fourteen years, there has not been any specific urban renewal programme that was carried out. This implies governance deficit as this period happens to be democratic dispensation when dividend of democracy is expected to have trickled down to the people at the local level. As expected, waste disposal system in the study areas follow the same pattern – burning of waste and dumping of waste in open space with the implication of inducing flood during rainy season. Though most of the buildings enjoyed road accessibility, some 45.5% of sampled houses in the two cities have no water supply in the house. About one half of the buildings have poor drainage, while buildings in the core areas are exposed to erosional impact due to lack of green cover and paving. As a result, about 9,788.76 m$^3$ of sand and top soil had been washed away over the years, thereby exposing foundations of most buildings, thus reducing their quality and stock, exacerbating dysfunctional infrastructure and inducing flood.

This paper considered it imperative for the adoption of pragmatic and problem-solving strategies that can help in mitigating flooding in the cities. The paper emphasizes, among other considerations, the use of traducture in reaching the grassroots for solution to the recurrent challenges of flooding. This study not only contributes to the body of knowledge on erosion and flooding but also provides policy template for addressing the challenges of urban degreening, erosion and flooding in the study areas and other Nigerian cities. Using Polycentric Environmental Planning Strategy, this paper adopts: (1) African Polycentric Sustainable Environment Model (APSEM) for inclusive decision making on urban environment to conserve and protect urban environment and (2) African Polycentric Urban Renewal Model (APURM) for synergizing the efforts of three major groups - governments, financial organizations and community institutions in addressing the problem of urban decadence and slums. These models and the proposed new institutional mechanism would enable local people and professionals/practitioners in the built environment to have a robust dialogue with the local government officials in order to reposition urban councils to effectively manage urban environment, green open spaces, improve housing quality, increase housing stock, enhance infrastructural supply and conserve natural resources. This, invariably, would produce a new urban governmentality that is polycentric, citizens driven and inclusive; thus, entrenching good urban environmental governance and citizens-centred planning.

REFERENCES


Urban degreening


ACKNOWLEDGEMENT:

The efforts of Part III students in the Department of Urban and Regional Planning of Osun State University are acknowledged for data collection. Those that coordinated the field exercise are: Ayodele Yewande Esther, Charanchi Amaechi J., Shafe Shakirudeen, Oyeniyi Ayobami, Adeniyi Abdulqadri, Fasanya Samuel, Oyekunle Temidayo, Ogunjinmi Bayonle H. and Ayinde Adewale Sodiq.

Appendix 1: Conditions of Buildings and Kitchen Facilities

<table>
<thead>
<tr>
<th>Conditions of Buildings</th>
<th>Kitchen Facilities (Percentage in Parenthesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open fire place</td>
</tr>
<tr>
<td>Very good</td>
<td>4 (8.2%)</td>
</tr>
<tr>
<td>Good</td>
<td>10 (9.4%)</td>
</tr>
<tr>
<td>Fair</td>
<td>23 (28%)</td>
</tr>
<tr>
<td>Poor</td>
<td>7 (43.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Work, February, 2013

Appendix 2: Conditions of Buildings and Water Supply in the Houses

<table>
<thead>
<tr>
<th>Conditions of Buildings</th>
<th>Water Supply in the House (Percentage in Parenthesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Very good</td>
<td>41</td>
</tr>
<tr>
<td>Good</td>
<td>69</td>
</tr>
<tr>
<td>Fair</td>
<td>26</td>
</tr>
<tr>
<td>Poor</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
</tr>
</tbody>
</table>

Source: Authors’ Field Work, February 2013
WHOLE LIFE COSTING PRACTICE IN PROCUREMENT OF PUBLIC BUILDINGS IN NIGERIA: MYTH OR REALITY?

Fatima M Bello, Ahmed Doko Ibrahim and Baba Adama Kolo
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Global best practices have adopted the use of whole life costing (WLC) along with the provision of definitive guides for achieving Value for Money (VfM) in construction. It is in this regards that the Federal government of Nigeria accepted the recommendations of the country procurement assessment report (CPAR) team that evaluated public procurement in Nigeria in 2000 and subsequently enacted the Public Procurement Act (PPA) in 2007. The Act established the Bureau for Public Procurement (BPP) to regulate and set standards for the procurement of public projects through, inter alia, the application of value for money (VfM) standards and practices. The BPP has produced documents (the standard bidding document and the public procurement manual) towards improving procurement but none addressed WLC concept therein, thereby presuming WLC practice is established in Nigeria. Thus, this study undertook an appraisal of WLC practice within client organizations and quantity surveying firms. The instrument for data collection was through the use of semi-structured interviews; analysed using constant comparative analysis method. The findings revealed that WLC practice is a myth in the procurement of public buildings in Nigeria due to political barriers, absence of standards and inadequate teamwork. Hence this study recommends that a standard guideline be put in place to facilitate WLC practice in Nigeria.

Keywords: Nigerian construction industry, public procurement act, value for money, whole life costing

INTRODUCTION

Globally, the construction industry plays a key role in the economy of both developing and developed countries, contributing between 4-14% of the GDP whilst generating vast amount of employment and wealth. The construction sector also provides the infrastructure that supports other sectors of the economy. In Nigeria, the sector is very strategic to the nation’s development efforts and a major indicator of the country’s wealth in social and economic terms. Nowadays, although the industry is still responsible for about 70% of the fixed capital formation, its contribution to the national economy now stands at about 4.2% of the GDP in recent years (Ibrahim, 2011).

The Nigerian construction industry (NCI) had been described as a ‘sleeping giant’ in terms of service delivery and capacity to satisfy the needs of its clients (Kolo and Ibrahim, 2010). In attempting to enhance good governance in public procurement, the Nigerian government commissioned the World Bank in collaboration with some Nigerian Private Sector Specialists to undertake studies of its financial systems and general procurement related activities. The study produced the Country Procurement
Assessment Report (CPAR) 2000 which led to the birth to the Public Procurement Act (PPA). The Act established the Bureau for Public Procurement (BPP) to regulate and set standards for the procurement of public projects through inter-alia the application of Value for money (V/M) standards and practices (FGN, 2007).

The BPP, in its public procurement manual, explain that “value may imply more than just price, quality issues also need to be addressed and lowest initial price may not equate to lowest cost over the operating life of the item procured”. Although the document did not mention whole life costing (WLC) as a concept for achieving V/M, it did acknowledge that the initial price might not translate to V/M. According to the OGC (2003), V/M is defined as “the optimum combination of whole-life cost (WLC) and quality to meet the user's requirement”. Thus, for V/M to be achieved the whole life cost of the facility must be considered.

WLC theory has been well established but practical applications still remains underdeveloped. This is due to the problems of data scarcity, uncertainty and the need for assessing non-monetary factors (Kishk and Al-Hajj, 2000). It is in regards to this that models were developed by various institutions and professional bodies so as to overcome the aforementioned problems (Kishk et al, 2003a; Bala et al, 2008).

WLC research can be classified into four major areas as identified by Kishk et al (2003) namely;

Data requirement aspect which deals with issues regarding storage and capturing of data to be used in life cycle assessment. Researches in this area include that of Al-Hajj et al (2001), Kishk et al (2002); Kishk et al (2003a); Ibrahim et al 2010 etc, these works addressed issues of data difficulty by providing alternative ways of sourcing data for WLC analysis.

Mathematical modelling and works in this area include those of Bousabbaine and Kirkham (2004a); Kirkham et al (2002); Kirkham et al (2004), etc. Researches in this aspect modelled maintenance cost of certain types of facilities in the UK.

Uncertainty and risk assessment and works in the area include those of Bousabbaine and Kirkham (2004b); Bala et al (2008b) these incorporate probabilistic approaches to WLC models so as to reduce the risk and uncertainties associated with the future.

Implementation of WLC which consist of analysis, planning and management issues related to WLC. Researches carried out in this area include those of Olubodun et al (2010); Rum and Akasah (2011); Chirigwi et al (2010), which looked into the application of WLC in different countries.

Research conducted in Nigeria in the area of WLC include that of Ibrahim et al (2010) which identified the characteristics of WLC data in the Nigerian construction industry to include non-formal documentation of sources, availability, reliability and consistency of WLC data as well as a standard procedure for the collection, analysis, validation and presentation of WLC data. Bala et al (2008a) developed a model to overcome the problem of data scarcity and uncertainty in the Nigerian construction industry. The efficiency of the model was subsequently tested by Bala et al (2008b) which ascertainment its reliability.

The Nigerian based research works on WLC identified the characteristics of the data as well as provided solutions to the problem of data uncertainty and scarcity. But there exist a gap as to the practice of WLC in the procurement of public buildings. In
Whole life costing

Nigeria, the practice of WLC remains unknown and non-availability of any standard guides by the BPP could lead to varied understanding and applications.

Thus, this study seeks to investigate the state of the art of WLC practice in procurement of public buildings towards the achievement of V/M in Nigeria whilst identifying the barriers and drivers that are inherent within the NCI.

RESEARCH METHOD

There are two approaches to a research, the quantitative approach and the qualitative approach. This research aims at getting an in-depth exploration of the state of the art as regards to the WLC practices in procurement of public buildings; hence the most suitable approach to it is the qualitative approach. Qualitative research is orientated towards analysing concrete cases in their temporal and local particularly starting from people’s expression and activities in their local contexts (Flick, 1998). Qualitative research seeks out the ‘why’, not the ‘how’ of its topic through the analysis of unstructured information. Qualitative research is used to gain insight into people's attitudes, behaviours, value systems, concerns, motivations, aspirations, culture or lifestyles.

Accordingly, Bryman (2004) argued that a qualitative research approach may be adopted when:

There is no existing research data on the topic and the most appropriate unit of measurement is not certain; and

The concepts to be researched are assessed on a nominal scale, with no clear demarcation and involve exploring behaviour or attitudes.

The sampling frames for this research were Quantity Surveying firms (QSF) in Kaduna and Abuja and Client organisations (CO) in Zaria, Kaduna and Abuja. Purposive sampling was used in selecting the samples from both populations due to the nature of the study. The purposive sampling allows participants to be chosen according to preselected criteria relevant to a particular research question. Purposive sample sizes are often determined on the basis of theoretical saturation (the point in data collection when new data no longer bring additional insights to the research questions).

The 12 quantity surveying firms that were used in the analysis were chosen based on the response gotten from the general questions asked. The basis of the selection was the firm has to be in existence for 10 years and above and have the federal government as their major client and should have consultancy on works across the nation.

The client organisations were some selected federal government institutions and establishments within Zaria, Kaduna and Abuja.

The semi-structured type of interview was used in preference to structured or unstructured interviews for this research to enable the researcher probe for further insights and clarification while maintaining some structure in the views collected. The interviewees included 20 people, 12 of whom are in consultants’ quantity surveyors representing their organisations and are the clients’ representatives from the client organization and are all quantity surveyors. The interviews were all conducted as individual sessions and each lasted an average of 35 minutes. All interviews from the QSF were recorded while some from the client organization were not recorded and hence notes were taken on a pro-forma designed to capture relevant information from
the interviews, and the interviews were analysed using the constant comparative analysis.

Those interviewed are the quantity surveyors in consultancy firms and the public client (federal government establishments). Questions asked were designed to collect the views of those interviewed on the use of WLC in procurement of public procurement and the barriers to the practice as well as how they think the practice can be effective within the Nigerian Construction Industry.

Data collected was analysed using constant comparative analysis method. The constant comparative strategy involves taking one piece of data (one interview, one statement, one theme) and comparing it with all others that may be similar or different in order to develop conceptualisations of the possible relations between various pieces of data (Thorne, 2000). For example, by comparing the accounts of two different people who had a similar experience, a researcher might pose analytical questions like: ‘why is this different from that’ and ‘how are these two related’.

The analysis entailed homogenising opinions of participating interviewees where necessary and highlighting the opinion of contrasting interviewees where applicable.

RESULTS AND DISCUSSIONS

CHARACTERISTICS OF THE INTERVIEWEES

In whole, twenty (20) interviewees participated in this research. Table 4.1 shows that the details of the participating organizations as to, years of existence and the range of employees experience. All the QS firms have the federal government as their major client and have executed works in various locations across the nation.

<table>
<thead>
<tr>
<th>Table 4.1: Interviewee Details</th>
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<tbody>
<tr>
<td>Number</td>
</tr>
<tr>
<td>QSF</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CO</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

QSF – Quantity Surveying Firms
CO – Client Organisation

INTERVIEW RESULTS

In analysing the interviews using the comparative content analysis method, the opinions of the interviewees have been combined where applicable; whilst highlighting the specific differences between the practices in the client organisations and the quantity surveying firms. In complying with the confidentiality requirements, the researchers had as much as possible tried to keep the identities of the interviewees anonymous and hence made notations to identify the different organizations involved. The results are provided below in the order by which the questions were asked. The results of the Quantity surveying firms and client organisations are presented individually.

Quantity Surveying Firms

Extent of WLC Use
The focus of investigations here was on the extent of usage or otherwise of WLC in the procurement of public buildings and the reason(s) thereof.

The response by the representatives of the quantity surveying firms showed that none of their projects considered the use of WLC in the procurement of public buildings in a formal way. This is because the public clients did not require that WLC techniques be put into consideration. The responses showed that the entire organisations under this study had the federal government as their major client.

Barriers to WLC Practice

The interviews focused on the discussion of the following barriers as identified from literature: Political reasons, Data issues, Capability, Absence of standards, Complexity of WLC process and Perceived inaccuracies.

i. Political barriers

The issues discussed here were under the following categories-

Most of the respondents admitted that the separation of capital budget from that of the operating budget by the Federal Government pose as constraints to the practice of WLC. While few of the respondents disagrees with this, stating that the two budgets are normally prepared by the government and as such should be complementary to each other.

All the interviewees revealed that WLC practice is hindered because the providers of public buildings are different from the end users. As a result, the procuring agencies are usually only concerned with the initial costs of construction without worrying about the cost of maintaining and operating the buildings.

The interviewees also complained that the public client is always faced with the problem of restricted budgets which makes WLC practice difficult; always leading to adoption of cost reduction strategies. However, some of the respondents are of the opinion that restricted budgets should not be a hindrance to WLC practice; as recommended adoption of principles of prioritisation using scale of preference for addressing competing demands. They added further that when only initial price is considered the maintenance budget will eventually be higher making planned maintenance difficult; resulting in dilapidated buildings and more expensive repair costs.

ii. Data issues

The responses obtained revealed absence of data to conduct WLC analysis and where records (maintenance) are available; they are usually kept for accounting purposes. Furthermore, it was established that the quality of data upon which to base WLC calculations are usually not reliable. This is because the maintenance records kept are for reactive repair works and not planned maintenance.

iii. Capability

Most of the interviewees are of the opinion that they are capable of practicing WLC. But they further acknowledged that capability improves with experience. While some of the respondents believe that a lot need to be put in place to equip the quantity surveyors to be able to effectively practice WLC.
iv. Absence of standards

The responses revealed that there is no standard for WLC in Nigeria thus contributing to the absence of the practice in building construction projects.

v. Complexity of WLC process

The responses of the representatives of the quantity surveying firms revealed that the WLC technique is not complex as far as there is a framework to be followed and hence the perception that the techniques of WLC are complex cannot be a barrier to the implementation of the practice.

vi. Perceived Inaccuracies

All the respondents in the quantity surveying firms are of the view that perceived inaccuracy should not be a deterring factor to WLC implementation because accuracy comes with experience. Furthermore, they argued that if all inputs are accurate, then there is no need to fear about inaccuracies.

vii. Client Barriers

The representatives of the quantity surveying firms said that the public clients do not require that WLC technique be used in costing construction projects. This is because the client’s main concern is to provide the facility at the lowest possible initial cost as a result of the client not comprehending the true nature of construction cost.

Drivers to WLC practice

The respondents in the quantity surveying firms identified the following as drivers to WLC practice:

- Requirement by the client – if clients require that WLC is practiced when costing construction projects the QS would have to do it, because they are there to provide service to the client.
- Provision of Guides – the Standardisation will go a long way of easing the practice of WLC as it puts everyone on the same level as to what is expected.
- Teamwork - the current practice in the Nigerian Construction industry is that there is no teamwork as the consultants do not sit together to discuss the project especially at the design stage. More involvement of the QS at the inception and design stages is vital to WLC.

Client Organization

Extent of WLC Use

The interview focused on the use or otherwise of WLC in the procurement of public buildings and the reason(s) thereof.

The responses from the representatives of the client organization revealed that none of the projects were procured on the basis of WLC. This is because clients (public) usually have restricted budget and also do not understand the true nature of cost.

Barriers to WLC Practice

The interviews focused on the discussion of the following barriers as identified from literature, they include: Political reasons, Data issues, Capability, Absence of standards, Complexity of WLC process and Perceived inaccuracies.
Whole life costing

i. Political barriers
The issues discussed here were under the following categories-
The capital budget of construction being separated from the operating budget makes it difficult for WLC to be practiced.
Another political barrier is the issue of favouritism whereby clients interfere with the activities of the consultants and designed team.
The client organisation sees restricted budget as a barrier for WLC considerations to be made.

ii. Data issues
The responses gotten under this issue is that planned maintenance are rarely carried out, hence making it difficult to have accurate historical data on the performance of building components.

iii. Capability
All the representatives of the client organisations are of the opinion that they might be incapability by professionals concerned for the practice of WLC. As such the QS need to be trained and be given continuing education on new techniques in estimating construction cost.

iv. Absence of standards
The responses obtained from the representatives of the client organisations showed that majority of the respondents see the absence of a standard as a hindrance to WLC implementation. While few of the respondents believe that there could be a possibility of having a WLC practice even without a standard.

v. Perceived Inaccuracies
All the representatives of the client organisations are of the view that perceived inaccuracy should not be a deterring factor to WLC implementation because accuracy comes with experience. Furthermore, they argued that if all inputs are accurate, then there is no need to fear about inaccuracies.

Drivers to WLC practice
The following were identified as drivers to WLC practice by the representatives of the client organisation:
Provision of Guides – the Standardisation will go a long way of easing the practice of WLC as it puts everyone on the same level as to what is expected.
Team work- the current practice in the Nigerian Construction industry is that there is no teamwork as the consultants do not sit together to discuss the project especially at the design stage. More involvement of the QS at the inception and design stages is vital to WLC.

DISCUSSION OF RESULTS
The Federal Government of Nigeria accepted the recommendations of the World Bank’s Country Procurement Assessment Report (CPAR) in 2000 and has since enacted the PPA to promote efficiency, accountability, transparency and integrity in the Nigerian public procurement system. The Act established the Bureau for Public Procurement (BPP) to regulate and set standards for the procurement of public
projects through the application of V/M standards and practices. According to OGC (2003) V/M is the optimum combination of whole-life cost (WLC) and quality to meet the user's requirement. Also Latham (1994) and Egan (1997) recommended the use of WLC in achieving V/M in construction.

Kishk et al (2003b) opined that most principles WLC are well developed in theory, yet it has not received wide practical application. Findings from both the quantity surveying firms and client organizations revealed that WLC is not practiced in the procurement of public buildings in Nigeria. This concurs also to Flanagan and Jewell’s (2005) statement that WLC is rarely used in the developing countries except in the intentionally financed projects like the World Bank assisted projects (mostly PPP projects). Furthermore Ityobee (2000) reported that WLC techniques are rarely utilized in the procurement of private buildings in Nigeria.

WLC implementation has been hindered by a number of factors, this include:

The absence of reliable data as reported in Chiurugwi et al (2010) and SCI-Network (2011). In addition, Flanagan and Jewell (2005) further stated that WLC implementation in developing countries has been marred by the absence of reliable data. The responses obtained in both the quantity surveying firms and client organisations reveals that there is inadequate and absence of reliable data upon which to base WLC analysis. Although Bala et al (2008a) have proposed a theoretical model to subdue the data difficulty in Nigeria, but this has not been tested empirically.

Furthermore the SCI-Network (2011) identified political barriers to WLC implementation as follows; capital budget of construction being separated from the operating budget, construction project providers in public organisation are different to the end users and decision makers opt for minimum initial investment so as to meet budgetary restrictions. But from the responses obtained from the interviewees, the argument is a little bit different. The quantity surveying firms are of the opinion that the issues of capital budget being separated from that of the operating budget shouldn’t be a barrier to WLC while the opinion in the client organisation conforms to what is obtainable in literature. Also the opinions obtained from quantity surveying firms on the issue of construction providers in public organisations being different from that of the end users as a barrier to WLC conforms to the literature.

In contrast, the views of the quantity surveying firms differ from what has been established in literature on budget restrictions; the QSF sees the issue to be of economic nature there by encouraging the public client to use scale of preference in executing projects rather than undertaking many at a time without achieving V/M. While the interviewees from the client organisation say that budget restrictions are barriers to WLC implementation as such confirming the literature position.

Another barrier to WLC is the issue of capability. Although the findings from the study reveals that the QSF are of the opinion that they are capable of practicing WLC while the representatives of the client organisations have doubts on the capability of professionals concerned. The SCI-Network (2011) reported that there is insufficient knowledge held by officers of the authority, and inadequate quality training for WLC practice. Also Chiurugwi et al (2010) found out that there are unavailable skills for WLC in the UK. However, Bello (2012) established that the QS in consultancy firms in Nigeria understand the principles underlying WLC adequately to enable them to practice same. Thus in the NCI, there is professional competence for the practice of WLC. Even though others believe a lot need to be put in place to equip the QS in the practice of WLC and a need for continuing education to keep professionals abreast of
new techniques in estimating construction cost. Thus the responses from this study indicates that capability to practice WLC exist in the NCI as such is not a barrier to its implementation.

Most developed nations have mandated the use of WLC by providing relevant standards and guidelines such as the BS ISO 15686 1 to 5 and the OGC guide 7. This is to encourage and simplify the use of WLC in achieving V/M in construction. But the BPP who is supposed to provide standard and guides towards the achievement of V/M is yet to provide a one for use in Nigeria. Furthermore it has been reported in Chiurugwi et al (2010) and Olubodun et al (2010) that absence of standard is a barrier to WLC. The responses obtained in this study conforms to what has been established in literature as majority of the respondents in both the QSF and client organisations sees the absence of a standard for WLC practice as a hindrance. But few of the respondents opined that even without a standard, WLC practice can be carried out, but this will lead to varied procedure and can make comparisons very difficult, thus for an effective WLC practice there is need for a standard to be provided. The absence of a standard for use in the NCI is a barrier to the practice.

The responses obtained in this study at both the quantity surveying firms and client organisations do not conform with literature that WLC process is complex thus hindering its wide spread implementation (Olubodun et al, 2010).

The respondents from both the quantity surveying firms and client organisations are of the view that perceived inaccuracy should not be a deterring factor to WLC implementation because accuracy comes with experience. But studies such as that of Olubodun et al (2010) and that of Chirigwi et al (2010) reported that perceived inaccuracy is a hindrance to WLC implementation.

The study found out that the response from the quantity surveying firms indicated that clients do not require WLC to be considered in public buildings in Nigeria as such a hindering factor for the practice of WLC. This conforms to the findings of Chiurugwi et al (2010) in which he reported that client requirement for WLC is vital to the implementation of WLC.

Lastly, Chirigwui et al (2010) and Olubodun et al (2010) had established that the drivers to WLC practice include: being required by the client, hands on approach to WLC training and the provision of guides. This study also identified requirement by the client, provision of WLC standards and effective teamwork among consultants especially at the design stage as the drivers for WLC practice in Nigeria.

**SUMMARY OF FINDINGS**

Below are the major findings from the study.

All the organisations that participated in this study reported that there is no formal practice of WLC. This is because the clients do not require that WLC techniques to be put into consideration as a result of the client’s restricted budget. Also the clients do not understand the true nature of cost.

The barriers to WLC inherent in the NCI are political reasons, absence of standard and inadequate teamwork.

The drivers to WLC include effective team work at the inception and design stages, provision of standards and clients requiring WLC techniques in procurement of buildings.
From the findings of this study, it can be concluded that WLC practice is a myth in the procurement of public buildings in Nigeria.

**RECOMMENDATIONS**

Based on the findings the following recommendations were made:

For an effective WLC practice, a framework for WLC practice for use in Nigeria should be developed to serve as a guide and basis for WLC.

Continuing education should be provided by the concerned bodies to ensure that professionals are kept abreast of the trends in estimating techniques.

Clients should be educated on the nature of construction project cost; this will make them see the need to make provision for planned maintenance through awareness programme by the NIQS.

Based on additional work the QS need to make to provide estimate based on WLC, there is need for their fee to be reviewed.

Maintenance records should be kept by building users in a format that will be useful for WLC analysis.

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