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(Volume 2)

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Proceedings of the WABER 2015 Conference (Volume 2)

Editors
Samuel Laryea
Roine Leiringer
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Volume 2

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Declaration
All papers in this publication have been through a review process involving initial screening of abstracts, review of full papers by at least two referees, reporting of comments to authors, revision of papers by authors and re-evaluation of re-submitted papers to ensure quality of content.
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**NEA ONNIM NO SUA A, OHU**

Symbol of knowledge, life-long education and continued quest for knowledge
FOREWORD

It is a pleasure to welcome you to our 6th WABER Conference taking place at the University of Ghana in Legon, Accra. Thank you for coming, and a very warm welcome to Accra and the beautiful campus of the University of Ghana. I know some of you have travelled long distances to get here. Some of you have also made considerable sacrifices to mobilise the resources required to be here. We appreciate your efforts. We hope the conference meets your expectations and provides you with valuable experience and developmental opportunities for a productive and rewarding career.

We are grateful for the presence of the Minister for Education – Professor Naana Jane Opoku-Agyemang – at the Opening Session of this conference. Thank you for kindly accepting our invitation to come and open the conference for us. We are equally grateful for the presence of the Vice Chancellor of University of Ghana – Professor Ernest Aryeetey – whose leadership and distinguished academic career serves as an inspiration to many. Professor Aryeetey leads a University which has recently been ranked by Thompson Reuters as the 10th best university on the African continent. We are proud to host our conference here and thank you for accepting our invitation to come and give a Welcome address. Thank you also to our other special guests – particularly leaders of academic institutions and industry – for joining us. The presence of industry practitioners and leaders of the built environment professions provides an opportunity for us to critically explore practical solutions to existing problems in our built environment like flooding, fire, building collapse, poor construction, health and safety of workers, environmental pollution, land management, development control, impact of construction on the environment, inclusive design, waste management, traffic on our roads and congestion in our cities. We believe that such interactions provide a much needed opportunity to start to bridge the proverbial gap between academia and industry.

The WABER Conference keeps growing each year. For this, I would like to thank our delegates and partners. Thank you for the contributions you have made to the life and success of this conference. As some of you know, this conference began in 2008 as an initiative of the School of Construction Management and Engineering at University of Reading. Over the years, colleagues including Prof. Will Hughes, Dr Roine Leiringer, Dr Chris Harty, Dr Sena Agyepong, Dr Emmanuel Essah, Prof. George Ofori and myself have formed a solid foundation for the development of the conference, which so far has proven to be successful. We have sustained the success through the provision and facilitation of appropriate academic infrastructure and leadership. Most importantly, the academic recognition and continued support we receive from delegates has been the key to our development. Indeed, the most important people in the growth of WABER are the conference delegates, and we take great pride in the high number of repeat participants. Let me focus now on this year’s conference and our activities.

The delegates at this year’s conference come from 64 different academic institutions spread across eight different countries. There is a real opportunity here for rich exchange of academic, social and cultural ideas. Please take every opportunity to interact, exchange ideas and develop collaborations with colleagues from other institutions.

From an initial submission of 165 abstracts, we eventually accepted 92 papers for presentation at this year’s conference. Congratulations to the authors of accepted papers. Thank you for the hard work put into doing the research and writing the papers. The papers being presented at this year’s conference are written by authors from six main academic backgrounds and disciplines namely: architecture, building, construction management, estate / property management, quantity surveying, and urban and regional planning. As such, the conference truly reflects an international gathering of built environment academics. We also have some mainstream academics and industry practitioners here who will contribute to the richness and quality of deliberations.
More than 50 reviewers from 12 different countries were involved in the peer review process for this conference. I would like to express sincere gratitude to each reviewer for the great job done. Without the dedication and expertise of our referees, this conference will not be as successful as it is. So thank you to all reviewers for your contributions to the success of this conference. I particularly wish to thank Dr Wisdom Kwawu, Dr Roine Leiringer and Prof Will Hughes for your significant contributions in this regard.

It is important to appreciate the roles and efforts of the following people for significant contributions made towards the successful organization of the conference: Florence Laryea (for among other things, formatting and typesetting the papers in this conference proceedings), Dr Sena Agyepong, Jonathan Ntsiful, Dr Emmanuel Essah, and colleagues at Scatterlings Conference and Events. It is always a mammoth task to mount an event of this nature successfully.

Our keynote speakers who have travelled long distances to come and share their time, knowledge and expertise with us deserve our profound gratitude: Professor George Ofori (National University of Singapore); Professor Koshy Varghese (Indian Institute of Technology, Madras); Dr Roine Leiringer (University of Hong Kong); and Dr Ron Watermeyer (Infrastructure Options Pty Ltd, South Africa).

I finally wish to thank our sponsors and partners who support us in diverse ways. In particular, John Riixs Construction and EPP Books Services / Zenith University College.

We aspire to provide a vehicle for the advancement of built environment research in Africa; and create opportunity for built environment academics, particularly those in the early stage of their career, to develop their research work and skills through constructive interaction with experienced international academics. Therefore, the future of this conference needs to be properly architected and sustained through innovative ideas, academic enterprise and leadership. The WABER conference values are knowledge, interaction, people and leadership. We have developed with a clear sense of purpose since 2008 and made significant impact on the research landscape in West Africa. We plan to continue our growth by serving the built environment community in our region. Plans for the publication of our African Journal of Built Environment Research are now firmly established. Two issues will be published within the next year. We are awaiting feedback on our application for indexing of the WABER Conference proceedings in the Thomson Reuters Conference Proceedings Citation Index. A positive outcome will facilitate greater scientific recognition of our work and dissemination of our research outputs in global databases like Scopus and the Web of Science collection. Our activities going forward will include: facilitating access to scientific literature, providing opportunity for experienced/leading international academics from elsewhere to interact with the built environment community in Africa, providing a forum for quality scientific engagement and interactions, facilitating the development of research skills and publications among built environment academics particularly those in the early stages of their careers, supporting the development of researchers in our academic institutions, and creating opportunity for people in different institutions to connect for exchange of ideas and collaborative work.

I thank you once again for coming to this conference. Enjoy it, engage in the exchange of ideas, build new relationships for the future, and have a safe journey back home. We wish you all the best in your endeavours and hope to see you again in the future.

Samuel Laryea, PhD
Chairman of WABER Conference, Associate Professor at Wits University School of Construction Economics and Management, Fellow of the Higher Education Academy

August 2015
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PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

10th August 2015

TO WHOM IT MAY CONCERN

I confirm that all papers in the WABER Conference Proceedings have been through a peer review process involving initial screening of abstracts, review of full papers by at least two referees, reporting of comments to authors, revision of papers by authors, and re-evaluation of re-submitted papers by the Scientific Committee to ensure quality of content.

It is the policy of the West Africa Built Environment Research (WABER) Conference that all papers must go through a systematic scientific and peer review process involving examination by at least two referees who are knowledgeable in the field. A paper is only accepted for publication in the conference proceedings based on the recommendation of the reviewers and the Scientific Committee.

The names and affiliation of members of the Review Panel and Scientific Committee for WABER Conference 2015 are published in the WABER Conference Proceedings and on our website www.waberconf.com

Papers in the WABER Conference Proceedings are published open access on the conference website to facilitate public access to the research papers and the wider dissemination of scientific knowledge.

Yours Sincerely,

Samuel Laryea, PhD
University of the Witwatersrand, Johannesburg, South Africa
Chairman of WABER Conference
We would like to express gratitude to the following people who conducted thorough scientific reviews of more than 100 papers submitted for WABER Conference 2015 and provided authors with constructive comments.

Dr Wisdom Kwawu, University of the Witwatersrand, South Africa
Dr Roine Leiringer, The University of Hong Kong, Hong Kong
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The main responsibility of the WABER Committee is to provide the infrastructure and academic leadership for developing the WABER conference.
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PRIZES TO BE AWARDED AT THE WABER 2015 CONFERENCE

• Best Research Paper

This prize is awarded to recognize the author(s) of an original piece of research which contributes a better understanding of the research question/problem investigated and demonstrates a high degree of scientific quality and innovative thought. This prize was created to acknowledge the continuing importance of high quality research to academic institutions, a researcher’s reputation and the development of the built environment field.

• Best Industry-Related Research

This prize is awarded to recognize an industry-related research paper which tackles a significant subject of relevance to construction practitioners and provides conclusions that are likely to help in resolving/improving a problem in practice. The paper should contain impactful research that is both scientifically rigorous and practically relevant.

• Best Presentation

This prize is awarded to recognise the presentation which is the most coherent, clearly enunciated, well-paced, easy to understand, and effective. The award is given on the basis of quality of the presentation and not the written paper. It recognizes the best presentation based on communication of the content of a paper and the ability of the speaker to deliver an impactful, authoritative and engaging presentation. The award looks to encourage researchers to put as much effort as possible into the presentation of their work.

• Gibrine Adam Promising Young Scholar Award

This prize is awarded to recognize and encourage truly exceptional young researchers. The recipient should be a young academic who demonstrates promise, such that he/she is likely to become established as a research leader. The prize is provided by Mr Gibrine Adam – President of Zenith University College and CEO of EPP Books Services – who has made significant contributions to the education sector through his educational establishments and philanthropic work. Awarding this prize each year will serve as an important inspiration for young African built environment academics.
PROFILE OF KEYNOTE SPEAKERS

Thank you to our keynote speakers for accepting our invitation to come and interact with delegates at the WABER Conference 2015. A brief profile of each keynote speaker is given in this section.

Dr Roine Leiringer, University of Hong Kong

Dr Roine Leiringer has been part of the WABER Conference since its inception and has made significant contributions to the conference development. He has participated in all our conferences since the start and been our custodian for research quality. Roine reviews at least 10 of the papers submitted for each year's conference and contributes to editing of the conference proceedings. Through this constructive engagement, he is able to identify the challenging areas for authors when it comes to navigating the contours of good scientific research and paper writing. This unique position offers him the understanding and platform to share ideas with delegates on issues of research quality and development from an international, as well as context-specific, perspective.

Bio

Dr Roine Leiringer is an Associate Professor in the Department of Real Estate and Construction at The University of Hong Kong. He holds an MSc in Civil Engineering and a PhD in Industrial Economics and Management from KTH Royal Institute of Technology, Sweden. In 2010 he was awarded the academic grade Docent at Chalmers University of Technology, Sweden. In research, Roine is committed to critical perspectives. Early research interests were in the areas of Public-Private Partnerships and innovation. Recently much of his research has been in the following four areas:
'service-led construction projects', investigating the strategic implications for firms shifting from product manufacturing to being providers of through-life service offerings;

- The impact of government policy and reform initiatives on firms and actors active in the creation of the built environment;

- Sustainability, in particular how individuals in construction organisations are incentivized (or not) to incorporate sustainability into their daily work;

- Client capabilities – what capabilities do public sector clients need in order to effectively procure and manage their capital projects?

Roine is: co-editor of Construction Management and Economics; a former committee member (Secretary) of the Construction Researchers on Economics and Organisation in the Nordic region (CREON) Network; past joint coordinator of CIB Task Group 84 on 'Construction Reform'; and co-founder and co-director of the West Africa Built Environment Research (WABER) conference series. He is currently a Professor Visitante at Universidad ORT Uruguay (Montevideo, Uruguay).

**Professor George Ofori, National University of Singapore**

In the league of built environment academics, Professor George Ofori is a leader with several international accomplishments. Professor Ofori will speak on "Developing your academic career" and "A research agenda for the built environment". Both topics are relevant for every academic in the built environment field. He is available for the first two days of the conference to engage with delegates and exchange ideas with particularly early career academics wishing to develop successful academic and research careers.

![Bio Image]
Prof. George Ofori, B.Sc., M.Sc., Ph.D., D.Sc. is a Professor in the Department of Building at National University of Singapore. He is married with four children. Formerly, Senior Quantity Surveyor, G.A. Takyi and Partners, Accra, Ghana; Senior Lecturer, 1983-91 and Associate Professor, 1991-99, National University of Singapore. Prof. Ofori has been Head of Department of Building (2002-05), Co-ordinator, Working Commission 107 of International Council for Research and Innovation in Building and Construction (CIB) on Construction in Developing Countries (1997-2007), Consultant to international agencies and governments on construction industry development, and construction management and economics since 1978, undertaking assignments in various countries including Botswana, Ghana, Malawi, Singapore, South Africa, Swaziland and Tanzania. Prof. Ofori is especially interested in the improvement of the construction industries of developing countries.

**Professor Koshy Varghese, Indian Institute Of Technology, Madras**

Prof Koshy Varghese is a leading international academic in the area of ICT in Construction. His keynote address will provide insights on applications of ICT in large construction projects in India and elsewhere in the world to integrate the processes of planning, design, construction and operation. Koshy will be available throughout the conference to share ideas with delegates on current developments in ICT and automation in construction. He will also be part of our research skills workshop where he will contribute to discussions on quantitative/technology research in construction and also how qualitative methods can complement quantitative techniques to strengthen research contributions.

**Bio**

Prof. Koshy Varghese is a Professor of Building Technology and Construction Management at the Department of Civil Engineering, Indian Institute of Technology Madras, India. He earned his Doctoral Degree
from the University of Texas at Austin, USA with a specialization in Computer Integrated Construction and is currently a member of the editorial board of several journals in the area. Prof. Koshy Varghese is a recipient of the prestigious American Society of Civil Engineers (ASCE) best paper award for Journal of Computing in Civil Engineering for 2011. He was conferred the Tucker-Hasagawa award for 2012 by International Association for Automation and Robotics in Construction (IAARC) for his contributions to Automation in Construction. The Project Management Institute (PMI) awarded him the Distinguished Scholar Award for 2012 for his research and practice based activities in the area of Project Management. He is currently the President of the International Association for Automation and Robotics in Construction.

Dr Ron Watermeyer, Director of Infrastructure Options (Pty) Ltd and Chair of ISO/TC 59/SC 18 Construction procurement

The design and adoption of innovative procurement systems in infrastructure delivery is a necessity in today's complex and challenging construction environment. Dr Watermeyer will speak on current developments and recent examples of projects involving design and adoption of alternative and innovative procurement systems. The keynote will outline how intended outcomes and value for money can be achieved through procurement strategy.

Bio

Dr Ron Watermeyer's qualifications include: DEng, CEng, PrEng, PrCM, PrCPM, FSAICE, FiStructE, FICE, FSAA. He is a renowned international expert on construction procurement and has been at the forefront of many development initiatives in South Africa since the early 1990s including the reinterpretation of building regulations, the classification of sites in terms of geotechnical characteristics and building practice, changing construction methods, technologies and practices to
facilitate socio-economic development imperatives and the development of construction procurement procedures and practices. His work on procurement has formed the basis for not only South African standards for construction procurement but also the recently published ISO 10845 family of standards. He has in recent years piloted the implementation of target contracts and framework agreements for the delivery of civil engineering and building projects within the public sector. He has also led the development of documented procurement and delivery management system for a number of South African public sector bodies. He served as the South African Institution of Civil Engineering's 101st President in 2004. In 2009 he obtained a senior doctorate (Doctor of Engineering) from the University of the Witwatersrand for his engineering development work which has significantly contributed to the delivery of infrastructure for the advancement of a changing South African society. In 2010 he was awarded the Institution of Civil Engineer's International medal for his contribution over time in the delivery of enabling engineering mechanisms for the UN Millennium Development Goals. He has published more than 70 papers and articles on various aspects on the delivery of infrastructure.
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Employability (or lack of) of graduates has become a widely discussed concern recently due largely to the fact that overall graduate employability is at an all-time low. The link between a nation’s economic progress and graduate employability challenges all stakeholders to make a concerted effort to tackle their respective roles in addressing the phenomenon. There are deficiencies in technical and discipline competencies, as well as other lacking employability skills/attributes such as team-working, communication, leadership skills, critical thinking and problem-solving. However the challenges experienced in developing nations runs a bit deeper. This study examines the roles and ideologies of employers, graduate students and Higher Educational Institutions (HEI’s) of architecture in North Central Nigeria and suggests key areas of improvement in the supply and demand of employment opportunities for architects in general and female architects in particular.

Key words: employability, employer ideology, female architect, Nigeria, skills development

INTRODUCTION

There is considerable evidence to suggest that those working in the construction industry are vulnerable to extenuating challenges to employability due to a variety of factors. Architects are faced with challenges associated with working in the construction industry, many of which lead to increased vulnerability to health and mental stress, career dissatisfaction with current positions and prospects, work-life conflicts and turnover intentions (Sang, Dainty and Ison, 2007). The architect is an integral part of the construction industry: made up of other allied professionals such as the engineers, surveyors, builders, quantity surveyors, town planners and estate value surveyors (Agbo and Ogbonna, 2002; Bamisile, 2004). Females remain largely underrepresented and underemployed in the profession though by international standards, almost half of the workforce (who are of legal working, those age) of Nigeria’s one hundred and forty million people, are women. In the

construction industry global figures are much lower; documented figures put female engineers at 8-10% of the total number of those registered and female architects hovering at just under 18% (Burns, 2012). Employment opportunities in architecture exist in Public Service (Federal and State) and Private Sector as consultants, project managers, administrators and academicians. Diversified areas of employment also exist in Real Estate (Housing) Procurement and Industrial Design. There is however, emerging evidence that currently only about 12% of global employment opportunities that exist in architecture and its allied construction professions are actually filled by female employees after qualification despite marginally increased figures of women in architectural programs (Sang, Dainty and Ison, 2007). Less than half those numbers likely go on to pursue active, progressive careers in design practice, management and education (Fitzpatrick, 2010).

This paper gives better understanding about the current challenges to employability of female architects in specified parts of Nigeria by examining the roles and ideologies of employers, the experiences of graduates and the contributions of Higher Educational Institutions (HEI’s) of architecture in north-central Nigeria. This is achieved by determining employer ideologies, assessment criteria, priority skills required in the employability of Female Architects on the one hand and determining curricular areas of development in HIEs and intern development programs that would enhance employability prospect for female architects on the other.

STUDY AREA

The study area is the North Central Zone which consists of six states and the Federal Capital Territory (FCT), namely Benue, Kogi, Kwara, Nasarawa, Niger and Plateau (The Conference, 1995). Since the creation of six geopolitical zones in 1995, the North Central Zone has transformed from a mainly agrarian zone of multiple ethnic minorities to a largely agrarian economy with a collective GDP of USD 29.51 billion and an average per capita is USD 1,536 as at 2010. It is the largest zone by landmass (203,050 km²) though sparsely populated (22,610,043 inhabitants). The zone is largely rural with urbanisation centred on the various state and federal capitals. As a result, amenities such as access to clean drinking water, household sanitation, and electricity supply are in short supply. The states that comprise the North Central Zone are a main source of the nation’s agriculture produce supply and solid minerals. Though adversely affected by insurgency, the zone known for tourism potentials, particularly economic tourism and the resultant construction boom, informed selection of this zone. Of the 840 architectural firms listed in the 2012 ARCON Register, 190 firms are located in the North Central Zone This makes the North Central Zone the second (22.62%) largest zone after South West Zone (42.14%). The zone also houses the Federal Capital Territory which is headquarters to all Federal Ministries and most
parastatals and governmental agencies (which account for more than half of the federal civil service workforce).

YOUTH UNEMPLOYMENT IN NIGERIA

The human capital theory expounds the perception that there exists a school-work linkage which assumes the degree of profitability of a job is dependent on the relevance of the training for the position being aspired for (Lututala, 2012). However, divergent writers argue that human capital theory does not consistently prove that productivity is linked solely to the level of education because other variable such as age, gender, race, region, profession and working hours may account for disparity in income levels. There is no short-selling the importance of good training which acts as a tool for job seekers and employers and a signal that can identify individuals most apt for recruitment for scarce jobs. Assuming fair and equal competition for employment searches, it is important to review existing training systems that would enhance the assimilation of young people into the job markets. However, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2012), graduate employment (or lack of) is still an issue of concern in most developing nations. Domestically, over half of Nigerian youth are unemployed in the formal sector although there is a high incidence of informal employment in agriculture, petty trading, commercial transportation and vending, most of which are not technologically driven. Fewer than 50% of youths in Nigeria were able to secure employment in their first year after graduation from colleges. Intervention programmes like the YouWin, National Directorate for Employment and Small and Medium Enterprises Development Agency anticipated the creation of 22,000 jobs for youth in Nigeria (Adetayo, 2015). Youth unemployment however still remains as high as 55% in 2012. There are fewer employment opportunities for women (24.9% unemployment compared to 17.7% with their male counterparts) in most of the largest contributors to economic sectors of developing economies, namely agriculture, construction, mining and trade (National Bureau of Statistics,(NBS), 2010; UNESCO, 2012). In the NBS (2010) survey, it was highlighted that there were 1,142,569 employees (out of 48,033,319 nationally) in the construction industry of which only 100,758 positions (a dismal 0.08%) were women despite a relatively even split in the sample made up of both genders. This imbalance in the supply and demand of labor in a sector of the economy that is already fraught with disparity only results in a glut that further widens the professional chasm.
THE CONCEPT OF EMPLOYABILITY: THE COMPLEXITY OF POLICY MAKING AND MANAGERIAL IDEOLOGY

The word “employability” has become the latest ‘buzzword’ in the discourse of labor market organization which scrutinizes the capacity of the education sector and training systems to endow individuals with the required skills that more likely enable them gain employment and be successful in their chosen occupations (Yorke, 2004 In Lowden, Hall, Elliot and Lewin, 2011; Almeida, 2007). At the turn of the 20th century, fresh distinctions required the use of the term to distinguish between those who were deemed employable and those who were not – its relevance intensifying due to heightened youth unemployment and underemployment in recent years. The National Institute of Adult Continuing Education (NIACE, 1998 In Lowden et al 2011) reasoned that employability was not solely an individual concern but also a social one, sharing responsibility equally between individuals, employers (whose values and attitudes shape the behaviors of their staff and to a large extent, determine who is employable) and public bodies.

Recent studies also determined that employers prefer to hire from among those that are willing to acclimatize to workplace cultures and ideologies as well as be a team player. This has often led to conflicting views on who assumes responsibility for preparing fresh graduates for employment and the requirements of the industry (Archer and Davidson, 2008; Glass et al, 2008 In Lowden et al, 2011). Employability is achieved through complex training in core skills, key skills, common skills, transferable skills, essential skills, functional skills, skills for life, generic skills and enterprise skills. The 2007 Confederation of British Industry (CBI) report broadly classified these groups of skills into “soft” and “hard” (technical) skills, where majority of employers observed in various studies seemed to value soft skills over hard skills in new graduates (Archer and Davidson, 2008; Glass et al, 2008; and CBI, 2007 In Lowden et al, 2011).

By 2009, the global recession and resultant increase in competition meant graduates and those in the workforce and seeking to progress needed to possess attributes to succeed in the workplace, especially with regards to the looming contrast between what universities are promoting and employers’ general perception of what is actually required by the industry. The significant impact of employability on a nation’s economic progress cannot be understated particularly as there presently exists political pressure on HEI’s to play a better role in addressing employability (Lowden et al, 2011; Almeira, 2007). The role of the employer, however, has continued to exert a considerable influence on the perception of graduate employability in recent times. Goll, Sambharya and Tucci (2001) surmised that growing global competition requires graduates to cope with fast changing technology, shorter product lifespans, industrial competition and rivalry and sometimes operating in culturally unfamiliar environments. The study identified corporate ideology as a significant
variable by which firm performance is assessed; this is largely attributed to the personal ideology and belief system cultivated from the upbringing, experiences and reflection of the business owner(s). In the corporate world, balancing personal ideology with smart business savvy is essential for sustainable or viable success (Lister, 2014). Key areas of ideological influence determine organizational policies which include operational judgments and schedules which produce progressive decision-making, prosocial values that improve employee-customer concern and organic hierarchical policies which encourage firms to be adaptive, flexible and responsive (Goll et al, 2001). Such organizational policies include, but are not limited to, gender policies especially in environments that may see women as women first and professionals second. In certain organizational cultures, women find they are treated equally but indifferentily. Wirth (2001) identified seven different organizational cultures or ideologies that exist in the workplace in Table 1

<table>
<thead>
<tr>
<th>Name of culture</th>
<th>Key features of workplace environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Gentleman’s Club</td>
<td>Women are seen as homemakers, men go out and work. Most women cannot challenge it and so accept such attitudes.</td>
</tr>
<tr>
<td>The Barrack Yard</td>
<td>In hierarchical structures (such as military organizations) with many layers of management. A bullying culture where subordinates are ignored. Women in particular work in junior posts and find it difficult to progress.</td>
</tr>
<tr>
<td>The Locker Room</td>
<td>An exclusionary culture where sexual references are made to confirm man’s heterosexuality. White males bonding through sport and sexual innuendo is rife. Women with power are treated the same as junior women.</td>
</tr>
<tr>
<td>The Gender Blind</td>
<td>This makes no reference to an employee’s home life or personal circumstances thereby assuming a level playing field for all employees.</td>
</tr>
<tr>
<td>The Smart Macho</td>
<td>Economic efficiency is sought at the expense of personal need. Those who cannot work long hours and sacrifice family lives do not achieve.</td>
</tr>
<tr>
<td>The Paying Lip Service</td>
<td>Men think they are not sexist as well as versed in feminism and define themselves as an “Equal Opportunist (EO)” employer. However they do nothing to promote women or minorities.</td>
</tr>
<tr>
<td>The Women as Gate-keepers</td>
<td>Resistance to women managers comes from other women employees with different career/family orientations</td>
</tr>
</tbody>
</table>


**UNEMPLOYMENT IN ARCHITECTURE: ARE FEMALE ARCHITECTS DISADVANTAGED?**

According to Rosenfield (2014) and Censky (2012), architecture is facing a new wave of unemployment challenges. In a latest study by the Center of Education and the Workforce at the American Georgetown University, 13.9% of undergraduate architects from a 2009-2010 Census Bureau’s American Community Survey database were unemployed. This figure was the most worrisome among other struggling majors such as arts (11.1%)
and the humanities (9.4%) and significantly higher than the overall graduate unemployment rate of 8.9% yet lower than the 22.9% unemployment rate of high school diploma holders. This implies that undergraduate architects are more than twice as likely to be unemployed after graduating college as engineers (7.5%), business administrators (7.4%) social workers (7.3%), agriculturists (7%), health workers (5.4%) or educators (5.4%). However, the unemployment figures of architects with postgraduate degrees dip to 7.7% which contributes to the debate on the extended involvement of HEI’s to employability of graduate architects. There are no documented records of graduate unemployment in architecture in Nigeria however a review process is ongoing (Enwerekowe, forthcoming).

METHODOLOGY
This study is a synthesis of literary research, field studies and data processing and analysis. Literary research covered the review of existing knowledge on employability and unemployment, labor imbalances, employers’ perceptions of employability of female architects and the influence of ideologies of employers on employability of female architects. The field studies gathered the responses from architectural employers (or supervisors) and graduates on the profiles of places of employment, the basic skill sets required to fill various positions of employment (permanent, contractual, seasonal etc.) and the capacity building needs of young female architects who may be seeking their first job. A total of sixty (60) questionnaires were distributed to employers in the study area from a random sampling from the current register of the Architects Registration Council of Nigeria (ARCON). A further forty (40) questionnaires were distributed to recent and current graduates with less than 5 years’ work experience employed in the above named establishments. A total of forty five questionnaires were filled correctly and returned from the employers representing a 75% response rate, while thirty six (36) questionnaires from recently employed graduates were properly filled and returned representing a 90% response rate. Questionnaires were issued electronically via email or manually using one-on-one contact which could be returned via the same channels. By means of simple statistical analysis such as index ranking, means of statistical dispersion and pictographs, the quantitative data yielded by the study presented the basis for analysis into the challenges to employability of female architects.

Theoretical Framework
In a recent review of graduate employability in the UK, Lees (2002) surmised that the discrepancy between academic and government views to the role of Higher Education (HE) constituted one of the major problems to employability. The proportion of women’s progress to representation in the professions is slow everywhere. Female architects constitute approximately 18% of the profession by international standards compared to lawyers (31%), general practitioners (30%) and dentists (22%), which is
more than twice the average number of female civil engineers at 8% (Burns, 2012). Employment and retention of women in these professions is a mutual concern not helped by the challenges to overall employability in recent times. Specific reference to challenges in the architectural profession include the existence of glass-ceiling barriers, discrimination, wage and promotion disparity, stereotyping, isolation, unfriendly firm ideology and workplace attitude challenges such as inability to work longer hours like their male counterparts or exclusion from male-friendly social networks (Anthony, 2008; Edwards, 2009). Architecture is the most centrally-placed field of design which requires years of commitment (first for training, then in practice) and women winnow themselves out of contention for limited positions of employment and advancement when they contend with obligations to gender roles characteristic to female architects in the study area. Consequentially, several myths about hiring and promoting women in competitive professions like architecture originate making it difficult for them to enhance the impressions about their employability. Available literature suggests that cultural systems (as manifested in beliefs, ideology, and myths) exert a powerful influence and enhance organizational outcomes, including recruiting and management of manpower (Lister, 2014). Ideology is an important variable by which organizational strategies affect organizational performance. Studies support the notion that ideologies influence decision making, pro-social values that improve employee-customer concern and organic hierarchical policies which encourage firms to be adaptive, flexible and responsive (Goll et al, 2001).

**Nigerian Scenario**

There are about 3,500 registered architects in Nigeria and nine hundred and fifty eight registered architectural firms in Nigeria (Nigerian Institute of Architects, (NIA), 2014); ARCON, 2012). The 2012 Register of Architects entitled to practice in Nigeria (ARCON, 2012 a) revealed that 64.8% of Nigerian architects work in private firms, 23.6% in governmental organizations at Federal, State and Local Government Levels, 6% in Schools of Architecture, 4% in other organizations, and 1.6% in Physical Planning Authorities of Tertiary Institutions. The percentage of female registered architects is presumably below 13%; the register of architects in Nigeria is not classified along gender lines (Enwerekowe, forthcoming). This is significant as a vital requirement for professional registration is supervised employment in architectural organizations. The low number of registered female architects suggests the following:

1. fewer female graduate architects are being employed in architectural organizations due to employers perceptions or employee competencies
2. fewer female graduate architects are seeking employed in architectural organizations

**DATA PRESENTATION: DISCUSSION AND ANALYSIS**

The results are presented both as a classification by gender to allow for comparison and identification of significant differences between the sexes;
and in summary to determine an overall impression of the key factors under analysis.

There is a comparable proportion of male and female employers in upper management and sole proprietorship positions in the architectural establishments surveyed however when overlaid with the lower proportion of female architects in the survey as a whole, the gender difference in the advanced stages of their careers is apparent. This is an important consideration when discussing any other gender differences that arise in the responses. Organizational size ranged from sole proprietorship respondents to those that employed over 15 people on a full time basis. Less than 40% of the respondents worked in an establishment/firm that employed between 4 and 6 people (made up of 41% of the male respondents and 33% of the female employers). 25% of the employers had between 7 and 10 people employed and an additional 19% had between 11 and 14 people employed in their establishments/firms. 13% of the total respondents worked in an establishment/firm that employed over 15 people and 6% worked in a firm that employed less than 3 people as shown in Figure 1.0

![Figure 1.0: Number of employees observed in the establishments/firms in the survey](image)

More than half (51.6%) of the female employees working in architectural establishments are non-professionals in the discipline. Female architects made up approximately 5% of senior management in the total sample (11% of the number of female architects) observed and 30% of the number of full architects although only 21% were engaged in full time employment. However, the study revealed that female graduate architects were twice as likely to be employed on a part time basis rather than as full time in most architectural establishments/firms.
### Table 2a: Employers' assessment of employability skills of female architects who work for them

| No. | Skill                                                                 | Weak (1) | Fair (2) | Good (3) | Excellent (4) | Unsure (0) | %MR | %FR** | %MR | %FR | %MR | %FR | %MR | %FR | %MR | %FR |
|-----|------------------------------------------------------------------------|----------|----------|----------|---------------|-------------|------|-------|------|-----|------|-----|------|-----|-----|
| A.  | **Functional skills:**                                                 | 0        | 0        | 25       | 67            | 33          | 33   | 33    | 0    | 9   | 0    | 9   | 0    | 9   | 0    | 9   |
| i.  | ready to participate, makes suggestions, accepts new ideas and constructive criticism, takes responsibilities for outcomes | 0        | 0        | 25       | 67            | 33          | 9    | 0     | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| ii. | Uses numbers effectively – measuring, estimating, recording and calculating | 0        | 0        | 9        | 67            | 66          | 33   | 25    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| iii. | Uses effective language – comprehends written and spoken English in a logical manner | 8        | 0        | 17       | 0             | 50          | 100  | 25    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| B.  | **Personal skills – ready to learn and exhibits good people skills** | 0        | 0        | 9        | 0             | 66          | 100  | 25    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| i.  | Self-management – punctuality and time management, appropriate dressing and behavior, overcomes challenges and seeks counsel | 17       | 0        | 17       | 33            | 42          | 67   | 24    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| ii. | Thinks and solves problems – creativity, prioritizing, solution development, self-actualizing | 8        | 0        | 25       | 67            | 58          | 33   | 9     | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| iii. | Team playing, cooperation, being assertive | 0        | 0        | 33       | 0             | 33          | 100  | 34    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |
| iv.  | Understanding the business ideology and culture, client satisfaction, and positive general outlook for the organization as a whole | 0        | 0        | 17       | 67            | 66          | 33   | 17    | 0    | 0   | 0    | 0   | 0    | 0   | 0    | 0   |

*%MR – percentage of male response, **%FR – percentage of female responses*

Tables 2a and 2b show the results of the Severity Index (SI) ranking of the employers’ assessment of the employability skills of their female workforce in architectural practices. Employability skills of female employees were ranked and the computed values establish the degree of importance of a preference used to analyze and quantify the responses of the male and female employers on the same skill. The highest ranked skill (1) is an
indication of the areas of strength of female employees in practice and vice versa.

Table 2b: Severity Index ranking of employers’ assessment of employability skills of female employees (architects)

<table>
<thead>
<tr>
<th>No.</th>
<th>Skill</th>
<th>Severity Index (Male)</th>
<th>Rank (Male)</th>
<th>Severity Index (Female)</th>
<th>Rank (Female)</th>
<th>Severity Index (Average)</th>
<th>Rank (Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Functional skills</td>
<td>2.83</td>
<td>5</td>
<td>2.33</td>
<td>5</td>
<td>2.58</td>
<td>6</td>
</tr>
<tr>
<td>(i)</td>
<td>Uses numbers effectively</td>
<td>2.83</td>
<td>5</td>
<td>2.33</td>
<td>5</td>
<td>2.58</td>
<td>6</td>
</tr>
<tr>
<td>(ii)</td>
<td>Uses effective language</td>
<td>3.12</td>
<td>1</td>
<td>2.33</td>
<td>5</td>
<td>2.73</td>
<td>4</td>
</tr>
<tr>
<td>(iii)</td>
<td>Uses IT effectively</td>
<td>2.83</td>
<td>5</td>
<td>3.00</td>
<td>1</td>
<td>2.92</td>
<td>3</td>
</tr>
<tr>
<td>B.</td>
<td>Personal skills</td>
<td>3.12</td>
<td>2</td>
<td>3.00</td>
<td>1</td>
<td>3.06</td>
<td>1</td>
</tr>
<tr>
<td>(i)</td>
<td>Self-management</td>
<td>2.75</td>
<td>8</td>
<td>2.66</td>
<td>4</td>
<td>2.71</td>
<td>5</td>
</tr>
<tr>
<td>(ii)</td>
<td>Thinks and solves problems</td>
<td>2.66</td>
<td>9</td>
<td>2.33</td>
<td>5</td>
<td>2.50</td>
<td>9</td>
</tr>
<tr>
<td>(iii)</td>
<td>Team playing</td>
<td>3.00</td>
<td>3</td>
<td>3.00</td>
<td>1</td>
<td>3.00</td>
<td>2</td>
</tr>
<tr>
<td>(iv)</td>
<td>Understanding the business ideology/culture</td>
<td>3.00</td>
<td>3</td>
<td>2.33</td>
<td>5</td>
<td>2.57</td>
<td>8</td>
</tr>
</tbody>
</table>

The results indicate that female architects are highly ranked in personal skills (ready to learn and having good people skills) by both male and female employers. Both male and female employers considered a deficiency in thinking and problem solving skill to be the greatest challenge to employability of female architects. However, in sharp contrast, male employers assessed their female workforce quite negatively in the aspect of self-management which includes time management, attire and behaviour, overcoming challenges and seeking counsel unlike the female employers who assessed self-management skills of their female staff more positively. The results also highlight the contrasting assessment of male and female employers on the ability of female employees to understand the practices ideologies and cultures. Conversely, none of the recent graduates (male or female) surveyed felt that employers’ ideologies posed an obstacle to getting employed after graduating from a Higher Education Institution (HEI). Rather 50% of the male graduates in the survey blamed lack of employment opportunities, 25% attributed the lag to lack of employable skills, nearly 13% cited the economic recession, and 5% cited a lack of personal effort and just below 7% stated “other” reasons. All of the female graduates in the survey maintained the biggest obstacle to getting employed after graduating from a HEI was a lack of employment opportunity. While half the male employers (53%) and two-thirds of the female employers (61%) expressed overall dissatisfaction with the current employability skills in recent architecture graduates, none of the
employers (male or female) attributed the deficiency to employers’ ideologies or expectations either. Rather, the emphasis was laid on ill-preparation by the HEI's and the graduates themselves. More than half of the graduates observed in the study maintain they were able to secure employment within the first year of graduating from a HEI but almost 70% of the employers admitted to not employing a female architect in the past 5 years although every single one of them conducted recruitments at least once within that same period.

DISCUSSION

The data presented here suggests that women do indeed face a number of challenges to employability in the architectural profession. While most male and female employers appear to be in agreement as to what constitute the major strengths and weaknesses to the overall employability of women in practice, the inner workings, which have a subliminal effect on the career progression and ascension of women in the profession, are not so clear-cut. The thinning down of female representation at the upper echelons of architectural practice and the higher incidence of female graduate architects in part-time employment than there are as full architects or consultants as suggested by this study, is an indication of a bigger problem: many female architects seemingly abandon their careers at a point where it is pivotal to their overall development. This study supports other empirical research on architecture and construction-specific literature that demonstrate women’s overall dissatisfaction over career prospects (Dainty et al, 2000; Anthony, 2001 In Sang et al 2007).

The nature of this study did not allow for an analysis of the causal impact of the work-styles and attitudes of the architectural profession on the employability skills of graduates and the resultant gender differences in practices but the findings can be valued in its relevance to existing research. Female architects are not getting the best out of their careers (Sousa-Poza and Sousa-Poza, 2000 In Sang et al, 2007) and there are significant gender differences in the structure of the architectural profession (Clark, 1997 In Sang et al, 2007). Further research would expound the relationship between age, experience, job satisfaction, unfriendly work practices, turnover intentions and work-life balance on the employability of female architects. Female architects in the current study showed a higher tendency to establish their own practices, perhaps in order to control their own working conditions and increase their prospects in employability.

The study reports clear aspects of growth and deficiencies in the employability of female architects in the sample. Personal skills, the most highly rated employability skill of female architects, are instrumental to development in architectural practices that deal with real people with real-life needs. Such skills would be useful in developing a niche for female
architects in consultation, project management or recently emerging fields of product sales and marketing. The study emphasizes the need for female architects to improve on their thinking, self-management and numeracy skills along with understanding their practice ideologies in order to remain relevant in the profession. The role of HEI’s cannot be understated: employers do not know the capacity of fresh graduates but their employability skills are revealed in the signs sent by their level of education which enable employers identify individuals best suited for employment. On-the-job training and mentorship schemes are viable options towards increasing the employability of female graduates which could be supported by building partnerships between HEI’s and employers with a view to harmonizing the needs of the latter with training curricula. The study suggests an increased use of internships, placements and work-based learning which current research has found to increase female students’ chances of getting a graduate-level job (Lowden et al, 2011).

CONCLUSION
The study highlights employers’ expectations that graduates in architecture (male or female) should possess technical and discipline competencies from their academic training as well as a broader range of skills attributes that include team-working, communication, leadership, critical thinking, problem solving and often, management potential. In Nigeria, where unemployment is still a challenge to the national economy, self-employment is a practical option for female architects who are prepared to build up the necessary employability skills needed to stand out in an underrepresented profession such as architecture. This study highly advocates further research into the challenges to employability of female architects in other geopolitical zones of the country and possibly the continent of Africa as a whole in order to bring about a reduction in the organizational and occupational turnovers characteristic of female architects. The data presented here are limited by the chosen methodology but could still enhance more qualitative studies into issue of declining employability and the way forward for female architects in Nigeria.

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HIGHEST AND BEST USE OF RESIDENTIAL LANDS IN SELECTED HOUSING ESTATES IN LAGOS, NIGERIA

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The study focuses on the ideology of highest and best use to achieve economic efficiency of residential land in Lagos metropolis of Nigeria. Data on variables determining the highest and best use of residential lands in Lagos were obtained through structured questionnaire fully and well completed by 542 private and corporate house owners and developers. Pearson Correlation analysis and the Multiple Regression analysis were employed to analyse the data. The study found that the significant variables determining HBU of residential lands in Lagos are accommodation units, land cost, plot size and the level of demand for the type of house on the land. Developers are advised to consider these variables when making decisions on the use of residential lands in Lagos metropolis.

Keywords: economic efficiency, highest and best use, housing estate, residential land,

INTRODUCTION

The pattern of land use in any urban area is a reflection of competition for sites between various uses operating through the price system. The impact of urbanization as well has great effect on land use patterns especially in the urban areas (Kadiri, 1998). Hence, the distribution of land for various purposes should be a major concern for efficient use of urban land. According to Mabogunje (2003), Nigeria must depend, among other things, on the highest and best use of its land resources to attain any technological breakthrough. The efficient use of land may prolong its useful economic value and promote its contribution to sustainable development.

The highest and best use of land for sustainable development requires that the use of land and its resources be harmonious with respect to physical, social, economic and institutional settings. For efficient use of land, the physical setting must be considered. This defines the natural environment in which man finds himself and with the nature and characteristics with
which he must work. The physical setting determines the total supply of land resource upon which the volume of human demands for its use is based. The physical environment has to be planned to provide easy communication and transportation, residential, commercial and industrial layouts, parks, playground, schools, shopping centres, open spaces, water, electricity, drainage, security and other hosts of facilities and services that make the city livable. Economic consideration has great impact on the allocation of land to different uses. This is because; individuals and groups will always seek to make profitable use of their land resources. The institutional setting is concerned with the roles that the cultural environment and communal forces play in influencing man’s use of land. All land developments must be legal and comply with laws, ordinances and regulations.

In the light of the preceding statements and in view of the relatively fixed physical supply of land coupled with ever-increasing population of urban centres demanding for land for residential and other uses, it becomes imperative to undertake a study on the economic use of urban residential land in Lagos metropolis.

LITERATURE REVIEW

The Highest and Best Use of Urban Land

Some land economists such as Barlowe (1986) argue that there may be two alternative highest and best uses for a particular property. One highest and best use is market derived or economic in nature and is the concept traditionally applied by valuers. In addition, there may be a social or community derived ‘highest and best use’ for a property. Barlowe uses the example of a forest which alternatively could be either cut down or retained. From the landowner’s point of view, cutting the forest may clearly be the highest and best use in economic terms. This may bring the property owner into conflict with environmental groups that promote a ‘social highest and best use’ of the property that requires that the forest be retained.

The correct definition of highest and best use has been a source of debate in real estate circles. Graaskamp (n.d) in Nalikies (2002) for example argued that highest and best use analysis should seek to incorporate or accommodate the reality of community politics. Moreover, town-planning controls may have significant impacts on the property development process and that in many instances, the optimum or most profitable development may be the one that takes the line of least resistance in terms of recognizing the concerns of the public. In terms of New Zealand valuation methodology, ‘highest and best use’ is defined in the New Zealand Institute of Valuers Technical Handbook – NZIV (1995) as: the most probable use of an asset which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the asset being valued.
Highest and best use is an economic concept and as all market-driven development is time-sensitive. According to Sevelka (2004) a bonafide developer has no use for land that cannot be immediately subdivided and “it is extremely rare for buyers to accept more than minimal risk when the contemplated use of a property involves legal condition e.g. rezoning or a physical condition (Lennhoff and Parli, 2004). The Appraisal Institute (2001) provides a similar definition of “Highest and Best Use” as the reasonably probable and legal use of vacant land or an improved property that is physically possible, legally permissible, appropriately supported, financially feasible and that results in the highest value. The word probable in the definition clearly indicates that a particular use is not a certainty – but most probable among alternatives. Probable does not by any means suggest that a complete study has been done, but that there are other possible uses and that a situation is not fully predictable. Black’s Law (2004) defines ‘Highest and best use’ as the use that will generate the most profit. This standard is used especially to determine the fair market value of the subject to eminent domain.

Although, the definitions of ‘Highest and Best Use’ from the Appraisal Institute and Black’s Law are somewhat similar, the Appraisal Institute’s definition more accurately reflects the meaning and intent of ‘Highest and Best Use’ in the market. Underlying the definition and meaning of highest and best use are four implicit criteria that a property must meet. The Highest and best use must be physically possible considering the size, shape, terrain, accessibility, frontage, depth, utility capacity and availability; legally permissible with recourse to land use regulation; financially feasible calling attention to supply and demand, construction cost versus income/return benefit; and maximally productive in relative to other comparable alternatives.

The highest and best use of a property, more than anything else, is what determines its value. According to Boddy (2002), highest and best use is defined as that use from among reasonably probable and adequately supported alternative uses which is legally permissible, physically possible, financially feasible and maximally productive. Boddy(2002) further explained that, property is always valued on the basis of its highest and best use which may or may not be its present use. Land value is based on the highest and best use of the property as if vacant and ready for development to that use. Improvements are valued according to how they contribute to (or detract from) the value of the land. The highest and best use must occur within the reasonably near future and cannot be remote or speculative.

**Highest and Best Use of Land as though Vacant**

A highest and best use analysis of the land as though vacant is performed, when appraisals include an allocation of property value between land and improvements. The major issues arising from this analysis include: the use to be made of the land being vacant and the type of improvements if any that should be put on the land and when. Land value can be based on the potential, rather than actual use.
In the analysis of highest and best use therefore, appraisers are to consider not only the suitability of the site for existing or proposed use but also its suitability for alternative uses. They must determine the use that will produce the highest present worth of the site. This determination is used later in the appraisal analysis to ascertain what contributions the improvements are making to the value of the total property.

**Highest and Best Use of Property as Improved**
The highest and best use of property as improved is analysed for two reasons. The first is to identify the property use that can be expected to produce the highest overall return for each Naira of capital invested. The second reason to estimate the highest and best use of property as improved is to help identify comparable properties.

Both the highest and best use of land as though vacant and property as improved should be the same or similar for each comparable property as for the subject property. As long as the value of the property “as improved” is greater than the value of the site as “if vacant”, the highest and best use is usually the “improved” property. Once the value of the vacant land exceeds the value of the improved property (including demolition cost), highest and best use will usually be that the improvements be demolished.

**Test of Highest and Best Use**
In order to be considered as the highest and best use of a property, any potential use must pass a series of tests. The exact definition of highest and best use varies; but generally the use must be:

- legally permissible;
- physically possible;
- financially feasible; and,
- maximally productive (Boddy, 2002)

**Legally Permissible**
Only those uses that are allowed may be considered as a potential highest and best use. This may exclude uses not allowed by zoning, uses forbidden by government regulations, and uses prohibited by deed restrictions or covenants. For example, a property that is in an area that is zoned only for single-family residential houses cannot legally be used for a commercial or industrial facility. Legally permissible uses are normally defined by current zoning and other land use regulations. Some types of land use restrictions, such as easements are relatively permanent. Zoning restrictions, on the other hand, can change depending on the government of the day.

Properties with a use that predates existing zoning regulations may be “legally non-conforming”. Legally non-conforming uses, also called “grandfathered uses” are generally considered to be legal uses of the property even though they do not meet existing zoning regulations. However, some of such uses may not be reproduced if the legally
nonconforming improvement is destroyed or damaged beyond a certain point.

**Physically Possible**

Every site has physical characteristics which determine its highest and best use. Some properties have value-enhancing views and frontages. Other properties are limited by poor access, steep topography or unstable soil. The site may have poor drainage and require an expensive type of septic system. Sometimes, one may have to balance the positive and negative attributes. For instance, an ocean front property may have geologic problems which require special foundation work, but the value of the ocean frontage may be worth the expense.

**Financially Feasible**

Financial feasibility is based on supply and demand, that is, finding out who are the potential buyers, tenants and customers. The use must have sufficient demand in the market place to have value. A use with no demand has no market value, and therefore cannot be considered a highest and best use.

**Maximally Productive**

Finally, the use must yield the maximum market value for the property. A vacant site may have possible residential, commercial and industrial uses that pass all three previous tests. However, only one can be the highest and best use. The use that would yield the maximum value would be the highest and best use.

**THE STUDY AREA**

Metropolitan Lagos is located within Lagos State in the south-western part of Nigeria. Although, there is no existing universally accepted definition of what constitutes Metropolitan Lagos, the Master Plan Unit of the Ministry of Economic Planning and Land Matters once defined it as “the area stretching from Lagos Island in the south to Agege and Isheri in the north, Ojo town in the west and Ikorodu town in the east”. It is located approximately on latitude 6° 22′N and 6° 52′N and longitude 2° 42′E and 3° 22′E (Odumosu, 1999).

Metropolitan Lagos consists of 16 urban local governments out of the 20 local government areas in Lagos State (World Bank, 2005; FGN, 2007). They are Apapa, Ajeromi-Ifelodun, Alimoso, Agege, Amuwo-Odofin, Etiosa, Ifako-Ijaiye, Ikeja, Kosofe, Lagos Island, Lagos Mainland, Mushin, Ojo, Somolu and Surulere. Lagos population according to the National Population Commission (2006) is 9.2 million. This figure is, however, being disputed by the Lagos State Government which claimed to have recorded a figure of about 18 million from a parallel census enumeration carried out.

Metropolitan Lagos comprises of heterogeneous population, with people belonging to diverse ethnic groups and nationalities. Lagos until 1991 was the capital of the Federal Republic of Nigeria. In spite of losing its position to Abuja as the Federal Capital, Lagos remains the commercial
centre of the nation. Today, Lagos exerts influential and central role in Nigeria in spite of its small land area. Lagos State with only 0.4 percent of the nation’s land area has about 7 percent of the nation’s population. A field survey conducted in 2001 showed that undeveloped land in Lagos metropolis amounted to less than 30 percent (Babade, 2003). Now more than ever, one can clearly see the unprecedented lateral expansion of Lagos veering alarmingly out of control. The pace of development has now pushed the boundaries of urban Lagos beyond the boarders of Lagos State well into neighbouring Ogun State.

**RESEARCH METHOD**

The design adopted for this study is descriptive while the sampling methods are purposive and stratified. The list of estates (sampling frame) is arranged into three strata of low, medium and high densities. In order to include some important estates, one residential estate is chosen from each stratum using purposive sampling method. The purposive sampling method helps to choose the estates that adequately represent all the estates in each stratum. In this wise, the following estates are chosen: Ikeja GRA, (low density); Ajao Estate-Isolo, (medium density); and Oyadiran Estate (high density). These estates are chosen due to their unique characteristics in terms of density, geographical location and ownership. The sample size from each of the estates has been determined statistically using Yamane (1967) model of estimating an appropriate sample size of a finite population. A total of 808 questionnaires were administered in the studied estates while 542 were returned and found useful for analysis. The overall percentage response was 67%. This was considered large enough and hence used for the study. In an attempt to evaluate the factors that determine the highest and best use (HBU) of residential lands in Lagos, the study considers the following variables namely: annual rental value, building type, accommodation units, zoning regulation, land cost, plot size, accessibility, building cost, market competition and demand. These variables are identified through review of related literature on the theme of the study, and the concepts of highest and best use of lands as vacant or developed. The Pearson Correlation is employed to determine the degree of association between HBU using annual rental value as proxy and the predictor variables. The Multiple Linear Regression Analysis is also used to determine the contribution of each of the variables to the HBU of residential lands as developed. Moreover, the analysis helps to know which of the variables made the greatest contribution. The regression analysis was conducted by employing SPSS16 computer software package. The generic equation of multiple regression models upon which the resultant model is based is given as:-

\[ Y = \beta_0 + B_X_1 + B_X_2 + B_X_3 + \ldots + B_X_9 + e_i \]

Where \( Y = \) Annual Rental Value as proxy for HBU
\( B_0 = \) Constant
RESULTS AND DISCUSSION

In pursuance of finding the significant variables that determine the highest and best use of residential lands in Lagos, this study gather all the data obtained in the low, medium and high densities together for analysis using multiple regression. The result from computer output on association between the variables is presented in Table 1.

Table 1: Pearson Correlation Analysis of HBU Determinants in Residential Estates in Lagos

<table>
<thead>
<tr>
<th>HBU Determinants</th>
<th>Correlation coefficient</th>
<th>Significance 1-tailed</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building type</td>
<td>-.002</td>
<td>.482</td>
<td>542</td>
</tr>
<tr>
<td>Accommodation</td>
<td>.256*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Zoning regulation</td>
<td>.022</td>
<td>.304</td>
<td>542</td>
</tr>
<tr>
<td>Land cost</td>
<td>.792*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Plot size</td>
<td>.790*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Accessibility</td>
<td>.349*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Building cost</td>
<td>.504*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Demand</td>
<td>.303*</td>
<td>.000</td>
<td>542</td>
</tr>
<tr>
<td>Market competition</td>
<td>-.248*</td>
<td>.000</td>
<td>542</td>
</tr>
</tbody>
</table>

Source: Analysis of Survey Data, 2012. * Significant at 0.01 level

Table 1 shows the relationships between the predictor variables and the highest and best use of residential lands in all the studied estates. The table shows that accommodation, land cost, plot size, accessibility, building cost and demand are positively correlated to annual rental values (proxy to HBU) at 0.01 significant level i.e. 99% level of confidence.

Market competition is inversely related to rental values at a relatively weak level though significant at 99% confidence level. Land cost and plot
size have the highest level of relationship with coefficient of 79.2% and 79% respectively. Building cost has an average correlation with coefficient of 50.4%. These three variables are also found to be positively related to rental values in the low density estates.

Table 2 shows the result of regression analysis on variables determining the highest and best use of lands in residential estates in Lagos.

It reveals R square i.e. the coefficient of determination as .780 or .78%. This shows the proportion of variation in the dependent variable (rental value) that can be explained by the independent variables. In other words, 78% changes in annual rental value can be explained by the joint contribution of all the independent variables while 22% variation in annual rental values can be attributed to other external variables other than the ones considered in this study. The F-value (F209.099) is highly significant at 0.01 level. Since the coefficient of determination is high (78%) and significant, the model is believed to be good and useful for predicting highest and best use of lands in residential estates.

Table 2: Results of Regression Analysis on Variables Determining HBU in Residential states in Lagos.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized Coefficient</th>
<th>Std. Error</th>
<th>Standardized Coefficient</th>
<th>Beta</th>
<th>t-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.264</td>
<td>.642</td>
<td>-3.526</td>
<td>.3526</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Building Type</td>
<td>.068</td>
<td>.076</td>
<td>.023</td>
<td>.897</td>
<td>.370</td>
<td></td>
</tr>
<tr>
<td>Accommodation</td>
<td>.218*</td>
<td>.016</td>
<td>.364</td>
<td></td>
<td>13.931</td>
<td>.000</td>
</tr>
<tr>
<td>Zoning Regulation</td>
<td>.075</td>
<td>.266</td>
<td>.006</td>
<td></td>
<td>.284</td>
<td>.777</td>
</tr>
<tr>
<td>Land cost</td>
<td>.032*</td>
<td>.011</td>
<td>.333</td>
<td></td>
<td>2.819</td>
<td>.005</td>
</tr>
<tr>
<td>Plot size</td>
<td>.002*</td>
<td>.000</td>
<td>.496</td>
<td></td>
<td>4.195</td>
<td>.000</td>
</tr>
<tr>
<td>Accessibility</td>
<td>-.230</td>
<td>.176</td>
<td>-.032</td>
<td></td>
<td>-.303</td>
<td>.193</td>
</tr>
<tr>
<td>Building cost</td>
<td>.010</td>
<td>.011</td>
<td>.023</td>
<td></td>
<td>.909</td>
<td>.364</td>
</tr>
<tr>
<td>Demand</td>
<td>.490*</td>
<td>.159</td>
<td>.075</td>
<td></td>
<td>3.081</td>
<td>.002</td>
</tr>
<tr>
<td>Market competition</td>
<td>-.182</td>
<td>.142</td>
<td>-.030</td>
<td></td>
<td>-1.278</td>
<td>.202</td>
</tr>
<tr>
<td>Df</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-value</td>
<td>209.099*</td>
<td></td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.780</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.776</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Analysis of survey Data, 2012. ** Significant at 0.01 level

The analysis further shows that accommodation, land cost, plot size and demand are all significant at 0.01 (99% confidence) level. From these analyses therefore, the significant determinants of highest and best use of lands in residential estates in Lagos are accommodation, land cost, plot size and demand.
CONCLUSION AND RECOMMENDATIONS:

The results of the study show that all the independent variables employed except zoning regulation have significant relationship with HBU. It is only market competition among others that has negative and weak correlation with HBU. The major determinants of highest and best use of residential lands in metropolitan Lagos are accommodation units, land cost, plot size and demand. It is therefore, proposed that a developer should consider the number of accommodation units in the property, the cost of the land, the size of the plot and the level of demand for the building to achieve the highest and best use of the land.

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IMPACT OF RESIDENTIAL PROPERTY DEVELOPMENT PATTERNS ON SUSTAINABLE ENVIRONMENT IN AKURE, NIGERIA

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Real property is important in physical and economic developments of towns and cities all over the world. It plays a critical role in a country’s welfare than is always recognised as it directly affects not only the well-being of the citizenry but also the performance of other sectors of the economy. This study examines the dynamics of residential property in Akure - a medium sized city in south western Nigeria and its implication on sustainable environment. The choice of this location was based on the fact that Akure is experiencing high pace of urbanization. Data were collected by grouping Akure into three neighbourhoods namely the inner traditional core, the transition zone and the peripheral district upon which multi stage sampling technique was used to select residential properties and their occupants for questionnaire administration. Simple descriptive statistical models were used in the analysis and interpretation of data. The study revealed that rooming house was dominant in the core area and transition zone and they lacked in essential infrastructure and services with its attendant effect on sustainable environment while the situation differs as when moving towards the peripheral district. The study further revealed different environmental consequences in each of the zones and based on this, deliberate and innovative policy strategies were proffered for the sustainability of our environment.

Keywords: Akure, environmental degradation, neighbourhood, residential property, spatial, sustainable environment

INTRODUCTION
The twentieth century has been a century of unprecedented population geconomic development and environmental change. For which there has been extensive debate worldwide on the relationship between population growth, depletion of resources and environmental degradation in the past few years. The transition from rural to urban is associated with shifts from an agricultural based economy to mass industry, technology and services. For the first time ever, the majority of the world’s population live in a city, and this preposition continues to grow. One hundred years ago, 2 out of every 10 people lived in an urban city. By 1990, less than 40% of the global

population lived in a city, but as of 2010, more than half of all people live in an urban area. By 2030, 6 out of every 10 people will live in a city, and by 2050, this population will increase to 7 out of every 10 people. Almost all urban population growth in the next 3 years will occur in cities of developing countries. (WHO, 2013). By the middle of the 21st century, it is estimated that the urban population of these countries will be more than doubles, measuring from 2.5billion in 2009 to almost 5.2billion in 2050. (WHO, 2013). Industrialization has provided for better economies and has sustained human development. However, this rapid urbanization and development has occurred unevenly throughout the world simultaneously with increasingly unsustainable utilization of world’s natural resources. In this context, the question about the impact of urban growth with limited and often degraded resources is most relevant for developing country like Nigeria. In the recent years ‘sustainable development’ is a commonly used terminology among various sectors of the society subsequent to the publication of Brundtland report in 1987. The Rio 1992, Agenda 21, all endorsed this need.

The sustainable development is defined as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). In order to sustain development, the supply and quality of major consumables and inputs to our daily lives and economic production such as air, water, energy, food, raw materials originate from them and are a habitat for flora and fauna. Any disturbance to this resource by way of change in land use e.g conservation of forest land, agricultural land into built up is irreversible.

Urban planners and administrative bodies require reliable information to assess the consequences of urbanization, to ensure a sustainable functioning of cities and to minimize negative impacts of rapid urbanization. Urban expansion in the developing world often takes place in an unplanned manner and administration is unable to keep track of growth-related processes (Griffiths et al., 2009). Since the 1980s, rapid population growth and urbanization have become issues in medium sized cities. The definitions vary. The most common definition is that of a town with a population of 20,000 up to 200,000, depending on population density and the respective urban system in a country (Rivkin and Rivkin 1982, Rondonelli, 1993). The geographical location has a strong influence on the respective function of a medium-sized town for the regional hinterland, though geography alone does not really explain and determine function of a medium-sized town. Such functions as it is in the case of Akure, can be - a development function that is the role of a medium-sized town as an engine for regional spatial development.

As a consequence of explosive growth, the living conditions of metropolis deteriorate. Development trends of the last twenty years have increased general wealth and modernization, this sets out how Akure is creating an increased demand for land combined with environmental degradation. The consequences of urban growth for Akure span three areas; changes in
land use, erosion and flooding, and depletion of natural resources. As population increases, this expanded growth begins to distort our environment leading to unsustainability of the environment. Land as similar to other resources is also a scarce commodity. The use of land unsuitable for development may be unsustainable for the natural environment as well as to the humans. Thus, the extent of resource exploitation, waste generation and environmental damage relies on that society’s lifestyles and pattern of development. Planning a sustainable development of cities therefore requires understanding of physical change of the main environmental drivers. This paper analyse the spatial distribution pattern of residential properties as a main environmental drivers in Akure and explore its implication on sustainable environment. While we are aware of the fact that findings of a study of this type may be more typical of the case than general to other cities, there is every reason to believe that the issues involved are more national than local. Therefore, the findings and recommendations will, hopefully be of great value to similar investigations elsewhere in Nigeria and other places of the developing country.

LITERATURE REVIEW

In Nigeria and other developing regions, urban areas and populations are growing. Cities are both engines for growth and sources of concentrated environmental problems. People flock to urban areas to seek employment, entertainment, shopping, and a generally higher standard of living. At the same time environmental infrastructure of works and services are inadequate to serve the resulting increases in population and population densities. The inevitable congestion causes environmental hazards and degradation until strategies for reversing environmental deterioration can be implemented.

The magnitude of urban population growth in developing countries is a direct indicator of the degree of spatial concentration of people, industries, commerce, vehicles, energy consumption, water use, waste generation, and other environmental stresses. Generally, most countries seek to generate increasing economic development which tends to exacerbate such problems which may exceed the preventive and solution capacity of the government as well as the assimilative capacity of nature (Roland, 2000).

Another determinant of the severity of environmental conditions within and around urban areas is their regional ecosystem type, such as: coastal, humid-tropical, mountainous, riverine ...etc. These urban ecological types are also critical factors in determining optimum environmental strategies and plans for specific and sustainable urban development. An important goal in the new millennium is to make existing and new urban areas more self-sufficient, sustainable, and enjoyable place to live.

The fact that Nigerian settlements still have inadequate systems of environmental management in contemporary times is confirmed in the
submission of the Third National Development Plan (FRN, 1975). This indicates direction of efforts by the Nigerian government. Apart from government’s plan to further consolidate efforts in housing programmes, the Third National Development Plan was also aimed at further combating overcrowding, slum and squatter settlements. Efforts at the international and global levels are on to enhance cooperation and commitment of all to a cleaner world by all. These efforts peaked in the 1990s given the two global summit (the Earth Summit 1992; and Habitat II of Istanbul, 1996). Concerns had earlier been on issues of urban deterioration, manifesting itself in a number of ways namely growth of slums and urban deterioration, increase in the growth of squatter settlement, increasing traffic congestion, air and water pollution, deteriorating infrastructure and short falls in service delivery among others. All these reduce productivity which detracts from an optimal development role for cities and a sustainable urban development path. Urban patterns are simply the outcomes of processes observed at one point in time. The spatial distribution of people and their dwellings within the urban space is the outcome of a complex set of factors (Rossi, 1955). Policies of government, the operations of the housing market, availability of land, historical factors in the development of a particular region – these all provide a background against which individual families make housing decision. The stages in the family life-cycle, income and occupation, as well as ethnic identification also appear to be important factors influencing the decision. What are the processes which give rise to the spatial structure and patterns of growth? Attempts to understand these processes have taken different directions of which two are recognized here. The distinction between the two is based on their underlying assumptions. The first approach is defined by the fundamental role of the “market” mechanism and the natural forces of competition among economic activities and social groups in an urban area. Under severely limiting assumptions, such studies are able to generate useful and testable spatial models. Among the best summaries and examples of the economic market approach to urban structure is a model of urban land use formulated by Alonso (1960).

Conceptual construct on urban land use generally draws from three different descriptive and prominent classical theories of Burgess (1925), Hoyt (1939) and Harris and Ulman (1964). These models were developed to generalize the patterns of urban land use found in early industrial cities of the United States. One of the earliest attempts to model the nature of urban land use was presented by E.W Burgess in 1925. The concentric zone model articulated by him states that as city grow; it expands radically around the Central Business District (CBD) to form a series of concentric circles. The operating mechanism of the concentric circle model was the growth and radial expansion of the city with each zone having a tendency to expand outward. The model was based on ecological principle of invasion and succession and therefore, was designed as both statement of function zoning of urban growth. In Hoyt’s model the central business district remains as a circular form at the centre of the city while residential area of similar socio-economic status originating near centre
tend to migrate in sectors towards the urban fringe. Socio-economic status then varies according to an angular measurement about the city center. The multiple nuclei model as applied to urban areas was first suggested by R.M. Hurd and R.D. McKenzie and later elaborated upon by C.D. Harris and E.L. Ullman. The basic notion of this model is that urban land uses concentrated around several nuclei rather a single core. It is an amalgam if Burgess and Hoyt’s model with the addition of multiple nucleuses, there are many nuclei in the city. That the central business district is not necessarily located at the geometric centre of the city, but may be off to one side, other nuclei may be centers of industry, wholesaling, education, etc.

In the case of urban communities and the structure of residential areas, these same forces become essentially social and environmental in nature, but the “competitive” market philosophy is still prominent. Filling in the cells created by the transportation network are the city’s residential sector. Within these sectors, distinctive community types may be recognized. Several studies have described the processes which give rise to specific residential land – use patterns (Robert 1971, David, 1971, Harold, 1971, Bourne, 1971). Other studies in Nigeria include Olawuni, Abegunde and Adeyinka, (2002) on spatial variation of housing quality in Nigerian urban centres, Ademola (2006) on land use change in Ibadan; and Julius and Ojeifo (2007) on neighbourhood preferences in Warri.

The second approach is concerned with the behaviour of urban residents and the decision – making processes which produced urban patterning. It is evident that the city grows and takes a certain form because of decision made by individuals, corporations and institutions. These decisions are varied. Several studies have been conducted in these regards. These include Oduwayne (2002) on determinants of residential land value, Amoo (2004) on the effect of location elements on property value.

Sustainable urban form has been recognized as one of the major concerns of the planning practice. Current land use pattern trends with low-density, single-use leapfrog urban growth on city outskirts call for a more efficient land use development strategies, balancing economy, environmental protection, and social equity. Current urban land uses exhibit inefficient patterns that are of a major concern for sustainable development (Lecceese et al, 2000; Silberstein and Maser, 2000; Ward, Murray and Phinn, 2003; Williams et al, 2000). Low residential densities, sprawl and leapfrog fragmentation of urbanization, rapid open space development on the edge outweighing redevelopment of the declined inner city, and patches of single land use, all dominate in current urban form reality (Galster, Hanson, Ratcliffe, Wolman, Coleman and Freighage, 2001; Grimshaw, 2000; Silberstein and Maser, 2000; Williams, 2000). Such trends lead to an increasing ethnical and economic separation, deterioration of the environment, loss of agricultural land and wilderness, and the erosion of society’s architectural heritage (Lecceese et al, 2000). Research suggests that up to 70% of the consumed energy is dependent on land use arrangements (Barton, 1990). In consequence, the importance of sustainable land use allocation cannot be underestimated.
In Nigeria, the literature on urban land use indicates a strong adherence to the conventional land use planning approach. Most major cities including Lagos, Kaduna, Port Harcourt, Onitsha, Enugu, Aba and some in other parts of Niger Delta region have been developing with the conventional land use approach (Jiboye, 2005). This has generated diverse urban problems manifesting in the form of deterioration of cities into slums, pollution, congestion, unsanitary condition and epidemics. They are characterized by non-functioning infrastructural facilities, most poorly governed, intensively dotted with illegal structures, while physical growth and development of the cities had not been properly managed or controlled (Aluko, 2000). According to Falade (2003), land use plans for most cities often seek to make life better for the masses living in cities as a major goal, but the reality of the case is that these lofty and laudable goals are never achieved. Thus, people in urban areas wallow not only in abject poverty, but they also do not live in planned urban areas, which are “orderly safe, convenient and healthy living environment’ that is promised as the gains of land use planning (Falade, 2003; Baba, 2003).

**STUDY AREA**

Nigeria is located in Sub – Saharan Africa and is a country in West Africa. Nigeria shares land borders with the Republic of Benin in the West Chad and Cameroun in the East and Niger in the North. Its coast lies on the Gulf of Guinea in the South and it borders Lake Chad to the North East. The country’s geographic coordinates are 10° 00’N 8° 00’E. Akure, the capital of Ondo State in South Western Nigeria, lies on the intersection of lat. 7° 17’ and long. 5° 14’. Akure is located approximately 700 kilometers South West of Abuja, the Federal Capital of Nigeria and about 350 kilometers to Lagos the former capital of Nigeria. It is located within the tropical rain forest region of Nigeria where rainfall is high throughout the year.

Shortly after the civil war years in Nigeria (1967 – 1970) and especially from the late 1970s, huge resources and national revenue from the highly profitable oil economy, political pressures and the need for ethnic integration and national stability led to the creation of more States and Local Government Council Areas in Nigeria (Akinbamijo, (2002). The restructuring led to reclassification of many settlements and the emergence of new urban centers of regional and national importance.

Akure, the study area is the product of this political administrative restructuring of the late 1970s in Nigeria. It metamorphosed from a hitherto quite low lying provincial headquarters status of the old Ondo province having been carved out of the old Western State of Nigeria. The increased relative political influence of Akure as a state capital since 1976 has greatly promoted its rapid growth and increased socio-economic activities resulting in its spatial expansion from an area of about 16 squares kilometers in 1980 to about 30 square kilometers in 2000 (Ministry of Works, Lands and Housing, 2000). The 1991 national
population census, however, puts the population of Akure at 239,124 and its population in 2006 was 353,211 (NPC, 2006). Using a growth rate of 3.2 percent (NPC, 2006), the city is estimated to have over 413,459 people as at 2010.

As a result of its designation as a State Capital in 1976, Akure experiences more accelerated growth and more serious problems compared to other towns in Ondo State (DHV, 1984). The population growth rate of Akure has serious implications on the trend of urban residential development and high demand for housing. This upgrading inevitably introduced new dimensions into the dynamics of urbanization processes, patterns and problems in Akure. The upgrading has also influenced the character of the urban growth and population redistribution patterns within urban centers of the old provinces and cities in Nigeria. In less than forty years, the change in political status of the new capital city has brought in structural peculiarities typified by a large presence of peripheral public and private residential estates. Easily discernable fallout of this restructuring is environmental degradation and its implication on sustainable environment. On a general note too, dynamic and conflicting land use patterns have crept unto the urban scene. The study was conducted within this setting.

**RESEARCH METHOD**

Akure the study area is made up of many residential areas, which for the purpose of this study have been differentiated into ‘natural areas’. These are simple amalgamations of the city based on their neighbourhood characteristics. In respect of this study, the stratified sampling and the systematic random sampling techniques were used. A study of this nature cannot possibly trace every building within a town; consequently the stratified sampling technique was adopted. This was achieved by dividing the region into smaller residential zones. Such criteria as established in previous works may include land use types, economic structure, and land use density, physical qualities of neighbourhoods or political divisions. This research adopted physical quality of residential neighbourhood as delineation criteria based on earlier works of Olanrewaju(1977), Fasakin(2000), Akinbamijo(2004) and Ogunleye (2011). Based on this, Akure town was therefore stratified into three zones namely the inner core, the transition zone and the peripheral districts for the purpose of data collection.

The inner traditional zone according to O'Connor (1983) can also be referred to as indigenous city, constructed mainly prior to the European colonization era. The zone is the heartland of the city and in this zone, 27 residential neighbourhoods were identified while 14 were selected for questionnaire administration. The transition zone includes most of postcolonial developments on the Akure urban space. It is quite extensive, reaching to the present day sub urban developments. It radiates in all directions from the old city core. In the transition zone, 10 residential
neighbourhoods were identified out of which 5 were selected for questionnaire administration. The peripheral district at the fringe is the low density area. These are estates developed by government agencies in high compliance with development control ethics. The houses have uniformly high building standards and as such have representation by whatever quantity sampled. Four housing estates were identified in this category out of which 2 were chosen for the research as a result of their homogenous nature.

The study adopted multi-stage sampling technique comprising stratified and random sampling technique. Based on previous similar studies, the study area was divided into 3 strata derived from 42 traditional and modern residential neighbourhoods. For ease of questionnaire administration, 50% of the total 42 residential neighbourhoods that is 21 neighbourhoods were chosen for the study. A sample is, therefore, selected from the 3 strata in proportion of the number of neighbourhoods in each stratum. Hence a sample of 14 neighbourhoods is selected from the high density and 5 and 2 were chosen from the medium and low density respectively. Thereafter systematic random sampling was used to select respondents in the classified residential neighbourhood. In order to gather necessary data from the households within the study area, a predetermined number of 1400 copies of questionnaire were decided on while. First, because the use of a particular mathematical model to determine the sample size may result in a sample size that cannot be managed by the researcher. According to Fasakin (2000), the above is rational and safer since the use of a straight jacketed statistical formula to obtain a sample size and proportion especially in the developing countries is fraught with dangers. Second, this method arises because of lack of disaggregated population figures for residential buildings. Again, as the time of data gathering, the 2006 census figures for houses were not available for Local Governments. There were also no available records of residential properties captured with Geographic Information Systems (GIS) in the study area. In each residential zone, every 5th house along a street was selected starting from the first building until the maximum number of respondents for that residential neighbourhood was covered. Altogether, 1014 questionnaire were retrieved for analysis.

**DATA ANALYSIS AND DISCUSSIONS**

The study examined the educational status of the respondents as it is seen to be crucial in the knowledge of basic housing studies that make for good urban living. In Table 1, it was discovered that 5.2% and 3.5% in the inner core and zone of transition respectively claim to have no formal education while the peripheral districts recorded the highest educational attainment level with 58.8% of the respondents having post-secondary education. The implication of this finding is significant in that education is crucial factor in the objective appreciation of contemporary issues relevant to environmental studies. This means that majority of the respondents are
aware of environmental education and the information given by them will be reliable.

| Table 1   Educational status across residential neighbourhood |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Education                          | Inner core      | Transition zone | Peripheral      | All density zones |
| status                             | Freq  | %      | Freq  | %      | Freq  | %      | Freq  | %      |
| No formal education                | 35    | 6.8    | 12    | 3.5    | 11    | 7.2    | 76    | 7.5    |
| Elementary                         | 225   | 43.4   | 64    | 18.7   | 6     | 3.9    | 287   | 28.3   |
| Secondary                          | 201   | 38.8   | 116   | 33.8   | 46    | 30.1   | 351   | 34.6   |
| Post secondary                     | 57    | 11.0   | 151   | 44.0   | 90    | 58.8   | 300   | 29.6   |
| Total                              | 518   | 100    | 343   | 100    | 153   | 100    | 1014  | 100    |

The household size was also examined. This is a measure of the number of persons residing in each housing unit. The household sizes were examined across the selected residential neighbourhoods. This is very crucial in urban spatial analysis. As shown in Table 2, the inner core area has 61% of large families – large families having been defined as families with more than six members (Fasakin, 2000). This family size however reduces as we approach the transition zone (55.4%) and the peripheral area (21.6%). The implication of this is the consequential effect on the environment as more pressure will be on available environmental resources and basic services.

| Table 2: Analysis of household size |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|
| Household size                    | Inner core      | Transition zone | Peripheral      | All density zones |
| size                              | Freq  | %      | Freq  | %      | Freq  | %      | Freq  | %      |
| 1-3                               | 50    | 9.7    | 26    | 7.6    | 39    | 25.5   | 115   | 11.3   |
| 4-6                               | 150   | 29.0   | 127   | 37.0   | 81    | 52.9   | 358   | 35.3   |
| 7 and above                       | 318   | 61.4   | 190   | 55.4   | 33    | 21.6   | 541   | 53.4   |
| Total                             | 518   | 100    | 343   | 100    | 153   | 100    | 1014  | 100    |

In carrying out the analysis of the physical condition of the building, the types of building occupied by respondents were examined. The study revealed five major types of building in the study area namely: tenement building, detached and semi – detached bungalow, block of flats and duplex houses. Table 3 reveals that the respondents in inner core and transition zone were mostly found in multi-family (tenement) buildings (88.2%) and (58.8%) respectively while detached bungalow constituted the highest building in the low density neighbourhood (45.1%). The implication of this is that different environmental impact will be applicable to different types of residential development. For example, in the inner core where we have majority of tenement buildings, with multiple occupation, environmental problems such as waste disposal, pollution, etc. will occur.
Table 3: Type of building across the zones

<table>
<thead>
<tr>
<th>Household size</th>
<th>Inner core</th>
<th>Transition zone</th>
<th>Peripheral</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Tenement</td>
<td>457</td>
<td>88.2</td>
<td>202</td>
<td>58.9</td>
</tr>
<tr>
<td>Block of flats (S/Detached)</td>
<td>10</td>
<td>1.9</td>
<td>18</td>
<td>5.2</td>
</tr>
<tr>
<td>Bungalow (Detached)</td>
<td>11</td>
<td>2.1</td>
<td>37</td>
<td>10.8</td>
</tr>
<tr>
<td>Duplex</td>
<td>32</td>
<td>6.2</td>
<td>73</td>
<td>21.3</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
<td>100</td>
<td>343</td>
<td>100</td>
</tr>
</tbody>
</table>

The age of the buildings varied among the residential neighbourhoods. The high density comprises the oldest part of the town and hence a large population of the buildings (48.2%) was constructed before 1960 of which a large number are unsatisfactory by modern standards. They lacked in essential facilities - kitchen (30.9%), waste disposal (60%), drainage (5%) and electricity (4.1%) as shown in Table 5. This will have an impact on the degradation of the environment.

Table 4. Age structure of building

<table>
<thead>
<tr>
<th>Neighbour type</th>
<th>Inner core</th>
<th>Transition zone</th>
<th>Peripheral</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Before 1960</td>
<td>241</td>
<td>47.3</td>
<td>31</td>
<td>9.0</td>
</tr>
<tr>
<td>1960-1975</td>
<td>124</td>
<td>24.3</td>
<td>102</td>
<td>29.7</td>
</tr>
<tr>
<td>1976-1995</td>
<td>85</td>
<td>16.7</td>
<td>104</td>
<td>30.3</td>
</tr>
<tr>
<td>1996-2010</td>
<td>60</td>
<td>11.8</td>
<td>106</td>
<td>30.9</td>
</tr>
<tr>
<td>Total</td>
<td>510</td>
<td>100</td>
<td>343</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Amenities/services within the residential neighbourhood

<table>
<thead>
<tr>
<th>Amenities</th>
<th>Inner core</th>
<th>Transition zone</th>
<th>Peripheral</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Kitchen facilities</td>
<td>160</td>
<td>30.9</td>
<td>153</td>
<td>44.6</td>
</tr>
<tr>
<td>Waste disposal</td>
<td>311</td>
<td>60.0</td>
<td>155</td>
<td>45.2</td>
</tr>
<tr>
<td>Drainage</td>
<td>26</td>
<td>5.0</td>
<td>28</td>
<td>8.2</td>
</tr>
<tr>
<td>Electricity</td>
<td>21</td>
<td>4.1</td>
<td>7</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
<td>100</td>
<td>343</td>
<td>100</td>
</tr>
</tbody>
</table>

Majority (97.7%) of the buildings in the high density zone are located on plot sizes approximately 450 square metres as shown in Table 6. The implication of this is that the crowding index of the buildings will be very high. Hence the crowded and cramped living condition noticed in this area.
This is likely to influence the impact of flooding in this area since in those days; enforcement by the Development Control Unit of the Town Planning Authority was not effective. At the peripheral zone, the facilities here are also of higher grade (93.3 %) of the buildings sampled having plot sizes ranging between 750m2 – 1000m2.

### Table 6: Size of plots across residential zones

<table>
<thead>
<tr>
<th>Plot size (m²)</th>
<th>Inner core</th>
<th>Transition zone</th>
<th>Peripheral</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Below 450m²</td>
<td>506</td>
<td>97.7</td>
<td>8</td>
<td>2.3</td>
</tr>
<tr>
<td>451-700m²</td>
<td>5</td>
<td>1.0</td>
<td>320</td>
<td>93.3</td>
</tr>
<tr>
<td>701-1000m² and above</td>
<td>7</td>
<td>1.4</td>
<td>15</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
<td>100</td>
<td>343</td>
<td>100</td>
</tr>
</tbody>
</table>

The analysis of the building condition across the neighbourhoods as shown in Table 7 revealed that most buildings in the peripheral neighbourhood (76.6%) are adjudged to be good while those in the transition and core areas are fair with 43.1% and 45.3% respectively. This means that environmental impact relating to bad housing will occur mainly in the medium and high residential neighbourhoods.

### Table 7: Building conditions

<table>
<thead>
<tr>
<th>Ownership</th>
<th>High density</th>
<th>Medium density</th>
<th>Low density</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Good</td>
<td>112</td>
<td>21.6</td>
<td>153</td>
<td>44.6</td>
</tr>
<tr>
<td>Fair</td>
<td>183</td>
<td>35.3</td>
<td>155</td>
<td>45.2</td>
</tr>
<tr>
<td>Poor</td>
<td>223</td>
<td>43.1</td>
<td>35</td>
<td>10.2</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
<td>100</td>
<td>343</td>
<td>100</td>
</tr>
</tbody>
</table>

The study further enquires about the causes of environmental degradation in each of the residential zones. Table 8 revealed that flooding (41.3 % and 38.3%) and pollution (26.2% and 14.9%) are the major consequences of environmental degradation at the inner core and the transition zone respectively. However, deforestation (37.3%), soil erosion (35.3%) and quarrying (15.7%) are the major environmental consequences in the peripheral district.

The study reveals that the city has been allowed to grow in a haphazard and unplanned way. Therefore uncontrolled expansion has meant that fertile agricultural land surrounding the city has been consumed by the city. Some dire environmental consequences have also resulted. The quantity of the environment has great implications on the quality and value of the people and their neighbourhoods. There are a number of important consequences of the existing residential structure of the inner core of Akure. One relates to the development of congested, old housing and unplanned layout inadequately served by facilities necessary for
healthy operations. The major problems associated with this include disease outbreak, water pollution, and air pollution and unbalance ecosystem.

Table 8: Type of Environmental degradation in the zones

<table>
<thead>
<tr>
<th>Household Size</th>
<th>Inner core</th>
<th>Transition zone</th>
<th>Peripheral</th>
<th>All density zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Pollution</td>
<td>136</td>
<td>26.2</td>
<td>51</td>
<td>14.9</td>
</tr>
<tr>
<td>Flooding</td>
<td>214</td>
<td>41.3</td>
<td>125</td>
<td>38.3</td>
</tr>
<tr>
<td>Deforestation</td>
<td>133</td>
<td>25.7</td>
<td>91</td>
<td>26.5</td>
</tr>
<tr>
<td>Quarrying</td>
<td>21</td>
<td>4.1</td>
<td>53</td>
<td>15.5</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>14</td>
<td>2.7</td>
<td>13</td>
<td>3.8</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
<td>100</td>
<td>333</td>
<td>99</td>
</tr>
</tbody>
</table>

One of the greatest environmental degradation at the inner traditional core and the zone of transition are flooding. Floods are usually called natural disaster, but human activities have contributed to the sharp rise in flood and damages. Flooding is devastating as has been done in city centre of Akure. This is mainly due to blocked drainage channels. The worst of such flood normally experience during the period of rainfall every year due to lack of proper drainage system channelization.

Again, the forest in the study area is noted for providing fuel wood for local population especially those at the core and transition areas. The persistent sourcing of alternatives for energy at home especially for domestic cooking and for small scale industries has necessitated the use of firewood and charcoal. The demand for wood energy is been augmented as a result of recent increase in oil and kerosene, and gas price and even erratic electricity supply.

The problem of deforestation and degradation have resulted from various human activities which have brought in its weak a host of other environmental hazards such as accelerated soil erosion, declining soil fertility, loss of biodiversity, loss of agriculture land, siltation of water bodies and inability of the forest to regulate the climate. The following human activities ranging from agricultural purposes, firewood collection and undulated timber harvesting are the principle of immediate causes of forest losses.

One of the main and obvious losses suffered at the peripheral district of Akure as a result of the phenomena city expansion is forest degradation. Serious and retarding as the wood shortages are, the problem hardly bears a comparison with the deep environmental effects of deforestation. It has led to loss of forest product, uncontrolled erosion, climatic change, the hydrological cycle in soil fertility and rapid extinction of biodiversity and also the loss of rich agricultural soil and farmlands to city dwellers with serious consequence to the food production capability of the area. Once a piece of land is bought up, the previous owners of the land abandon farming and either move into the city or find the less exciting occupation
to engage in; yet these occupations by themselves add to the environmental and resource depletion in and around the city.

This zone also losses a lot of fertile land to gravel merchants who lease close tracts of rich alluvial soil from the owners. By the time the gravel and the sand winners have finished with the excavation, land is utterly destroyed and is not good for any purpose whatsoever. Quarrying also destroys good land and also takes place at the peripheral zone. Sometimes the land leased out for quarrying actually is overlaid with the good soil that can support vegetation and farming, but quarrying destroys all this. Quarrying also encourages gully erosion.

The population of Akure has been growing very rapidly and as population increases, there is the need for more land for residential development especially around the fringes. This has increased the demand of wood for residential buildings, roads and bridge construction, thus placing further pressure on the forest. In addition to this direct cause of forest degradation, forest, forest clearing and de – reservation have been carried out to give way to infrastructural development in several places. As a result of this, timberwork is a flourishing enterprise in Akure and these activities take place within the periphery. The findings of this study agrees with related previous studies of Omisore and Abegunde (2002) and Abegunde and Omisore (2003) on environmental degradation in Nigeria.

The extensive and excessive use of the remaining land around Akure perhaps is one of the factors contributing to the North West and south westward encroachment of the savannah type that is becoming noticeable in the northern outskirts of the city.

CONCLUSION AND RECOMMENDATIONS

The study examined the impact of residential property development patterns on the sustainability of the environment in Akure, Nigeria. Data were collected by grouping Akure into three zones namely inner traditional core, transition zone and peripheral districts. It was discovered that different environmental degradation are peculiar to each zones.

Property development as a result of urbanisation is a major contributing factor to much type of these environmental stresses. The role of increasing population size is especially prominent as the major force driving the need to increase food production and environmental stresses on water, forests, soil and air that stem from agriculture. The development challenge ahead is to explore and understand the implications of a sustainable future and to adopt a new set of guiding principles and practices suited for it. Sustainable communities are the next steps in suggesting an alternative vision for a better life in a still unsustainable region. If we fail to create cities that are environmentally and socially sustainable, the prospects for human development in Nigeria and indeed developing countries are grim.
There is a need therefore for a deliberate government policy that would provide the necessary database for a given location to tackle the challenges of environmental degradation such tools as economic and regulatory instruments, property rights, land management instruments, and information / education. Experience throughout the world recommends that an effective approach for confronting urban environmental issues is to formulate an urban environmental management programme complete with policies, strategies and action plan (Adeshina, 2003, Oyinloye, 2011). This approach is based on participation, building commitment, and choosing effective policy interventions. The key policy messages recommended are as follows:

The process of urban decay and renewal is a phenomenon that is usually associated with cities. The type of renewal scheme advocated here is an environmental improvement schemes for the inner core area. The blighted area should be left as it is with little disruption to the social and economic life of the people but the area is renewed gradually through the provision of social infrastructures and piecemeal renovation and upgrading of existing residential buildings.

Mobilizing public support and participation especially in the inner core areas where increased awareness can bring about necessary political commitment and the implementation of affordable solutions. Base on this, environmental awareness campaign should be pursued with vigour and determination as a tool for conditioning the attitude and behaviour of Nigerians towards the environment and corporate activities. At present, majority of city dwellers especially at the inner core seems to treat environmental issues with levity. This emanates from gross ignorance of environmental issues. Thus mounting an environmental awareness campaign represents a sure source of stimulating dormant environmental consciousness.

Land use permeates virtually every aspect of sustainable communities. Sustainable land use can help invigorate communities, and provide considerable environmental, economic, social, and cultural benefits. The solution to environmental problem is the adoption of the policy of sustainable development, which could be achieved through balanced land use and resources conservation and preservation.

Nigeria has over the years indicated good intention to protect the environment. The seriousness attached to environmental problems has been informed in the numbers of environmental laws, regulations, guidelines and standards put in place. It is clear from the paper that in order to reverse this. The city planners ought to try and exercise some degree of control over how the city is allowed to grow. There should also be deliberate attempt to monitor environmental consequences in order to make the study area a liveable urban centre that will enhance the quality of life of its inhabitants. Therefore, the monthly compulsory environmental sanitation organised by the state government is commendable and should be pursued with vigour.
Poverty alleviation and population reduction should be among the highest priority of any urban development strategy. Elimination of poverty requires a systematic effort geared at fully exploiting our agricultural resources and shoring up the utilization of the installed capacity in our industries. Concerns for the desire for a satisfactory quality of the environment have led to an increase focus of solid resource utilization. What is required is the adoption of policies towards waste reuse as a way to develop more sustainable cities in which waste is recycle into urban farming whereby the environment and health will be improved, employment generated and indeed the production of more agricultural products with solid waste could make a significant contribution to society’s agricultural need.

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INCLUSIVE ACCESS TO ACCRA SHOPPING MALLS

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On daily basis, People with Disabilities (PWDs) are faced with barriers, which effectively exclude them from participating in society as equal citizens. Many of these barriers relate to the accessibility of the built environment. In recent years, a number of shopping malls have sprung up in Accra, the capital of Ghana. They depict grandeur and class and the question is whether all and sundry have equal access to these facilities. This study was conducted on six shopping malls in Accra to assess the various provisions made by their designers to give equal access to all users. Using purposive sampling, fifty five (55) questionnaires were distributed to PWDs who belong to the Ghana Federation of the Disabled in Accra. Also, a checklist designed from international standards (BS 8300, 2010 and Solidere, 2004) were employed to audit the malls. Interviews were also conducted with major stakeholders of the built environment including governmental institutions. The data was analysed using descriptive statistics. The outcome of the study revealed that the buildings studied did not meet most of the requirements of standards on accessibility for the PWDs.

Keywords: accessibility, built environment, equal access, people with disabilities, shopping mall

INTRODUCTION

Guaranteeing equal access for People with Disabilities (PWDs) has been a major quest which came to the fore internationally with the declaration of 1981-1992 as the UN Decade of Disabled Persons. Disability is seen to arise from the interaction of health conditions with contextual factors. It is therefore not seen only as a medical issue but more so as a social one (Gibilisco, 2010). In this regard, factors that are seen to affect equal access, participation and inclusion of PWDs include those in the built environment (WHO, 2011 WHO, 2001). PWDs include persons who have physical, mental, intellectual or sensory impairments, which while

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interacting with various barriers, may hinder their full and effective participation in society on an equal basis with others (UNESCAP, 2011). The United Nations (2013) therefore advocates for the removal of barriers in the built environment.

Barriers are factors in a person’s environment that, through their absence or presence, limit functioning and create disability – examples include inaccessible physical environments (WHO, 2011). Barriers are manifested by way of stairs, lack of ramps, narrow doorways and complex door furniture among others (Danso et al., 2012). Article 9(2.b) of the CRPD (2006) requires that states parties ensure that private entities that offer facilities and services which are open or provided to the public take into account all aspects of accessibility for PWDs. This includes shopping malls. In fact it is also in the interest of mall owners that malls are as accessible as possible in order to attract more people to the shops and also compete with internet shopping (Hashim et al, 2011). The aim of this study therefore is to ascertain whether the several shopping malls that have sprung up in recent years in the nation’s capital are accessible to the disabled people.

The preamble of the United Nations Universal Declaration of Human Rights emphasises the importance of equality. This is further buttressed by the Convention on the Rights of Persons with Disabilities (CRPD, 2006). Various states parties have accordingly taken steps through national constitutions, various legislations, codes and standards to put these rights into effect. In Ghana, the 1992 Republican Constitution, the Labour Act 2003, (Act 651), and the Persons with Disability Act 2006, (Act 715) are some of the legislations that aim at giving effect to the realisation of these rights.

Ghana’s Persons with Disability Act stipulates that the owner or occupier of a place to which the public has access shall provide appropriate facilities that make the place accessible to and available for use by a PWD (Act 715, Sec.6). Among places that the public has access are shopping malls. The BS 8300 (2010) also states that shopping malls should be accessible to disabled shoppers and provision should be made for disabled staff to be employed in all areas. Therefore the approach, entry and internal circulation among others should be capable of being used by PWDs (BS8300, 2010). In fact an appropriate inclusive design will not only benefit consumers but also those companies who want to expand their potential market (Hashim et al, 2011).

Accessibility includes ease of independent approach, entry, evacuation, and or use of a building and its services and facilities by all of the building's potential users with an assurance of individual health, safety, and welfare during the course of those activities (ISO, 2009). It is the degree to which an environment, service, or product allows access by as many people as possible, in particular PWDs (WHO, 2011). The principle of accessibility may be mandated in law or treaty, and then specified in detail according to international or national regulations, standards, or codes,
which may be compulsory or voluntary. This then becomes the accessibility standard or code. To further ensure accessibility, nations and international bodies do come up with their accessibility standards or codes (WHO, 2011). Article 9(2.a) of the CRPD (2006) enjoins states parties to take appropriate measures to develop, promulgate and monitor the implementation of minimum standards and guidelines for the accessibility of facilities and services open or provided to the public. Examples of these are the UN Accessibility for the Disabled: A Design Manual for a Barrier Free Environment (Solidere, 2004); British Standards BS8300:2010; and Accessibility Standards: A Practical Guide to Create a Barrier-Free Physical Environment in Uganda (UNAPD, 2010). Ghana does not have her own accessibility standards so consultants pick and choose which aspects of international standards they should incorporate in their designs (Danso and Tudzi, 2015). This study on All Inclusive Access to Shopping Malls in Accra, Ghana has therefore been motivated by these underlying conditions.

**METHODOLOGY**

The study involved a review of relevant literature; interviews with engineers and architects of the built environment; questionnaires administration; and the development and use of a checklist for the assessment of the elements of the malls. The purposive (selective) sampling technique was used to select the respondents because there was no data on the population of PWDs who use malls in Accra from which sampling methods (especially probability sampling) could be used. This method is based on the judgement of the researchers. Purposive sampling techniques have different goals and can provide researcher(s) with the justification for generalisation from the sample that is being studied (Laerd.desertation.com, 2015). The key research questions on which the analyses of this study have been based had to do with the bio data of respondents; type of disability; frequency of mall visits; and the perception of the extent of restrictiveness of the malls. The items on the questionnaire were mostly closed ended ones so as to provide a good basis for statistical analyses. There were some open ended ones too to provide qualitative data to further enrich the responses.

Using purposive sampling, fifty five (55) questionnaires were distributed to PWDs who belong to the Ghana Federation of the Disabled and also use shopping malls in Accra, the capital of Ghana. Fifty were appropriately responded to and retrieved but the remaining five PWDs could not be traced. 46% of the respondents were females and the rest were males. The respondents were a relatively youthful population with a mean age of 32 years for males and 33 years for females. This implies they belong to the age group of the active working class of the society (UNDESA, 2015). The respondents were also made up of 28% visually impaired; 24% hearing impaired; and 48% mobility impaired compared with data from the Ghana Statistical Service (GSS, 2012) which indicated that in the last population
census, the most dominant disability type in Ghana is the visually impaired (40.1%) followed by physical impairments (25.4%).

A checklist designed from BS 8300 (2010) and Solidere (2004) were used to determine levels of restrictiveness of various elements in the malls since they are among the key international standards that currently influence construction in Ghana. The levels of restrictiveness were graded on a scale of 1 to 3 (‘1’ was for mild or no restriction i.e. where the element met 70% or more of the requirements stipulated in the two standards mentioned above, ‘2’ was for moderate restriction i.e. where the element met 40% to 69% of the requirements, and ‘3’ was for severe restriction i.e. where the element met less than 40% of the requirements). Building elements like car parks, building entrances; stairs; ramps; lifts; lavatories; access routes; signage; and counters/ reception areas of the malls were covered in the checklist. The survey was conducted in 2013 and it covered the number of large malls (six) in operation in Accra at the time. The names of the malls are presented in Table 1. The number of storeys in each building refers to the number of floors covered by the shopping malls only.

Table 1 Shopping Malls

<table>
<thead>
<tr>
<th>Mall</th>
<th>Year of Construction, Commissioning or Start of Operation</th>
<th>Total floor area (SQM)</th>
<th>Number of storeys</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; C Mall (ACM)</td>
<td>2005</td>
<td>6,000</td>
<td>2</td>
</tr>
<tr>
<td>Accra Mall (AM)</td>
<td>2008</td>
<td>25,500</td>
<td>2</td>
</tr>
<tr>
<td>Legon Mall (LM)</td>
<td>2012</td>
<td>Not available</td>
<td>1</td>
</tr>
<tr>
<td>Makola Shopping Mall (MSM)</td>
<td>1996</td>
<td>4,042</td>
<td>2</td>
</tr>
<tr>
<td>Melcom Accra Central Mall (MACM)</td>
<td>1990</td>
<td>Not available</td>
<td>3</td>
</tr>
<tr>
<td>Melcom Plus Mall (MPM)</td>
<td>2010</td>
<td>8,360</td>
<td>3</td>
</tr>
</tbody>
</table>

RESULTS

Responses from People with Disabilities
Patronage of Malls

The study shows that the AM was the most patronised mall by PWDs during the period of the research. This was followed by the MACM, the MPM, ACM and finally MSM and LM (Table 2). With the exception of the LM which was patronised predominantly by the hearing impaired, all the other malls had the mobility impaired being the dominant class of PWD clientele. This record was only equalled at the AM by the visually impaired. The relatively high patronage by the mobility impaired may be due to the fact that they can see and talk, which makes shopping relatively easier since beyond the actual shopping, there is a lot of opportunity for interacting or communicating with other shoppers and staff. It also agrees with Meyers et al (2002) study in the USA which revealed that the mobility impaired could access shopping areas. This is not surprising because compared with other forms of disabilities, architects usually take
into account the mobility impaired when designing a building (Tuckett et. al., 2004)

### Table 2 Patronage of Malls

<table>
<thead>
<tr>
<th>Type of impairment</th>
<th>MACM</th>
<th>AM</th>
<th>MSM</th>
<th>LM</th>
<th>MPM</th>
<th>ACM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually Impaired</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Hearing Impaired</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mobility Impaired</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10</td>
<td>14</td>
<td>5</td>
<td>5</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Field data, 2013

### Perception of Extent of Restrictiveness of Shopping Malls

The perceptions of the respondents regarding the extent of restrictiveness of the elements in the various malls are presented below.

- **Accra Mall (AM)**

  All the 14 PWDs surveyed at the AM (Fig. 1) indicated that the level of provision of facilities such as car parks, ramps, signage and lavatories in the mall generally made the place friendly to PWDs. They rated the level of restriction of this mall as mild.

- **A & C Mall (ACM)**

  With the A & C mall (Fig. 2) all the respondents assessed the level of accessibility of the various elements to be mildly restrictive except for parking and communication systems. For these two elements, 85.7% considered them to be mildly restrictive while the rest saw them to be moderately restrictive.
• Legon Mall (LM)
At the LM (Fig. 3) 80% of respondents considered the lavatories and the ramps to be mildly restrictive and 20% considered them to be moderately restrictive. Aside these, the provision of all the other facilities were deemed to be mildly restrictive.

• Makola Shopping Mall (MSM)
80% of the respondents at MSM (Fig. 4) said the level of accessibility in the mall was severely restrictive as against the rest who claimed that it was moderately restrictive and according to them this made the place unfriendly to the disabled people.

• Melcom Accra Central Mall (MACM)
At MACM (Fig. 5), half of the PWDs saw the access to the mall to be moderately restrictive. With the exception of the access to the mall, parking and communication systems, the majority of the PWDs perceived all the other facilities to be in unfriendly to the disabled.
Melcom Plus Mall (MPM)

Whereas two-thirds of the respondents at the MPM (Fig. 6) saw the access to the mall, lavatories and parking facilities to be mildly restrictive, 88.9% considered signage, communication systems and provision of counters in the shop to be mildly restrictive but all the respondents at this mall rated the ramps as mildly restrictive.

Results of Audit of Malls

For the purpose of the audit, the BS 8300 (2010) and the Solidere (2004) were used as the benchmarks and Tables 3 and 4 show the results of the physical audit of the shopping malls.

Table 3 Level of Accessibility of Elements in Malls

<table>
<thead>
<tr>
<th>Facilities/ Elements</th>
<th>AM</th>
<th>MACM</th>
<th>MSM</th>
<th>LM</th>
<th>MPM</th>
<th>ACM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car parking</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Entrance</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Steps / stairs</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ramps</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lifts</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Lavatories</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Access Routes</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Signage</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Car parking

According to the BS 8300 (2010), parking spaces of shopping malls should be close to an accessible entrance of the building and should have at least one designated space for each worker who is a disabled motorist in addition to 6% of the total capacity for visiting disabled motorists. Secondly the surfaces of the car parks should be level and firm. From the above, only the car park of AM was found to be mildly restrictive. The rest had severe restrictions. Of all the elements assessed, car parking was comparatively the least conforming to the requirements of the standards (Table 3). While AM made provision for PWD parking, the others did not make any special consideration for PWDs and this agrees with the perception of the PWDs.

Entrances

Problems identified with building entrances in the standards included lack of distinct accessible entrances and inadequate spaces in front of the entrances. The mitigating planning principle is to provide accessible and easy to find building entrances. This can be achieved by making all main public entrances accessible to PWDs and in multi storey buildings, the accessible entrance should allow access to a conveniently located accessible elevator or lift. The accessible entrances should be signed with the international symbol of accessibility (Solidere, 2004). The survey
conducted with the checklist indicated that AM, LM (Fig. 7), MPM, and ACM had mild restrictions with respect to their entrances, MSM had moderate restrictions, while MACM had severe restrictions. Apart from MSM all the other malls had alternate entrance(s) for users such that in the event of an emergency, safety could be guaranteed. At MPM and AM, there were automated doors while the entrance of MSM had a barrier because it led to a stair way. At LM and MACM, there were staff members who assisted shoppers by opening the door for them to enter.

Figure 7. A ramped entrance at LM

- **Staircases**

According to Solidere (2004) steep staircases and poorly designed steps are some of the design flaws associated with staircases. To overcome this problem a designer should provide a safe and well dimensioned staircase especially for PWDs. BS 8300 (2010) further states that the preferred dimension is between 150 mm to 180 mm for a riser and 300 mm to 450 mm for a going. Also, it is ideal that a stair comprises straight flights, with any change of direction made on a landing. A level landing should be provided at the top and bottom of each flight of steps. In the case of staircases, with the exception of MACM which came out as moderately restrictive, all the other malls had mild restrictions. It must be pointed out that staircases were the most conforming building elements as far as the standards were concerned.
Ramps
A ramp should have a surface width of 1,500 mm and lowest possible gradient within the range of 1:20 to 1:12. Also landings of at least the width of the ramp but not less than 1,500 mm long and clear of obstructions should be provided at the foot and head of a ramp (BS8300:2010). With the exception of MACM and MSM which had no ramps, the others had mild restrictions. ACM and MPM (Fig. 8) also provided ramps with hand rails to prevent users from falling off.

Lifts
There should be at least one conventional passenger lift that is of an appropriate size to accommodate a wheel chair user where there is a multi-storey structure. This should have a clear manoeuvring space of 1,500 mm x 1,500 mm in front of the door. There should also be the international symbol of access indicating where the accessible lift is located (BS8300:2010). Regarding lifts, AM, LM and MPM (Fig. 9) had mild restrictions while the rest had severe restrictions (Table 3). It must be pointed out that the number of storeys shown in Table 3 refers to those storeys used as the shopping space only within each building.
• **Lavatories**

Insufficient manoeuvring space inside a lavatory, poor design and positioning of fixtures and fittings and difficulty in gripping taps are some of the common problems associated with lavatories. To ameliorate these problems designers are expected to provide sufficient accessible space inside lavatories with all the fixtures and fittings of the sanitary appliances placed within easy reach (Solidere, 2004). It should also be possible for PWDs to approach, transfer to and use these facilities with ease. At each location where toilet facilities are provided for customers, workers or visitors there should be at least one unisex accessible toilet for PWDs (BS8300:2010). From the survey, only AM had accessible lavatories. All the other malls had lavatories that did not meet the specifications of the standards (Fig. 10).

![Figure 10. A Restrictive Sanitary Facility at MPM](image)

• **Accessible Routes**

The access routes of four malls namely ACM, AM, LM and MPM had mild restrictions. MACM and MSM generally had severe restrictions except on the score of the width of the access routes where they had moderate restrictions. According to the British Standards (BS8300:2010) access routes should be continuous and barrier free for PWDs. They should have a minimum surface width of 1,500 – 1,800 mm (BS8300:2010).

• **Signage**

Signage is provided in public places to facilitate orientation especially for the disabled, in locating items and services within shops, and in locating exits and car parks when inside shops. Good signage should be visible, simple to read and understand, located at an appropriate place and properly illuminated at night. Signs to facilities for PWDs should incorporate the International Symbol for Access (BS8300, 2010; Solidere, 2004). Based on these criteria, it came up that the signage at the malls had various degrees of restrictions. AM (Fig. 11 and 12) had mild
restrictions. MPM, LM and ACM had moderate restrictions while the rest posed severe restrictions to the PWDs.

- Communication Systems
To facilitate communication with shoppers during times of emergency, ACM, AM and LM had audible communication gadgets with flashing beacons at the building entrances to enhance safety in case of emergencies. MPM had an audible communication system but was without any flashing devices.

- Counters/ Reception Desks
Regarding the location and means of access to the counters in the malls, AM, LM and ACM had mild accessibility problems. MACM and MPM had moderate accessibility problems. The heights of the counters were generally good. MSM had severe accessibility problems. AM was the best with respect to manoeuvring spaces at counters while MSM was the worst (Table 4). According to the BS 8300 (2010) counters and reception desks should be easy to locate from the entrance of a building. They should be accessible, of an appropriate height and also provide enough manoeuvring space.

<table>
<thead>
<tr>
<th>Description</th>
<th>AM</th>
<th>MACM</th>
<th>MSM</th>
<th>LM</th>
<th>MPM</th>
<th>ACM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION AND ACCESS FOR PWDs</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>HEIGHT OF COUNTER</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MANEUVERING SPACE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Overall, the survey with the checklist indicated that the AM was the least restrictive shopping mall. This was followed by ACM. LM and MPM came next while the most restrictive among the malls were MSM and MACM.
From the survey it came to light that generally, shopping malls that were constructed before the passage of the Disability Act in 2006 were more restrictive to PWDs than those constructed after the passage of the Act. These findings agree with Hashim et al., (2011) that suggested that the level of restrictiveness of a mall is related to the period of design and construction of the mall. It shows that with the passage of the Act, designers of the shopping malls are becoming more conscious of the needs of the disabled people in their work.

Interviews with Professionals
Interviews were held with professionals in the built environment to ascertain their views about accessibility of the shopping malls. They comprised of five engineers and three architects who were purposively sampled from Architectural & Engineering Services Limited (AESL), Accra Metropolitan Assembly and Lycopodium Engineering Pty. These professionals had either worked on the malls or similar projects. Architectural & Engineering Services Limited is a practicing professional group of consulting architects, engineers, land and quantity surveyors which was hitherto a state owned organisation. Lycopodium (Ghana) Pty Ltd is a private consulting architectural and engineering firm in Accra and Accra Metropolitan Assembly is the authority that controls development within the Accra metropolis where the malls are located.

It also came to light during the interviews that the professionals were not oblivious of the provisions of the Persons with Disability Act, 2006 (Act 715). Their position was that with just about two years to the end of the deadline of making all public buildings in Ghana accessible to all, the shopping malls had various degrees of restrictiveness. Hence there was the unlikelihood that the deadline would be met. To solve the problem, they urged the government and its agencies to enforce the provisions of the Persons with Disability Act. This assertion is reinforced by a UN document which states that ‘In many countries in the Global South, accessibility standards do not exist. In the few countries where they exist, they are very often not legally binding, not enforced and not monitored’ (UNAPD, 2010). In Ghana as well as many developing countries, problems of this nature arise not due to lack of legislation but the lack of enforcement thereof. Secondly they said the problem is persisting due to the unwillingness of owners of the shopping malls and other public buildings to expend extra resources for the modification and retrofitting of these shopping malls and other public buildings to make them accessible to people with disabilities.

CONCLUSION
The audit conducted by the checklist to ascertain the state of accessibility of the shopping malls, the questionnaires administered to the PWDs to seek their perception about the level of restrictiveness of the malls and the interviews held with the professionals of the built environment all point to the fact that most of the shopping malls studied pose moderate or severe restrictions to PWDs by way of the non-availability or inappropriate
design of building elements like car parking, entrances, stairs, ramps, lifts, lavatories, access routes, signage, and counters/ reception areas because they do not fully meet the parameters set by International standards. Even though the professionals of the built environment see the need to adhere to requisite legislation pertaining to access for PWDs in the shopping malls, they are constrained on the one hand by the unwillingness of property owners to expend extra resources to make their premises accessible and on the other hand by the lack of enforcement of the requirements of the international standards by government agencies. The above findings are similar to those of Hashim et al., (2011) whose study of shopping malls in Malaysia concluded that poor design and planning, lack of enforcement of policies and limited guidelines have resulted in some accessibility challenges in the shopping malls studied. From the foregoing, it is evident that serious retrofitting of the shopping malls is required to make them accessible to all. To achieve this all the relevant stakeholders such as building professionals, building owners and the requisite government agencies would all be required to play their respective roles well to make the dream of making not only these shopping malls but all public buildings in Ghana accessible by the year 2016 a reality.

RECOMMENDATIONS

Guaranteeing inclusive access is possible with the right attitude, legal framework and the willpower to do what ought to be done. Therefore, to correct the deficiencies described in UNAPD (2010), the following recommendations are made to help address the issue of restrictive malls in particular and restrictive built environments in general for PWDs in Ghana:

a) The Ministry responsible for Gender, Children and Social Protection should spearhead the development of an Accessibility Code/ Standard for Ghana. A team of experts together with representation from the Ghana Federation of the Disabled and other related Civil Society Organisations should immediately be put together to prepare a draft document for approval by Government. This is critical because the grace period given for compliance with the Disability Act is almost over. This should be followed by the demonstration of the willingness of the various enforcement and regulatory authorities like the Metropolitan assemblies and the Judiciary to ensure compliance and enforcement.

b) It is proposed that further research should be undertaken among policy makers in the country to ascertain the reasons for the seeming lack of commitment to fully implement the provisions of the Persons with Disability Act, 2006 in shopping malls in Ghana.
ACKNOWLEDGEMENT

The authors acknowledge the assistance of Messrs Ronald Offei, Kingsley Amanfo Lamptey and Edmund Emmanuel Abban, former students of the Department of Building Technology, KNUST for the preliminary role they played in this research.

REFERENCES


INCORPORATING ENVIRONMENTAL SUSTAINABILITY INTO CONSTRUCTION PROCUREMENT AT THE DISTRICT ASSEMBLY LEVEL IN GHANA

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Construction projects account for high carbon emissions, high water consumption, high amount of landfill waste and high usage of raw materials. By incorporating environmental sustainability into construction procurement in the public sector it would be possible to reduce the corresponding effects on the environment. The study aimed at exploring the driving factors of environmental sustainability into construction procurement at the district assembly level in the western region of Ghana. Census sampling technique was combined with purposive sampling to identify the four categories of respondents from the twenty-two (22) district assemblies used for the study. Related literature on construction procurement and factors driving environmental sustainability issues were reviewed, questionnaires was used as the data collection instrument for the study. Four major factors namely: leadership influence, environmental culture, public influence and personal skills were identified as driving environmental sustainability into construction procurement at the district assembly level in Ghana. The study concluded that environmental officers are to be made part of the construction procurement team as they have the expertise knowledge in environmental laws and environmental impacts such as forest degradation, water pollution, farm land destruction, and air pollution at the various districts. The study highlighted issues, requirements and responsibilities necessary to promote more responsive environmental outcomes from construction projects.

Keywords: district assembly, environmental sustainability, Ghana, procurement

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INTRODUCTION

There is increasing onus on public organizations in society to minimize impacts of their activities upon the environment in most countries (Strandberg, 2002; McWilliams and Siegel, 2000). Governments around the world have been urged to take the lead in introducing environmentally sustainable practices in their own operations, in particular through procurement policies (United Nations, 1999; European commission 2011). This is due to the fact that construction activities, especially buildings embarked on by public organizations contribute to environmental degradation in various ways such as resource depletion, energy consumption, air pollution, waste creation, etc. (Opintan-Baah et al., 2011; Ayarkwa et al., 2010; Chavan, 2005). Worldwide, buildings account for 20% fresh water consumption, 25% wood harvest, 40% CO₂ emissions, 40% energy use and 30% raw material use (Seneviratne, 2011). Ayarkwa et al., (2010) found that the consumption of raw materials from the construction industry leads to major environmental degradation because the consumptions are non-renewable. According to Ofori (2000), construction contributes to the loss of forests because the raw materials are consumed and irreversibly converted to timber or other raw materials for construction activities; wild or agricultural lands are changed because of urbanization or other development projects mostly embarked on by the government. Many recent researchers have identified procurement as a major tool to augment governments’ environmental protection efforts, but, it is apparent that none of the major studies in Ghana have identified factors driving environmental sustainability into the construction procurement at the district assembly level (Adetunji et al., 2008). Interestingly, the study conducted by Adetunji et al. (2008) revealed that government procurement practices have largely been focused on price, whereas the commitment to environmental sustainability has been an act of faith rather than a contractual deliverable (Poon et al., 2004). Varnas et al. (2009) revealed that environmental criteria in tender evaluations are less common and seldom affect the award decisions. Furthermore, Jaillon et al. (2009) revealed that the construction industry pays less attention to environmental issues than other issues such as construction cost, construction time, familiarity with the construction technology, and availability of resources. Boyefio (2008), identified efforts by Ghana’s Public Procurement Authority to address sustainability in public procurement. This study therefore aimed at identifying the factors driving the incorporation of environmental sustainability into construction procurement at the district assembly level. The district assemblies in the Western Region of Ghana was selected because the region is known to have crucial environmental concerns such as large and small scale mining, deforestation, coastal erosion and sanitation, urban sanitation, water hyacinth/ marine pollution (Adjarko et al., 2014). The study finally proposed ways of incorporating environmental sustainability issues into construction procurement at the various districts in Ghana.
STUDY AREA

The Western Region covers about 10 per cent of Ghana’s total land surface. Occupying an area of 23,921 square kilometres, it is located in the South-Western part of Ghana, bordered by Ivory Coast on the West, Central Region on the East, Ashanti and Brong-Ahafo Regions on the North and on the South by 192 km of coastline of the Atlantic Ocean. The southernmost part, also the southernmost part of Ghana is called Cape Three Points, near Busua. There are 410,142 households in 259,874 houses, which give an average of 1.6 households per house for the region (Ghana Statistical Service, 2012). Most were built in the cocoa and timber economic boom years of the late 1950s and early 1960s. There is congestion in many houses which has resulted in the construction of new buildings at areas that served as agricultural lands and other purposes. There is the need for measures to reduce the effect of these growing construction activities on the environment. Figure 2.1 illustrates the map of the study area.

The key environmental concerns in the western region include: Impacts of large and small scale mining, Deforestation, Industrial pollution (disposal of solid waste, effluent discharges and gaseous emissions), Coastal erosion and sanitation, Urban sanitation, and Water hyacinth/ marine pollution. The Western Region was selected based on these growing environmental concerns. These environmental concerns arising from construction activities could be curtailed by incorporating environmental sustainability into construction procurement in the various districts. Respondents were selected from the Sekondi-Takoradi Metropolis, Tarkwa Municipal, Nzema East Municipal, and Sehwi Wiaso Municipal including 18 other districts in the Western Region of Ghana.
PREVIOUS RESEARCH

Public Procurement of works in the Ghanaian Context

In the year 1996, the Government launched the Public Financial Management Reform Programme (PUFMARP) to improve overall public financial management in Ghana (Adu, 2011). The Public Financial Management Reform Programme (PUFMARP) identified weaknesses in the procurement system which includes: no comprehensive public procurement policy, etc (Adu, 2011). This led to the establishment of the Procurement Oversight Group in 1999 to steer the design of a comprehensive public procurement reform programme. A drafted public procurement bill was produced in September 2002. The Public Procurement Act, 2003 was passed into law on 31 December 2003 (Adu, 2011). This has been the legal document governing procurement of works at the district level in Ghana. The Public Procurement Act, 2003 (Act 663) establishes the Public Procurement Authority, Tender Committees and Tender Review Boards. It Specifies rules for procurement methods, and also defines offences and applicable penalties.

![Diagram of Construction Procurement Process at the district level](Source: Adapted from the Public Procurement Manual (2003) of Act 663)
Public Procurement Regulations is issued by the Minister for Finance in consultation with PPA under section 97 of the Act and contain detailed rules and procedures for all aspects of the procurement system such as the operations of PPA and procurement entities and the conduct of procurement activities. The Guidelines are issued by PPA under the Act and provide supplementary guidance on specific topics e.g. disposal, single source procurement and margins of preference. The standard Tender Documents is issued by PPA and are listed in Schedule 4 of the Act. Separate documents for Standard Invitation and contract documents for procurement of goods, works and services are provided (Adu, 2011). According to the Public Procurement Manual (2003) of Act 663, “Works” means work associated with the construction, reconstruction, demolition, repair or renovation of a building or structure or surface and includes site preparation, excavation, erection, assembly, installation of plant, fixing of equipment and laying out of materials, decoration and finishing, and any incidental activity under a procurement contract. Construction procurement is however not confined to construction works. Construction procurement includes services, goods, construction works and disposals in the form of demolitions and the disposal of surplus materials, plant and equipment (International Organization for Standardization, 2010). The process for construction procurement at the district assembly follows the process outlined in the Public Procurement Act. In the current tender documents, there are no provisions for environmental sustainability to be incorporated; there are no competitive clauses to discuss with the contractors, making it difficult for the client to enforce what district perceives as valuable. Figure 2.1 below shows the basic procedure for construction procurement at the district level in Ghana.

Environmental Responsibilities at the District Assembly Level in Ghana
The Constitution of the Republic of Ghana (1992) requires all citizens of Ghana to protect and safeguard the environment as stipulated in chapter six, article 41 (k). Also the Environmental Protection Agency Act (Act 490) mandates the Environmental Protection Agency to ad infinitum improve and preserve the countries environment (Yeboah and Mensah, 2014). Again the constitution grants the District Assemblies the highest political authority in the district, and that the District Assembly has deliberative, legislative and executive powers. The Local Government Act No. 462 of 1993 and the National Development Planning (System) Act 480 of 1994 are some of the main legislative texts pertaining to District Assemblies. The Assemblies have an executive committee, which is headed by a District Chief Executive who is appointed by the President. The District Chief Executive has significant authority over the affairs of the Assembly. Community Environmental Management Committees are set up and undergo training under the Ghana Environmental Management Project (GEMP) which was initiated in 2008 and funded by the Canadian International Development Agency (CIDA). The District Planning officer is the team leader of the District Environmental Management Committee. Members of the District Environmental Management team are the
National Disaster Management Committee (NADMO), the Environmental Health and Sanitation Unit, District Community Development Officer, the Ghana Education Service (GES), the Department of Social Welfare, the Gender Desk office, the representatives of traditional rulers, the Town and Country Planning, and the Police Force, most of whom are given further training. The Environmental Management Committee respond to reports of activities that degrade the environment (Agyekwena, 2014). The Local Government Act of 1993 prescribes to the District Assemblies broad mandates. The District Assemblies deliver many services, such as pre- and primary education, social welfare, health clinics, cemeteries, museums and libraries, water and sanitation, refuse collection, environmental protection and transport, and many of these have environmental impacts (Farvacque et al., 2008). The district assemblies together with district environmental management committees are responsible for local management of the environment.

**Drivers to the Incorporation of Environmental Sustainability into Construction Procurement**

The following drivers to the incorporation of environmental sustainability into procurement management were identified from literature and are discussed below:

- Skilful policy entrepreneurs, Personal commitment, Extension of Founder’s Value, Values of Owner, and Desire to Improve Position: In order to incorporate environmental sustainability into construction procurement, it is believed that the personal skills and commitment of the procurement officer play key roles (Walker et al., 2008). Wycherley (1999) found that the personal and ethical values of the founder of the company could filter through the organisation. At the district assembly level, the District Chief Executive representing government should have passion for the environment and find ways to promote environmental protection in their districts (Wycherley, 1999).

- Desire to reduce costs, improve quality, desire to reduce risk of consumer criticism, pressure from investors, and desire to manage economic risk: The desire to reduce costs represents a common driving force for environmental considerations in projects (Walker et al., 2008). Costs can be prevented by embracing the concept of pollution prevention (Walker et al., 2008). There is need to find out whether it is same in the construction sector in Ghana.

- Legislative and Regulatory compliance and ISO 14000 certification: According to Walker et al. (2008), government regulation and legislation appears to be a strong driver for environmental projects. Companies that have the ISO certification appear to have improved environmental performance (Ayarkwa et al., 2008). Environmental regulations promote the reduction of environmental impact at low cost compared to cost of litigation. Since these regulations govern all procurement activities in the public sector, their availability may be key to the promotion of environmental sustainability.
Investor pressure, Pressure from customers, Public pressure, Non-economic Stakeholders and Pressure by Environmental Advocacy Groups: According to Green et al. (1996), increased customer pressure and investor pressure may be enough to drive environmental sustainable practices into the procurement process. Projects from donor supported funds perform better environmentally due to pressures from the donors (Trowbridge, 2001). Stakeholder groups as well as Non-organisational stakeholders can pressure public organisations which have a much bigger purse to address environmental concerns (Hall, 2001). The voices of activist campaigners, non-governmental organisations (NGOs) or green pressure groups cannot be ignored anymore, as they have the ability to seriously embarrass non-compliant organisations (Gabriel et al., 2000).

Gaining competitive advantage, Potential for receiving publicity: According to Gonzalez-Benito and Gonzalez-Benito (2005), a policy of environmental purchasing may not be undertaken because of a desire to protect world’s resources, but to gain competitive advantage and improve the financial performance of the institution. Since the districts are known to compete for resources, an improved environmental performance may be an advantage. The deterioration of the environment over recent years has drastically increased public awareness of environmental sustainability.

**RESEARCH METHOD**

The study implored exploratory research methods. Purposive sampling was used to identify the population for the study namely: procurement officials, environmental officers, quantity surveyors, and the district engineer. The inclusion of these officers helped the researcher to know the relevant environmental problems that could be solved through the procurement process and helped in bringing out the driving factors pushing environmental sustainability into the procurement process. Census sampling technique was used to select the twenty-two districts due to all the districts being in one region, Western Region; and the number of districts relatively small. Sample frame was collected from Western Regional Coordination Council. The sample size was eighty-eight (88) people drawn from the population of twenty-two (22) districts in the Western Region of Ghana. The population were in four subgroups of twenty-two each from district engineers, procurement officers, environmental officer, and procurement officers. The personal visits to the respondents took place over a period of three months between May 2014 and July 2014.

**Questionnaires:** In all 88 questionnaires were distributed personally to respondents. Out of this figure, 22 were given to procurement officers, quantity surveyors, district engineers, and the rest were given to environmental officers. Sixty questionnaires were retrieved representing a response rate of 68%. The structured questionnaire was used to guide the researcher in interviewing the respondents. The questionnaire consisted of
both open and closed ended questions. The questionnaire was used because respondents could be able to respond to the questions unaided. Also the questionnaire facilitated the collection of data that ensured the best matching of concepts with reality.

**Conceptual framework of the study:** This research adopted Dolva’s

<table>
<thead>
<tr>
<th>LI</th>
<th>METROPOLITAN</th>
<th>CAPITAL</th>
<th>NUMBER OF RESPONDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928</td>
<td>Sekondi-Takoradi</td>
<td>Sekondi</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MUNICIPAL ASSEMBLIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1886</td>
<td>Tarkwa Nsuaem</td>
<td>Tarkwa</td>
<td>4</td>
</tr>
<tr>
<td>1917</td>
<td>Nzema East</td>
<td>Axim</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>Sefwi Wiaso</td>
<td>Sefwi Wiaso</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>DISTRICT ASSEMBLIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1387</td>
<td>Bibiani/Ahwiaso/Bekwai</td>
<td>Bibiani</td>
<td>4</td>
</tr>
<tr>
<td>1394</td>
<td>Jomoro</td>
<td>Half Assini</td>
<td>4</td>
</tr>
<tr>
<td>1395</td>
<td>Ahanta West</td>
<td>Agona Nkwanta</td>
<td>4</td>
</tr>
<tr>
<td>1757</td>
<td>Amenfi West</td>
<td>Wassa Akropong</td>
<td>4</td>
</tr>
<tr>
<td>1840</td>
<td>Prestea-Huni Valley</td>
<td>Bogoso</td>
<td>4</td>
</tr>
<tr>
<td>1882</td>
<td>Shama</td>
<td>Shama</td>
<td>4</td>
</tr>
<tr>
<td>1884</td>
<td>Sefwi Akontobra</td>
<td>Sefwi Akontobra</td>
<td>4</td>
</tr>
<tr>
<td>1918</td>
<td>Ellembele</td>
<td>Nkroful</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>Wassa Amenfi Central</td>
<td>Manso</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>Wassa Amenfi West</td>
<td>Asankrogua</td>
<td>4</td>
</tr>
<tr>
<td>2013</td>
<td>Bia West</td>
<td>Essam-Daboso</td>
<td>4</td>
</tr>
<tr>
<td>2014</td>
<td>Bia East</td>
<td>Adabokrom</td>
<td>4</td>
</tr>
<tr>
<td>2016</td>
<td>Suaman</td>
<td>Dadieso</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>Aowin/Suaman</td>
<td>Enchi</td>
<td>4</td>
</tr>
<tr>
<td>2018</td>
<td>Wassa East</td>
<td>Daboase</td>
<td>4</td>
</tr>
<tr>
<td>2019</td>
<td>Mpohor</td>
<td>Mpohor</td>
<td>4</td>
</tr>
<tr>
<td>2020</td>
<td>Juaboso</td>
<td>Juaboso</td>
<td>4</td>
</tr>
<tr>
<td>2021</td>
<td>Bodie</td>
<td>Bodie</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td>88</td>
</tr>
</tbody>
</table>

actor-oriented perspective on the norm model (Dolva, 2007). It was adopted and used as a basis for the questionnaire and as an instrument for guiding the analysis and discussion of the data collected. Hyden (2002) argued that in order to promote sustainable policies such as environmental sustainability, the following three (3) issues must be addressed:

- Will (certain set of values motivating environmental sustainability),
• Knowledge (knowledge on how to incorporate environmental sustainability) and
• Opportunity (the possibility to do so in practice).

He argued that will, knowledge and systematic conditions are necessary to transfer sustainable policies into action. He developed a model based on these factors called the norm model upon which this study was based.

RESULTS

Distribution of Respondents
As can be seen from Table 4.1, 4 respondents were drawn from the Western Region’s Metropolis, Municipal and district assemblies, comprising District Engineers, Quantity Surveyors, Procurement Officers and Environmental Officers. Out of the total number of 88 questionnaires sent, 60 responses were received representing 68%.

Parts of the Tender Documents to Insert Environmental Sustainability Issues
Respondents were asked to indicate which part of the tender documents were relevant areas to insert environmental considerations and at what stages in the procurement process are potential areas to introduce environmental sustainability issues. Table 4.2 below depicts the summary of respondents’ responses on the part of a tender document that environmental sustainability issues may be incorporated. Respondents were asked to rank their level of agreement to the parts of the tender document where environmental issues may be incorporated on a 5 point Likert scale (where 1-Strongly Disagree, 2-Disagree, 3-Uncertain, 4-Agree, and 5-Strongly Agree). The results were ranked based on their mean scores and are presented in Table 4.2 below and discussed (c.f. Ayarkwa et al., 2010).

Table 4.2 Part of a Tender Document That Environmental Sustainability Issues Are Incorporated

<table>
<thead>
<tr>
<th>Parts of the Tender Document</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Subject Matter of the Contract</td>
<td>4.27</td>
<td>1.023</td>
<td>2nd</td>
</tr>
<tr>
<td>Technical Specifications for the Product/Work/Service</td>
<td>4.15</td>
<td>.899</td>
<td>4th</td>
</tr>
<tr>
<td>The Selection Criteria for Candidates</td>
<td>3.98</td>
<td>1.000</td>
<td>5th</td>
</tr>
<tr>
<td>The Contract Award Criteria</td>
<td>4.27</td>
<td>1.103</td>
<td>3rd</td>
</tr>
<tr>
<td>The Contract Performance Clauses</td>
<td>4.43</td>
<td>.789</td>
<td>1st</td>
</tr>
</tbody>
</table>

A mean score of 3 and above was considered significant.

Respondents ranked the ‘contract performance clause’ (mean- 4.43, standard deviation .789) first, indicating strong agreement that it is the
best part of the contract document to insert an environmental requirement. It must however be noted that almost all the parts recorded high means indicating that all parts of the tender document are likely areas to include an environmental sustainability issue. Nevertheless, three of the variables had high standard deviations, namely ‘the subject matter of the contract’ (1.023), ‘the selection criteria’ (1.0), and ‘the contract award criteria’ (1.103). This indicates variability in the data collected and inconsistency in agreement among the respondents. The results emphasized that, in all parts of a tender document, environmental sustainability issues may be incorporated, but only with the involvement of Environmental Officers would this be realised since they have the environmental responsibility at the district level. The key issue is not to breach the basic procurement ethics (European Commission, 2011; British Standards Institution, 2010, Public Procurement Act, Act 663, 2003). This is a good signal that portrays opportunity for environmental considerations even with the current procurement system in Ghana.

Stages to Incorporate Environmental Sustainability in the Construction Procurement Process

Table 4.3 below, shows the summary of responses on the stages of procurement that environmental sustainability may be incorporated. Respondents were asked to indicate their level of agreement to the stages in the procurement process where environmental issues may be incorporated on a 5 point Likert scale (where 1-Strongly Disagree, 2-Disagree, 3-Uncertain, 4-Agree, and 5-Strongly Agree). The results were ranked based on their mean scores and are presented in Table 4.5.

Table 4.3 Stage of Procurement That Environmental Sustainability Issues Are Incorporated

<table>
<thead>
<tr>
<th>Stages of Procurement</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishing What is to be Procured</td>
<td>*3.98</td>
<td>1.242</td>
<td>3rd</td>
</tr>
<tr>
<td>Decision on Procurement Strategies in terms of Contract, Pricing and Targeting Strategy and Procurement Procedure</td>
<td>*3.87</td>
<td>1.142</td>
<td>5th</td>
</tr>
<tr>
<td>Soliciting Tender Offers</td>
<td>*3.90</td>
<td>1.175</td>
<td>4th</td>
</tr>
<tr>
<td>Evaluation of Tender Offers</td>
<td>*4.20</td>
<td>1.132</td>
<td>1st</td>
</tr>
<tr>
<td>Award of Contract</td>
<td>2.12</td>
<td>1.195</td>
<td>6th</td>
</tr>
<tr>
<td>Administering Contracts and Confirmation of Compliance with Requirement</td>
<td>*4.10</td>
<td>1.160</td>
<td>2nd</td>
</tr>
</tbody>
</table>

A mean score of 3 and above was considered significant

The fourth stage of procurement, Evaluation of tender offers, recorded the highest mean value of 4.20. This suggests that respondents strongly agreed that it is the best stage in procurement to introduce an environmental sustainability issue. It is surprising to note that, all the variables had high standard deviations, indicating variability in the data collected and inconsistency in agreement among the respondents. Administering contracts and confirmation of compliance with requirement had the second highest mean value of 4.10. This also suggests that respondents strongly agreed that it was crucial to confirm compliance with
environmental requirements during the contract execution period. However, theory suggests that all stages are relevant areas to include an environmental issue (European commission 2011). It can be concluded that, in totality, almost all the respondents agreed that at each stage of the tendering process, environmental sustainability could be incorporated though there was inconsistency in agreement among the respondents. Again, the key issue here is that basic procurement ethics must not be breached (European Commission, 2011; British Standards Institution, 2010, Public Procurement Act, Act 663, 2003)

Factors Driving the Incorporation of Environmental Sustainability into Construction Procurement at the District Level

Respondents were asked to score on a scale of 1 (Least) to 5 (Highest) the significance of the various factors driving the incorporation of environmental sustainability into construction procurement at the district assembly level that were identified from literature. These factors are analysed and presented below. The variables were coded for easy interpretation.

<table>
<thead>
<tr>
<th>CODE</th>
<th>VARIABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Gaining competitive advantage</td>
</tr>
<tr>
<td>V2</td>
<td>Government pressure</td>
</tr>
<tr>
<td>V3</td>
<td>Investor pressure</td>
</tr>
<tr>
<td>V4</td>
<td>Awareness of environmental impacts</td>
</tr>
<tr>
<td>V5</td>
<td>Consensus on standard EMS needed in sector</td>
</tr>
<tr>
<td>V6</td>
<td>Environmental culture among competitors</td>
</tr>
<tr>
<td>V7</td>
<td>Society pressure</td>
</tr>
<tr>
<td>V8</td>
<td>Legislature and Legal compliance</td>
</tr>
<tr>
<td>V9</td>
<td>Develop good image</td>
</tr>
<tr>
<td>V10</td>
<td>Desire to improve quality on performance</td>
</tr>
<tr>
<td>V11</td>
<td>Skilful policy procurement/environ officers</td>
</tr>
<tr>
<td>V12</td>
<td>ISO 14001 certification</td>
</tr>
<tr>
<td>V13</td>
<td>Desire to manage economic risk</td>
</tr>
<tr>
<td>V14</td>
<td>Potential for receiving publicity</td>
</tr>
<tr>
<td>V15</td>
<td>Reduce risk of consumer criticism</td>
</tr>
</tbody>
</table>

From Table 4.4, it can be seen that reducing risk of customer criticism (V15), legislature and legal compliance (V8), desire to manage economic risk (V13), developing good image (V9) and gaining competitive advantage (V1) were considered as the major factors driving the incorporation of environmental sustainability into construction procurement at the district
assembly level. All these factors had mean scores greater than the mean value of 3.0. Other factors driving the incorporation of environmental sustainability into construction include government pressure (V2), ISO 14001 certification (V12), consensus on standard EMS needed in sector (V5) and awareness of environmental impacts (V4). Investor pressure (V3), society pressure (V7) and desire to improve quality on performance (V10) on the other hand were considered the least factors by the respondents.

Table 4.4 Factors Driving the Incorporation of environmental Sustainability into Construction Procurement at the District assembly level

<table>
<thead>
<tr>
<th>Code</th>
<th>Factors</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Gaining competitive advantage</td>
<td>*4.09</td>
<td>1.11</td>
<td>5th</td>
</tr>
<tr>
<td>V2</td>
<td>Government pressure</td>
<td>*3.91</td>
<td>1.18</td>
<td>6th</td>
</tr>
<tr>
<td>V3</td>
<td>Investor pressure</td>
<td>1.49</td>
<td>0.61</td>
<td>15th</td>
</tr>
<tr>
<td>V4</td>
<td>Awareness of environmental impacts</td>
<td>*3.65</td>
<td>1.27</td>
<td>9th</td>
</tr>
<tr>
<td>V5</td>
<td>Consensus on standard EMS needed in sector</td>
<td>*3.73</td>
<td>1.34</td>
<td>8th</td>
</tr>
<tr>
<td>V6</td>
<td>Environmental culture among competitors</td>
<td>*3.56</td>
<td>1.39</td>
<td>10th</td>
</tr>
<tr>
<td>V7</td>
<td>Society pressure</td>
<td>2.35</td>
<td>0.93</td>
<td>14th</td>
</tr>
<tr>
<td>V8</td>
<td>Legislature and Legal compliance</td>
<td>*4.60</td>
<td>0.66</td>
<td>2nd</td>
</tr>
<tr>
<td>V9</td>
<td>Develop good image</td>
<td>*4.24</td>
<td>0.98</td>
<td>4th</td>
</tr>
<tr>
<td>V10</td>
<td>Desire to improve quality on performance</td>
<td>1.91</td>
<td>0.89</td>
<td>13th</td>
</tr>
<tr>
<td>V11</td>
<td>Skilful policy procurement/environ officers</td>
<td>*3.22</td>
<td>1.34</td>
<td>12th</td>
</tr>
<tr>
<td>V12</td>
<td>ISO 14001 certification</td>
<td>3.87</td>
<td>1.09</td>
<td>7th</td>
</tr>
<tr>
<td>V13</td>
<td>Desire to manage economic risk</td>
<td>*4.45</td>
<td>0.74</td>
<td>3rd</td>
</tr>
<tr>
<td>V14</td>
<td>Potential for receiving publicity</td>
<td>*3.31</td>
<td>1.41</td>
<td>11th</td>
</tr>
<tr>
<td>V15</td>
<td>Reduce risk of consumer criticism</td>
<td>*4.85</td>
<td>0.36</td>
<td>1st</td>
</tr>
</tbody>
</table>

A mean score of 3 and above was considered significant
Source: Field Survey 2014

Table 4.5 represents the correlation matrix of the data. The correlation matrix helped in determining the relationship between the various factors. The highest correlation occurred between V_{14} (potential for receiving publicity) and V_{12} (ISO 14001 certification) with the value of 0.63. The second highest correlation occurred between V_{6} (environmental culture among competitors) and V_{5} (consensus on standard EMS needed in sector) with the value of 0.60. Other correlations like V_{7} (Society pressure) and V_{6} (environmental culture among competitors), V_{12} (ISO 14001 certification) and V_{2} (government pressure) have moderate high correlation, 0.44. Table 4.5 also show that, there exist a negative correlation between V_{8} (legislature and legal compliance) and V_{3} (investor pressure) with a value of -0.29. There is also a negative correlation of -0.10 between V_{10} (mode of dressing) and V_{5} (legislature and legal compliance).

The KMO statistic varies between 0 and 1 with a value of zero indicating that the sum of partial correlations is large relative to the sum of
correlations. This indicates diffusion of pattern of the correlations, and hence, factor analysis is likely to be inappropriate (Field, 2005). A value close to 1.00 indicates that patterns of correlation are relatively compact and so factor analysis should yield distinct and reliable factors (Field, 2005). However, literature recommends that the KMO value should be greater than 0.50 if the sample size is adequate (Child, 1990 and Field, 2005). With the KMO value of 0.8, as indicated in Table 4.6 above, it means that the factors are meritoriously adequate for factoring. This suggests that factor analysis is appropriate and correlation matrix is appropriate for factoring. The Bartlett’s test of sphericity is also significant.

The correlation analysis, the KMO and the Bartlett’s tests above suggest that, there are correlations among the indicator variables and hence, the original 15 indicators can be subjected to a factor analysis procedure.

Table 4.5 Correlation Matrix
Source: Field Survey 2014

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
<th>V5</th>
<th>V6</th>
<th>V7</th>
<th>V8</th>
<th>V9</th>
<th>V10</th>
<th>V11</th>
<th>V12</th>
<th>V13</th>
<th>V14</th>
<th>V15</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>0.09</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V3</td>
<td>-0.23</td>
<td>0.09</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V4</td>
<td>0.22</td>
<td>0.13</td>
<td>0.13</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V5</td>
<td>0.15</td>
<td>0.28</td>
<td>0.03</td>
<td>0.27</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V6</td>
<td>0.42</td>
<td>0.17</td>
<td>-0.03</td>
<td>0.32</td>
<td>0.60</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V7</td>
<td>0.27</td>
<td>0.00</td>
<td>-0.01</td>
<td>0.28</td>
<td>0.38</td>
<td>0.44</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V8</td>
<td>0.33</td>
<td>-0.10</td>
<td>-0.29</td>
<td>0.39</td>
<td>0.15</td>
<td>0.33</td>
<td>0.23</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V9</td>
<td>0.29</td>
<td>0.02</td>
<td>-0.26</td>
<td>0.10</td>
<td>0.23</td>
<td>0.27</td>
<td>0.19</td>
<td>0.41</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V10</td>
<td>-0.07</td>
<td>-0.06</td>
<td>0.19</td>
<td>0.09</td>
<td>0.07</td>
<td>-0.08</td>
<td>-0.01</td>
<td>-0.10</td>
<td>-0.08</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V11</td>
<td>-0.29</td>
<td>0.27</td>
<td>0.14</td>
<td>0.15</td>
<td>0.33</td>
<td>0.25</td>
<td>0.18</td>
<td>0.04</td>
<td>0.21</td>
<td>-0.05</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V12</td>
<td>0.07</td>
<td>0.44</td>
<td>0.04</td>
<td>0.17</td>
<td>0.23</td>
<td>0.04</td>
<td>-0.07</td>
<td>-0.07</td>
<td>-0.25</td>
<td>0.12</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V13</td>
<td>0.17</td>
<td>0.20</td>
<td>-0.09</td>
<td>0.07</td>
<td>0.22</td>
<td>0.22</td>
<td>-0.07</td>
<td>0.38</td>
<td>0.31</td>
<td>-0.22</td>
<td>0.25</td>
<td>0.05</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V14</td>
<td>-0.17</td>
<td>0.33</td>
<td>0.12</td>
<td>0.23</td>
<td>0.38</td>
<td>0.28</td>
<td>-0.08</td>
<td>-0.06</td>
<td>-0.31</td>
<td>0.21</td>
<td>0.21</td>
<td>0.63</td>
<td>0.09</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>V15</td>
<td>-0.20</td>
<td>-0.08</td>
<td>-0.09</td>
<td>-0.03</td>
<td>0.19</td>
<td>-0.06</td>
<td>0.04</td>
<td>0.14</td>
<td>0.05</td>
<td>0.02</td>
<td>0.15</td>
<td>-0.05</td>
<td>0.11</td>
<td>-0.02</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 4.6 KMO and Bartlett’s Test

Source: Field Survey 2014

<table>
<thead>
<tr>
<th>Measure</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Meyer-Oklin Measure of Sampling Adequacy</td>
<td>0.77</td>
</tr>
<tr>
<td>Bartlett’s Test Critical Value</td>
<td>234.44</td>
</tr>
<tr>
<td>Bartlett’s test degree of freedom</td>
<td>105</td>
</tr>
<tr>
<td>Bartlett’s significant value</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Field Survey 2014
### Table 4.7 Total Variance Explained

<table>
<thead>
<tr>
<th>Component</th>
<th>Total</th>
<th>% of Variance</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.85</td>
<td>28.56</td>
<td>28.56</td>
</tr>
<tr>
<td>2</td>
<td>2.98</td>
<td>17.55</td>
<td>46.11</td>
</tr>
<tr>
<td>3</td>
<td>1.98</td>
<td>11.62</td>
<td>57.73</td>
</tr>
<tr>
<td>4</td>
<td>1.39</td>
<td>8.20</td>
<td>65.93</td>
</tr>
<tr>
<td>5</td>
<td>1.29</td>
<td>7.57</td>
<td>73.50</td>
</tr>
</tbody>
</table>

Source: Field Survey 2014

Using the Eigenvalue greater than one rule, the first factor explained about 28.56% of the data. The second factor also explained about 17.55% of the data, the third factor explained about 11.62% and the fourth factor explained about 8.20% of the data. The cumulative percentage of these four components amounted to 65.93%. This is highly significant to explain the total variations in the data.

![Scree Plot](source)

From Figure 4.2, it can be seen that the ‘elbow’ of the diagram occurs at the fourth component. This intends depicts that, the number of factors that should be considered for extraction is four (4).

Setting a cut-off point of 0.5, the following factor groupings were obtained. Table 4.8 above presents the results of the rotated component matrix. The interpretability of results can be improved through rotation (Norusis, 2000). The rotated factor solution is displayed by default and is essential for interpreting the final rotated analysis. Rotation suggests the behaviour of the variables under extreme conditions and maximizes the loading of each variable on one of the extracted factors whilst minimizing the loading on all other factors and it is best factor output solutions for interpreting factor analysis (Child, 1990).
Table 4.8 Rotated Factor Matrix

<table>
<thead>
<tr>
<th>Component Code</th>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Gaining competitive advantage</td>
<td>0.02</td>
<td>0.39</td>
<td>0.37</td>
<td>-0.80</td>
</tr>
<tr>
<td>V2</td>
<td>Government pressure</td>
<td>0.92</td>
<td>0.02</td>
<td>0.52</td>
<td>0.03</td>
</tr>
<tr>
<td>V3</td>
<td>Investor pressure</td>
<td>0.06</td>
<td>-0.04</td>
<td>-0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>V4</td>
<td>Awareness of environmental impacts</td>
<td>0.24</td>
<td>0.21</td>
<td>-0.20</td>
<td>0.03</td>
</tr>
<tr>
<td>V5</td>
<td>Consensus on standard EMS needed in sector</td>
<td>0.36</td>
<td>1.09</td>
<td>0.07</td>
<td>0.24</td>
</tr>
<tr>
<td>V6</td>
<td>Environmental culture among competitors</td>
<td>0.13</td>
<td>1.22</td>
<td>0.18</td>
<td>-0.07</td>
</tr>
<tr>
<td>V7</td>
<td>Society pressure</td>
<td>-0.18</td>
<td>0.48</td>
<td>0.08</td>
<td>0.03</td>
</tr>
<tr>
<td>V8</td>
<td>Legislature and Legal compliance</td>
<td>-0.09</td>
<td>0.17</td>
<td>0.13</td>
<td>-0.09</td>
</tr>
<tr>
<td>V9</td>
<td>Develop good image</td>
<td>-0.25</td>
<td>0.28</td>
<td>0.60</td>
<td>0.04</td>
</tr>
<tr>
<td>V10</td>
<td>Desire to improve quality on performance</td>
<td>0.04</td>
<td>0.04</td>
<td>-0.42</td>
<td>0.05</td>
</tr>
<tr>
<td>V11</td>
<td>Skilful policy procurement/environ officers</td>
<td>0.27</td>
<td>0.27</td>
<td>0.42</td>
<td>1.13</td>
</tr>
<tr>
<td>V12</td>
<td>ISO 14001 certification</td>
<td>0.91</td>
<td>0.02</td>
<td>-0.18</td>
<td>-0.10</td>
</tr>
<tr>
<td>V13</td>
<td>Desire to manage economic risk</td>
<td>0.14</td>
<td>0.13</td>
<td>0.33</td>
<td>0.05</td>
</tr>
<tr>
<td>V14</td>
<td>Potential for receiving publicity</td>
<td>1.04</td>
<td>0.43</td>
<td>-0.67</td>
<td>0.25</td>
</tr>
<tr>
<td>V15</td>
<td>Reduce risk of consumer criticism</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.00</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Source: Field Survey 2014

Upon critical examination of inherent relationships among the various factors identified, the various principal components were named. The names of various principal components were formed based on the factors with the highest loadings and the understanding of the relevance of these factors in the context of the study. The various principal components extracted are: Component 1: Leadership Influence; Component 2: Environmental culture; Component 3: Public Influence and Component 4: Personal Skills.

DISCUSSION

Factors Driving the Incorporation of Environmental Sustainability into Construction Procurement at the District assembly Level

The discussions herein are based on the components extracted with their respective factor loadings.

**Component 1: Leadership Influence:** It was observed that, component one loads highly on V2 (government pressure-0.92), V12 (ISO 14001 certification- 0.91) and V14 (potential for receiving publicity-1.04). Thus the factor here is named leadership influence. From Table 4.7, this cluster accounted for 28.56% of the total variance. A significant body of research indicates that government pressure is a major driver for companies’ environmental efforts (Walker et al., 2008, Adetunji et al., 2008, Varnas et al., 2008). According to Walker et al. (2008) government can play a leading role in driving environmental sustainability into the
procurement process. This could be done by creating the opportunity in the form of procurement legislature and laws that allow for environmental sustainability to be incorporated into the construction procurement process for implementation at the district assembly level. According to Walker (2008), ISO certification drives the incorporation of environmental sustainability into the procurement process. The findings agree with literature that current procurement laws in Ghana addresses few sustainability issues (Boyefio, 2008), and that the government must take the lead in promoting environmentally friendly practices through more proactive environmental legislature specially designed for procurement of works.

Component 2: Environmental culture: Component two loads highly on V₅ (consensus on standard EMS needed in sector-1.09) and V₆ (environmental culture among competitors-1.22). Thus the factor here is named environmental culture. From Table 4.10, this cluster accounted for 17.55% of the total variance. These two factors indicate that to be able to incorporate environmental issues into construction procurement there is the need for Procurement Officers and District Engineers to develop an environmental culture. This should be enabled by a common Environmental Management Standard available for implementation in the various districts. This would ensure an effective Environmental Management System to be established among all the districts (Gonzalez-Benito and Gonzalez-Benito, 2005).

Component 3: Public Influence: The third component loaded highly on V₁₄ (potential for receiving publicity-0.67), V₉ (develop good image-0.6) and V₂ (government pressure-0.52), thus the factor is named public influence. From Table 4.10, this cluster accounted for 11.62% of the total variance. This result agrees with literature. Walker (2008) observed that public awareness on environmental impact of construction activities is drastically increasing, and this generates pressure to improve environmental performance in the construction industry. Public pressure and stakeholders are causing firms to review their environmental supply practices (Delmas, 2001). Some non-governmental organisations (NGOs) are putting pressure on organisations to improve their environmental performance (Gabriel et al., 2000).

Component 4: Personal Skills: Component four loads highly on V₁₁ (Skilful policy procurement/environ officers-1.13) and V₁ (gaining competitive advantage-0.80), thus the factor is named personal skills. From Table 4.10, this cluster accounted for 8.2% of the total variance. This agrees with the observation of Drumwright (1994) cited in Walker (2008) that in order to incorporate environmental sustainability into construction procurement, personal skills of responsible officers is key. Improvement on the financial performance of the district and reduction in cost of environmental impacts of construction procurement activities would enable the district to gain a competitive advantage over other districts, especially in competing for the national purse, but this can only be achieved through the personal skills of
responsible officers for construction procurement at the various districts (Gonzalez-Benito and Gonzalez-Benito, 2005).

**Discussion based on Hyden’s norm theory**

The discussions are herein related to the main factors of Hyden’s norm theory explained in the methodology. The three components of the norm-model were identified and grouped as shown in Fig 4.2.

*Opportunity:* previous research revealed that lack of government guidance limited any progress of incorporating environmental sustainability into procurement. According to Dolva (2007), there are several aspects that can determine the procurement officer’s opportunity to integrate environmental sustainability into their procurement process. This research found such factors as political/administrative initiatives, organisational structures, laws and regulations or public awareness. The findings show the availability of laws in Ghana to promote sustainable construction in the districts. The fact that none of the districts had environmental officers as key members in works procurement, and that the district engineers felt it was their duty though they did not have the requisite laws show how indeed it did limit the promotion of environmental sustainability into construction procurement. Positive results have been achieved in donor funded projects where environmental officers are given the opportunity to operate as safeguard officers to enforce environmental regulations in the contracts.

*Will:* Wickenberg (2004) argued that administrative decisions are taking by the procurement officer at the local level, where opportunities and constraints as well as prevalent norms and knowledge can determine the successful incorporation of environmental sustainability into the procurement process (Dolva, 2007). The results revealed that a strong will to include environmental sustainability into construction procurement at the district level exists. The answers and considerations by the environmental officers indicated that they all felt it as an important aspect of their responsibility. But it was revealed that most of the district engineers were of the view that they could handle that aspect. This in itself does not indicate that there is no will. It is however important to note that there was a general misunderstanding of how to insert environmental requirements into contracts. Respondents indicated that they had the will but felt little public pressure or consumer criticism to push them to do so.

*Knowledge:* the results from the questionnaires indicate that there is lack of knowledge on how to transform environmental sustainability issues into contractually enforceable requirements. The current procurement documents have no provisions for environmental sustainability issues. The research also revealed that there was no guidance from government, no tailor-made training and limiting standards to promote such issues into the procurement practice. From the findings one can conclude that knowing what environmental aspects to consider, procurement document that have provision made for environmental sustainability, knowing how to introduce environmental sustainability into the procurement process
are crucial factors in incorporating environmental sustainability into construction procurement. The findings support the notion that without knowledge the will to include environmental requirements might not be utilised.

**CONCLUSION**

The survey responses highlighted that all key stakeholders; namely District Engineers, Environmental Officers, Quantity Surveyors and Procurement Officers, have a considerable role to play across all the procurement stages. It was evident from the survey results that the major factors driving the incorporation of environmental sustainability into construction procurement are desire to reduce risk of consumer criticism (in this case community members), legislature and legal compliance, desire to manage economic risk, and desire to develop good image. These factors were put together under four components namely: leadership influence, environmental culture, public influence and personal skills. The research calls for the need for an environmental culture among stakeholders to be developed, and enabled by a common Environmental Management Standard available for implementation in the various districts. The personal and ethical values on the environment of Environmental Officers, District Engineers, Procurement Officers and Quantity Surveyors in the various districts could filter through the whole organization if these professionals are proactive. Interestingly, Environmental Officers are seldom consulted in most of the construction activities that take place at the district level. It has become necessary to include Environmental Officers as key members of the works department at the district assemblies since there is constant degradation of the forest, farm lands, water bodies, and constant air and noise pollution. Environmental officers seem to be the best expertise at the district level to highlight these
problems in the procurement process and to help the various district assemblies to develop a good environmental culture. This research has highlighted that the identification and inclusion of environmental sustainability issues into construction procurement and tender documents are important factors in environmental management at the district level. Also through this research, a new paradigm of environmentally friendly construction mind-set is suggested to be employed by the works department at the district assembly level in order to produce more environmental sustainable projects. Finally, it has been ascertained that the exploitation of the knowledge of Environmental Officers within the structure of the local government system through the procurement processes is vital for the acquisition of added value environmental sustainable construction projects.

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INFLUENCE OF ENVIRONMENTAL VARIABLES ON THE MECHANICAL PROPERTIES OF RICE HUSK ASH BLENDED CEMENT CONCRETE

Mohammed Hassan Nensok
Department of Building Technology, Waziri Umaru Federal Polytechnic, Birnin Kebbi, Kebbi State, Nigeria

This study focuses on the influence of environmental variables (ambient temperature, relative humidity and wind speed) on the strength property of RHA blended cement concrete. Three dissimilar environments in Nigeria were studied. Jos, humid-cold; Makurdi, hot-humid; and Birnin Kebbi, dry-hot in rainy season. Concrete cubes at various replacement levels of Ordinary Portland Cement (OPC) with RHA were cast. Makurdi, which has the moderate values of the conditions when cured in water, has the highest compressive strength at 28 days and 10% RHA replacement of 27.3N/mm² followed by Jos 25.4N/mm² and lastly Birnin Kebbi 22.7N/mm². Similar trend of differences of flexural strength was also confirmed. This implies that higher values of temperature and wind speed as experienced in Birnin Kebbi and Jos respectively is detrimental to concrete. It is therefore recommended that shading of concrete products at high temperature and the use of wind barriers at high wind speed should be adopted. Further studies should be undertaken in Nigeria during harmattan and dry season to ascertain their effects on RHA concrete in different environmental conditions. It is also recommended that 20% RHA replacement is the optimum under all environmental conditions for both water and field curing especially in mass concrete construction.

Keywords: ambient temperature, mechanical properties, Nigeria, relative humidity, rice husk ash, wind speed

INTRODUCTION

Concrete, a mixture of cement, fine aggregate (river sand) and coarse aggregate (gravels) with water is the most versatile construction materials worldwide. Cement, which is the main binder in concrete and mortar, is equally the most expensive construction materials in concrete. Apart from being expensive, the production of cement results in the release of hazardous gases such as CO₂, NH₄, and NO into the atmosphere which in turn pollutes the environment and results in global warming.
Over the years, numerous research efforts have been made in the use of agricultural waste, such as, Acha Husk Ash (AHA), Corn Cob Ash (CCA), Sugarcane Waste Ash (SWA), Periwinkle Shell Ash (PSA), Rice Husk Ash (RHA) (Dashan and Kamang, 1999; Adesanya and Raheem, 2009; Morales et al., 2009; Umoh and Olusola, 2012; Aka et al 2013) respectively to partially replace OPC in concreting. Amongst these agricultural wastes, RHA has been established to have the greatest potential as a blended OPC supplement (Nensok et al, 2012).

Apart from its availability all over the world, research efforts have shown that OPC when blended with RHA improves a lot of mechanical properties of concretes, mortar and sandcrete blocks. Oyekan and Kamiyo (2008), in blending cement concrete and sandcrete blocks with RHA achieved an optimum replacement level of 20% and 10% respectively. Rukzon et al., (2008) when investigating the effect of grinding on mechanical properties of RHA mortar discovered that the strength of RHA mortar increased with fineness of the RHA, and that 20% replacement of OPC with RHA is the optimum in mortar production. Da Silva, (2008) showed that silica extracted from RH when blended with OPC shows an appreciable increase in strength at 10% replacement. Summary of the properties of RHA blended cement concrete was highlighted by Reddy and Alvarez (2006) in a conference as follows: Substantial reduction in mass loss (lightweight concrete); Considerable reduction in alkali silica and sulphate expansion; Higher compressive strength; Higher resistance to chloride ion penetration; Higher abrasion resistance compared to the control; Higher resistance to carbonation; Higher frost resistance of non-air entrained RHA concretes compared to silica fume concrete.

Despite all these advantages accrued to RHA blended cement concrete and a lot of research efforts undertaken on it, a gap still exist. Little or no effort has been made on studying the properties of RHA concrete with respect to different environmental conditions especially in Nigeria as a tropical country. The question that this gap would like to addressed included: Does the environmental variables has any effects on the mechanical properties of RHA concrete? What is the optimum percentage replacement of RHA to OPC that can be utilised to produce normal concrete under varying environmental conditions?

However, few research efforts on effects of environmental variables on concrete in the temperate and the arid (golf) region of the world do exist: Obla et al (2005) investigated effects of non-standard curing in Maryland in two different weather conditions (cold weather condition of winter and hot weather condition of summer); Abaza (2006) in Palestine investigated the effect of wind speed and air temperature on the durability of Portland cement concrete (PCC) surfaces; Shen (2010) in China investigated the effect of environmental conditions on temperature field of concrete.

It is in line with the above coupled with the problem of climate change and global warming, that this study determine the influence of environment on the properties of RHA blended cement concrete in Nigeria. This was
achieved through investigating the effects of three weather conditions on the properties of RHA blended cement concrete; and by comparing the effects of these varying weather conditions on the properties of the RHA concrete.

AN OVERVIEW ON ENVIRONMENTAL VARIABLES

The properties of fresh and hardened concrete are affected by weather conditions. The two weather conditions as identified by Neville (2000), Shetty (2005), and Neville and Brooks (2008) are cold and hot weather conditions. In cold weather; concretes are mostly influence by the effect of frost (freezing and thawing) which is mostly common in the temperate part of the world. While in hot weather conditions; concrete are mostly influence by the very high temperature, fluctuating humidity, and dry wind speed as experienced mostly in the tropical part of the world. Abaza (2006) identified three air temperature categories. These are hot-32°C and above, cold- 10°C and below, and normal- 10°C to 32°C. In terms of relative humidity, Shetty (2005) has identified a minimum relative humidity of 80% and above on OPC concrete exposed to open or field curing. In addition, Neville (2000) stressed that the risk of plastic shrinkage is possible when the wind speed is in excess of 4.5m/s.

The environmental variables considered in this study are; ambient temperature, wind speed and relative humidity. The study considered three different environments in the country which are; Jos, dry-cold, (23.1°C, 95%, 160Km/hr); Makurdi, hot-humid, (29.6°C, 80%, 110Km/hr); and Birnin Kebbi, dry-hot, (32.3°C, 77%, 104Km/hr). The study was undertaken in Nigeria during rainy season, between the months of July-September. Hence, results are applicable to weather conditions in the rainy season. Data on environmental variables of the study area was obtained from Nigerian Meteorological Agency (NIMET) of Jos, Makurdi, and Birnin Kebbi.

ENVIRONMENTAL CONDITIONS OF THE STUDY AREA

Table 1, shows the variation in ambient temperature, relative humidity and wind speed of the study areas. The table indicate that Jos (23.1°C) is colder than Makurdi (29.6°C) which is in turn colder than Birnin Kebbi (32.3°C). Jos also experiences the highest percentage of relative humidity (95%) as compared to Makurdi (80%) and Birnin Kebbi (77%). In the same manner Jos (160Km/hr) experiences the highest wind speed followed by Makurdi (110Km/hr) and then lastly Birnin Kebbi (106Km/hr).
Table 1: Variation of Maximum Average Ambient Temperature, Relative Humidity and Wind Speed in Jos, Makurdi, and Birnin Kebbi at Every Curing Period.

<table>
<thead>
<tr>
<th>Environmental Conditions</th>
<th>Environments</th>
<th>Curing Periods (Days)</th>
<th>Average Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Ambient Temperature (°C)</td>
<td>Jos</td>
<td>23.1</td>
<td>23.2</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>29.9</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>32.1</td>
<td>32.2</td>
</tr>
<tr>
<td>Relative Humidity (%)</td>
<td>Jos</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Wind Speed (Km/hr)</td>
<td>Jos</td>
<td>176</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>104</td>
<td>103</td>
</tr>
</tbody>
</table>

MATERIALS AND METHODS

Constituents Materials of Concrete
RHA used in this research was obtained from Yelwa District of Shendam Local Government Area of Plateau State. The Rice Husk was burnt into ash and ground in the National Metallurgical Development Centre (NMDC), Jos. The OPC used in the three different environmental regions was the Ashaka Brand of OPC produced in Gombe State of Nigeria. The cement is classified according to Nigerian Industrial Standard as NIS 444: 2003 CEM II A-L 32.5R. The chemical analysis of RHA and cement type is also done at NMDC.

From the result of chemical analysis as shown in Table 2 below, the RHA used in the study satisfies the requirements of ASTM C618-2005 for Pozzolanas since the summation of the percentage composition of silica oxide (SiO₂), Aluminium Oxide (Al₂O₃) and Iron Oxide (Fe₂O₃), is 84.19% greater than 70% as specified by the Code. The loss-on-ignition (LOI) value is very low (2.70%) lower than 10% minimum as specified by the same code. lower values of loss on ignition means lower carbon content which makes the RHA pozzolan more reactive.

The sand used was obtained from the Naraguta River in Jos, Plateau State. Machine Crushed Granite of average size 19.00mm was used in the three different environments studied. And finally, Clean portable tap water was used in the three different laboratory studied.

The aggregate materials were tested for sieve analysis in accordance with ASTM C139-92; specific gravity according to BS 812: Part1: 1975; bulk density according to BS 812: Part2: 1975; and the result of the physical
properties is summarise in table 3. The specific gravity value of 2.56 and 2.66 of the sand and granite sample is closed to the value of 2.60 and 2.62, respectively, as obtained by Saffiuddin et al., (2007). The values obtained for bulk density of OPC loose and compacted were respectively 1405Kg/m³ and 1517Kg/m³ compared to that of RHA which was also respectively 462.5Kg/m³ and 536Kg/m³. This implies that RHA is less dense than OPC.

Table 2: Chemical Analysis of RHA and OPC

<table>
<thead>
<tr>
<th>Constituents</th>
<th>RHA (%)</th>
<th>OPC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Oxide (CaO)</td>
<td>1.79</td>
<td>72.70</td>
</tr>
<tr>
<td>Silica Oxide (SiO₂)</td>
<td>76.3</td>
<td>11.00</td>
</tr>
<tr>
<td>Aluminium Oxide (Al₂O₃)</td>
<td>2.40</td>
<td>3.20</td>
</tr>
<tr>
<td>Ferrous Oxide (Fe₂O₃)</td>
<td>5.49</td>
<td>3.87</td>
</tr>
<tr>
<td>Magnesium Oxide (MgO)</td>
<td>1.19</td>
<td>2.05</td>
</tr>
<tr>
<td>Sulphur Oxide (SO₃)</td>
<td>0.10</td>
<td>2.9</td>
</tr>
<tr>
<td>Potassium Oxide (K₂O)</td>
<td>3.09</td>
<td>0.73</td>
</tr>
<tr>
<td>Sodium Oxide (Na₂O)</td>
<td>0.08</td>
<td>0.19</td>
</tr>
<tr>
<td>L.O.I</td>
<td>2.70</td>
<td>1.20</td>
</tr>
<tr>
<td>Others</td>
<td>6.86</td>
<td>2.16</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>3.76</td>
<td>1.05</td>
</tr>
</tbody>
</table>

RHA used in this study is finer than the Ashaka brand of OPC, since 85% of the RHA used passes through 45-micrometer sieve compared to the 77% of OPC passing through the same sieve. The fineness would improve pozzolanic activity as ascertained by Rukzon et al., (2008). In addition, the fineness also would make RHA serve as a good micro-filler and thus improved the density and compressive strength of the RHA/OPC concrete.

METHODS

Mix Proportions and Casting of Concrete Cubes and Beams
The same type of mixing and batching was adopted in all three environment of this research. Manual mixing method was undertaken in preparing the concrete for placing. Absolute volume method of mix proportioning was adopted. Table 4 below gives the summary of general mix proportion of concretes. The water cement ratio used in this study was 0.65. The whole process of mixing and sampling was in accordance with B. S 1881: Part 125: 1986.

An average of three samples of concrete cubes are produced per each partial replacement of 0%, 5%, 10%, 20%, and 30% with RHA at the hydration period of 7, 21, and 28 days. This resulted to a total of 45 Concrete cubes of size 150mmx150mmx150mm. Since there are two methods of curing adopted, 45 are cured inside water after 48 hours exposure to external environmental conditions, whiles 45 were cured...
outside in the open subjected to the actual site condition in the field and cured sprinkled with water, morning and evening. This resulted in a total 90 concrete cube in each environment, all of which were tested for compressive strength. Equal numbers of concrete beams of dimension 100mmx100mmx500mm were produced using the same partial replacement level at the hydration period of 14, 21, and 28 days. The beams were tested for flexural strength.

Table 3: Summary of Physical and Mechanical Properties of Materials.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Properties</th>
<th>Results Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHA</td>
<td>Colour</td>
<td>Dark Grey</td>
</tr>
<tr>
<td></td>
<td>Fineness</td>
<td>85% finer than 45 micrometer Sieve</td>
</tr>
<tr>
<td></td>
<td>Moisture Content</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Bulk Density (Kg/m³): Loose</td>
<td>462.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compacted</td>
</tr>
<tr>
<td>PC</td>
<td>Colour</td>
<td>Ash</td>
</tr>
<tr>
<td></td>
<td>Fineness</td>
<td>77% Finer than 45 micrometer sieve</td>
</tr>
<tr>
<td></td>
<td>Moisture Content</td>
<td>1.6%</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Bulk Density (Kg/m³): Loose</td>
<td>1405</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compacted</td>
</tr>
<tr>
<td>River Sand</td>
<td>Fineness</td>
<td>100% finer than 5.00mm Sieve</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity</td>
<td>2.57</td>
</tr>
<tr>
<td></td>
<td>Bulk Density (Kg/m³): Loose</td>
<td>1455</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compacted</td>
</tr>
<tr>
<td>Crushed Granite</td>
<td>Fineness</td>
<td>72% finer than 20mm sieve</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity</td>
<td>2.66</td>
</tr>
<tr>
<td></td>
<td>Bulk Density (Kg/m³): Loose</td>
<td>1273</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compacted</td>
</tr>
<tr>
<td>Normal tap water</td>
<td>Density</td>
<td>1000 Kg</td>
</tr>
<tr>
<td></td>
<td>pH value</td>
<td>8.04</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Results of Consistency and Setting Time Tests
Consistency and setting time test was conducted in accordance with ASTM C 192-92. From table 5, it is clear that value of consistency increases with increase in percentage partial replacement of OPC with RHA in all the environments, which is in agreement with findings of Oyetola and Abdullahi (2005). In addition, the value of consistency in Birnin Kebbi is
higher than that of Makurdi and that of Makurdi is in turn higher than that of Jos. This is because the setting time of cement is effected by the temperature and the humidity of the surrounding air (Neville, 2000). Considering the various temperatures in the three different environment it implies that, the higher the temperature the higher the value of consistency, or quantity of water required to produce a paste of standard consistency and vice versa. Hence, Jos, with recorded average temperature of 23.2°C, relative humidity of 95% and wind speed of 170Km/hr has the lowest consistency values of 31-33% compared to Birnin Kebbi which has average ambient temperature of 32.7°C, relative humidity of 77% and wind speed of 103Km/hr experiences higher consistency values of 34-38%.

Table 4: General Mix Proportioning (Per Meter Cube of Concrete)

<table>
<thead>
<tr>
<th>Batch number</th>
<th>% RHA Replacement</th>
<th>Mix Proportioning</th>
<th>W/C Ratio</th>
<th>OPC (Kg)</th>
<th>RHA (Kg)</th>
<th>River Sand (Kg)</th>
<th>Crushed Granite (Kg)</th>
<th>Water (Litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1:2:4</td>
<td>0.65</td>
<td>315.00</td>
<td>0</td>
<td>653</td>
<td>1142</td>
<td>205</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>1:2:4</td>
<td>0.65</td>
<td>299.25</td>
<td>15.75</td>
<td>653</td>
<td>1142</td>
<td>205</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>1:2:4</td>
<td>0.65</td>
<td>283.50</td>
<td>31.50</td>
<td>653</td>
<td>1142</td>
<td>205</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>1:2:4</td>
<td>0.65</td>
<td>252.00</td>
<td>63.00</td>
<td>653</td>
<td>1142</td>
<td>205</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>1:2:4</td>
<td>0.65</td>
<td>220.50</td>
<td>94.50</td>
<td>653</td>
<td>1142</td>
<td>205</td>
</tr>
</tbody>
</table>

Similarly, there is an increase in setting time as the percentage partial replacement increases. This is in agreement with the finding of Dashan and Kamang (1999). This implies that RHA in the mix slows down the rate of chemical reaction of the cement paste, which is the main cause of flash setting and crazing of concrete especially in hot weather like Birnin Kebbi. Hence, RHA blended cement concrete is environmentally friendly in hot environment. However, the setting time were within the range specified by ASTM C192-92 limits of not less than 45 minutes initial setting time and not more than 10 hours final setting time for OPC.

Table 5 also indicated differences in the setting times of the three different environments. Jos experiences the highest values of setting time in all the different batches of concretes mixes since the average temperature in Jos (23.2°C) lower than that in Makurdi (29.6°C) and Birnin Kebbi (32.3°C).

Result of Slump and Compacting Factor Test

Slump and Compacting factor test was undertaken in accordance with BS 1881: Part 102: 1983 and BS 1881: Part 103: 1983 respectively. Table 6 gives the result of workability test undertaken in the three different environments. Slump and compacting factor increase as partial replacement with RHA increases. This simply implies that as percentage partial replacement increases workability also increases, which is one of the advantages of using RHA as a pozzolana as earlier testified by Reddy and Alvarez (2006).
Table 5: Variation of Consistency and Setting Time Tests in Jos, Makurdi, and Birnin Kebbi

<table>
<thead>
<tr>
<th>Properties</th>
<th>Environment</th>
<th>Percentage Partial RHA Replacement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Consistency</td>
<td>Jos</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>34</td>
</tr>
<tr>
<td>Initial Setting time</td>
<td>Jos</td>
<td>130</td>
</tr>
<tr>
<td>(minutes)</td>
<td>Makurdi</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>115</td>
</tr>
<tr>
<td>Final Setting time</td>
<td>Jos</td>
<td>280</td>
</tr>
<tr>
<td>(minutes)</td>
<td>Makurdi</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>145</td>
</tr>
<tr>
<td>Average Temperature</td>
<td>Jos</td>
<td>23.1</td>
</tr>
<tr>
<td>(°C)</td>
<td>Makurdi</td>
<td>29.6</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>32.3</td>
</tr>
<tr>
<td>Relative Humidity (%)</td>
<td>Jos</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>77</td>
</tr>
<tr>
<td>Wind Speed (Km/hr)</td>
<td>Jos</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>104</td>
</tr>
</tbody>
</table>

In addition, as one goes down the table, there is decrease in the slump and compacting factor values from Jos to Birnin Kebbi at each partial replacement level. This might be attributed to the differences in temperature and relative humidity of these environments. Since Jos has the lowest temperature (23.2°C) and the highest relative humidity (95%), there will be less surface evaporation of the fresh concretes mix in Jos compared to Birnin Kebbi, which has the highest temperature (32.2°C) and the lowest value of average relative humidity (70%). The issue is that, higher temperature implies high rate of surface water evaporation, lower relative humidity also means high rate of atmospheric moisture absorption. This means that more evaporation of water would be experience in such environment, and lower water content in fresh concrete implies lower workability as reflected in the values obtained in Birnin Kebbi.
Table 6: Variation of slump and Compacting Factor in the Three Different Environments.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Environments</th>
<th>Percentage RHA Replacement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>W/C Ratio</td>
<td>Jos</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>0.65</td>
</tr>
<tr>
<td>Slump</td>
<td>Jos</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>20</td>
</tr>
<tr>
<td>Compacting Factor</td>
<td>Jos</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Makurdi</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>Birnin Kebbi</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Results of Compressive Strength of Concretes

The procedure for testing and crushing were carried out in accordance with BS 1881: Part 116: 1983. From table 7, the results of the compressive strength in the three different environments at various replacement levels indicate that compressive strength increases with increase in curing age. This fundamental fact, has been ascertained by Dashan and Kamang (1999), Reddy and Alvarez (2006) etc, considering the three different environment and the result obtained with respect to the environmental conditions attached thereof, Makurdi has recorded the highest strength compared to Jos and Birnin Kebbi. The reasons for Makurdi achieving such strength could be:

1. The moderate curing temperature of 29.6 °C at placement and curing is categorized as normal. Abaza (2006).

2. Average wind speed recorded for Makurdi was 110 Km/hr compared to the value of 160Km/hr recorded for Jos. The higher the value of wind speed the higher the rate of surface moisture evaporation.

3. The main reason behind Birnin Kebbi achieving lower strength is the value of relative average high ambient temperature of 32.3 °C, compared to 23.1 °C and 29.6 °C recorded in Jos and Makurdi respectively. This was the reason why Birnin Kebbi obtained an early high strength at 7days curing periods and at the replacement level of 0%, 5%, and 10% compared to Jos, and Makurdi, while at later curing periods of 21 and 28 days, the strength drop drastically at all replacement level. This finding is in agreement with work of Neville (2000), Tashima, Da Silva, Akasaki, and Barbosa (2006)

Generally, there is increase in strength with increase in RHA replacement up to 10%, then at 30% replacement, there is drastic decrease in strength under all environmental condition. In all cases of environmental conditions concretes cured in water exhibited higher compressive strength to their counterparts cured outside water. However, 20% RHA replacement at 28 days for concrete cured outside (field curing) resulted in production of
normal strength concrete. Since the compressive strength at 28 days is Jos (20.8 N/mm²), Makurdi (21.6 N/mm²) and Birnin Kebbi (20.1 N/mm²) all of which satisfied the requirement specified by BS 8110: Part 1: 1995 for normal strength concrete. Therefore the replacement of OPC with RHA at 20% is possible using field curing under all adverse environmental condition in the production of normal strength concretes in Nigeria during rainy season.

Table 7: Variation of Compressive Strength of Concretes Cubes Produced in Jos, Makurdi and Birnin Kebbi

<table>
<thead>
<tr>
<th>Mechanical Property</th>
<th>Jos</th>
<th>Makurdi</th>
<th>Birnin Kebbi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength (N/mm²)</td>
<td>Curing age (days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curing Age (Days)</td>
<td>7</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Percentage RHA Replacement (%)</td>
<td>0% cured in water</td>
<td>16.4</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td>0% cured outside</td>
<td>10.8</td>
<td>14.2</td>
</tr>
<tr>
<td></td>
<td>5% cured in water</td>
<td>17.5</td>
<td>22.7</td>
</tr>
<tr>
<td></td>
<td>5% cured outside</td>
<td>12.4</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td>10% cured in water</td>
<td>16.2</td>
<td>23.6</td>
</tr>
<tr>
<td></td>
<td>10% cured outside</td>
<td>12.9</td>
<td>17.8</td>
</tr>
<tr>
<td></td>
<td>20% cured in water</td>
<td>16.0</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>20% cured outside</td>
<td>11.5</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>30% cured in water</td>
<td>12.9</td>
<td>18.4</td>
</tr>
<tr>
<td></td>
<td>30% cured outside</td>
<td>8.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Environmental Variables</td>
<td>Temperature</td>
<td>23.1</td>
<td>23.0</td>
</tr>
<tr>
<td></td>
<td>Rel. Humidity</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Wind Speed</td>
<td>174</td>
<td>154</td>
</tr>
</tbody>
</table>

Results of Flexural Strength of Concretes

Flexural strength test was conducted on beam of size 100x100x500 mm in accordance with BS 1881: Part 118: 1983. The result given in table 8 is similar to the result of compressive strength discussed above and the same reasons applied. Flexural strength increases with increase in the hydration periods. This is also in line with the findings of Zang and Mahorta in Reddy and Alvarez (2006) and Tashima, Da Silva, Akasaki, and Barbosa (2006). In both cases concrete cured in water not directly exposed to the direct effect of impact of tropical ambient temperature relative humidity, and wind speed performs better in terms of compressive and flexural strength than those cured outside water.
Table 8: Variation of Flexural Strength of Concretes Beams Produced in Jos, Makurdi and Birnin Kebbi

<table>
<thead>
<tr>
<th>Mechanical Property</th>
<th>Flexural Strength (N/mm²)/Curing age (days)</th>
<th>Curing Age (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td>0% cured in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0% cured outside</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5% cured in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5% cured outside</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% cured in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% cured outside</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20% cured in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20% cured outside</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30% cured in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30% cured outside</td>
</tr>
<tr>
<td>Environmental Variables</td>
<td>Temperature</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rel. Humidity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wind Speed</td>
</tr>
</tbody>
</table>

CONCLUSION

This study shows that differences in environmental conditions seriously affect the mechanical properties of RHA blended cement concrete. It revealed that very hot weather condition, low relative humidity and high wind speed is detrimental to OPC and or RHA/OPC concrete. The study also confirmed the significance of the used of RHA blended cement concrete in reducing the tendency for flash setting, since it increases initial and final setting time of concrete. In addition, this paper also ascertains the need for proper curing (water curing) especially in hot and windy environments. Study also reveals that 20% RHA replacement is acceptable for concretes exposed to field curing in all environmental conditions for the production of normal strength concretes. Results from the study imply the need to have adequate knowledge of environmental conditions before commencement of any concreting or mortar work.
RECOMMENDATIONS

The following recommendations are therefore suggested:

1) In a dry-hot environment like Birnin Kebbi surfaces of concretes should be properly shaded and concrete members should be cast during cold hours; while in a windy environment like Jos wind barriers should be erected.

2) 20% OPC replacement with RHA is recommended for production of grade 20 (C20) concrete exposed to field curing under all environmental conditions during rainy season.

3) Standard practices like good curing methods and carrying out concreting without delay should be encouraged in all environments.

4) Further studies should be undertaken in Nigeria during harmattan and dry season to ascertain their effects on RHA concrete under different environmental conditions.

5) Further studies should be undertaken using some other forms of pozzolanas (Agricultural, natural, and artificial pozzolanas) and determining their effects to different environmental conditions in Nigeria.

REFERENCES


INFLUENCE OF FADAMA ACTIVITIES ON WOMEN EMPOWERMENT IN EDE NORTH LOCAL GOVERNMENT AREA OF OSUN STATE, NIGERIA

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

The study was conducted to assess the influence of Fadama activities on women empowerment in Ede North Local Government Area of Osun State, Nigeria. The specific objectives examined the rate at which women participated in Fadama and the differences in income before and during Fadama in the area. Data were obtained from primary and secondary sources. Primary data was obtained purposively with the use of 240 structured questionnaires in a survey of 24 Fadama Users Groups (FUGs) whose representatives constitutes 6 Fadama Communities Associations (FCAs) in the study area. Secondary data was obtained from published and unpublished sources. Primary data was analyzed with the aid of statistical package for social science (SPSS) to obtain both descriptive and inferential statistics. Findings show with regards to the Fadama activities undertaken, majority 58.8% were into agro processing, 25.4% into farming, 12.5% - into poultry while 2.9% were into fish farming. Similarly, 74.6% earned N18,000-28,000, 21.2% of Fadama farmers received an average annual income of below N18,000, and 3.8% earned N29,000-39,000 per annum before joining Fadama and after 45.4% of the respondents received income of N29, 000-N39, 000, 42.9% earned N40, 000 and above while 10.0% received N18, 000-N28, 000. The Result of the factor analysis reveals that the total variance explained by each component extracted made up to 69.61% of total variance with variable 1 gender explaining 31.34%, the second 17.65%, third 11.22% and fourth variable 9.40%. Based on the findings of the study, it is evident that the Fadama program in Ede North Local Government increased the participation of - rural women farmers in agricultural production which has helped to reduce the problems of gender discrimination which if explored could create jobs with value chain addition, reduce poverty, food security and advance the MDGs.

Keywords: Fadama, food security, women empowerment, poverty reduction

INTRODUCTION

Women have been perceived as house wives or farmers’ wives rather than farmers and this gender ideology is reflected in policies that affect access to the means of production and the social relationships of production which

Gasu and Ajani

Fadama provides (Ogbona and Nwaobiala, 2014). Ajah (2010), observed that if disparities between men and women’s statuses, access to resources, control of assets and decision making powers persist, sustainable and equitable development would be undermined. Edoka (2008), opined that “women still lack independent right to own land, involvement in food production, manage property, conduct business, or even travel without their husbands’ consent”. In Nigeria, women play very significant roles in all areas of agricultural production. Ogungbile et al., (1991) cited in Ehiemere (2008) in a study of women in Muslim and non-Muslim areas of Northern Nigeria, observed that the activities of women include land preparation, planting, harvesting, food processing, livestock and transportation.

Similarly, it has equally been reported that they are involved in food production, processing and marketing (Rahman et al., 2004) and produce 60-80 percent of food in the country (Buchland and Haleegoah, 2006). Women equally provide about 60-80 percent of agricultural labour force and contribute to well being of their households through their income generating activities (Mgbada, 2000 and Rahman et al., 2004). Furthermore, Akangbe, et al., (2012), noted that out of 95 percent of small-scale farmers in Nigeria, 55 percent of them are women who produce the bulk of agricultural products. Women in southwestern Nigeria are playing active role in agriculture. Studies have shown that many government agricultural intervention development programmes in Nigeria have not had lasting impact on agricultural development and that many have not yielded the expected results of sustained increase in food production (Baba and Singh, 1998).

The National Fadama Development Project (NFDP) in Nigeria is one of such programmes in states with Fadama potentials. Nigeria as a country is blessed with potentially good land and water resources required for sustainable agricultural development. The National Fadama Development Project (NAFDP) is a project of the Federal Government of Nigeria through the pooled World Bank loan, to finance the development of Fadama lands by introducing small-scale irrigation in states with Fadama development potentials. The project aims at boosting incremental food production and raise the standard of living of the beneficiaries.

Fadama are low lands subjected to seasonal flooding or water logging along the banks of streams or depressions. It is a Hausa word meaning, the seasonally flooded or floodable plains along major savannah rivers and or depressions or adjacent to seasonally or perennially flowing streams and rivers. It is called Akuro in Yoruba land and Akpauru in Igbo. Fadama is a Hausa name for irrigable land-usually low-lying plains underlay by shallow aquifers found along Nigeria’s major river systems (Blench and Ingawa, 2004). Such lands are especially suitable for irrigated production and fishing, and traditionally provide feed and water for livestock. The enormous potential of this land is only very partially developed.

The Fadama I and II projects successfully refined approaches for improved utilization of these lands. Fadama II implements an innovative local development planning (LDP) tool and builds on the success of the community-
driven development initiative. The cumulative impact of these earlier successful World Bank-assisted projects attests to the robustness of the small-scale and community based approach to Fadama development in an environmentally sensitive manner. The World Bank’s Fadama III Project, a follow up to the Fadama II Project, which impacts the lives of the rural farmers, raising their incomes by 63% is showing early results in 36 Nigerian states and the Federal Capital Territory (FCT) (NFDP II, 2003).

CONCEPTUAL/THEORETICAL FRAMEWORK

Several theories and concepts could be employed to form the framework to assess the roles of gender on Fadama activities. Some of these theories and concept include; Citizen Participation, Community Development, Social Inclusion, Sustainable Development as well as Community-Driven Development (CDD). The concept of Community-Driven Development has been identified as critically relevant to this study. The World Bank defines CDD as ‘a development approach that gives control over planning decisions and investment of resources to community groups and local governments’ (Dongier et al, 2003). This is so because CDD provides communities with a voice and control over all project stages, it is believed to i) Enhance sustainability; ii) Improve efficiency and effectiveness; iii) Allow poverty reduction efforts to be taken to scale; iv) Make development more inclusive; v) Empower poor people, build social capital, and strengthen governance; and vi) Complement market and public sector activities (Dongier et al. 2003; van Domelen 2007, 2008; Baird et al. 2009; Binswanger et al. 2010, Aduse-Asante and Hancock, 2012).

Therefore, in this approach community groups are organized to plan, implement and manage the process. CDD can also be defined as an approach that empowers local community groups, including local governments by giving direct control to the community over planning decisions and investment on resources through a process that emphasizes participatory planning and accountability (World Bank, 2006). CDD gives control on decisions and resources to community groups. These groups often work in partnership with demand-responsive support organization and service providers including elected local government officials, the private sector, non-governmental organizations (NGOs) and central government agencies. CDD is therefore a way to provide social and infrastructural services, organise economic activity and resource management, empower poor people and improve governance and also enhance security of the poorest (World Bank, 2003). Importantly, the strategy represents a shift from public sector domination to a community-driven development (CDD) approach, which is built around community-defined priorities where each community has a comparative advantage over a resource. The participatory component of the project was based on Fadama user groups with common economic interests, such as farmers, fishers, pastoralists, women, the disabled, and students (NFDP II, 2003). The project encouraged these groups to develop plans, and then each group request money to pay for income-generating “community-
level assets,” such as fishing nets, fertilizer, water-pumps, or generators just to name but a few.

Community organisations decide on how the resources are allocated among the priorities that they themselves identify and they equally manage the funds. Extensive facilitation, training, and technical assistance are provided through the Project to ensure that women and vulnerable groups, especially the physically challenged, participate in the collective decision-making process. The project helps by giving voices to the communities as well as promotes the principles of transparency and accountability in planning and management of public investments within the Local Government Areas (LGAs).

Ejiofor (2007) explained that the CDD strategy makes it possible for beneficiaries to play leading roles in:-

a) Identification and prioritisation of their needs;

b) Deciding and preparing of micro-projects required to address the identified needs;

c) Co-financing the micro-projects;

d) Continue to operate and maintain the micro-projects thereby ensuring sustainability;

e) Learn to do things for themselves and in so doing their capacities are built; and

f) Ownership of the micro-projects is guaranteed by active participation of beneficiaries in all the phases of the micro-projects cycle (identification, planning, prioritisation, designing, implementing and maintenance of Intervention measures)

Fadamas have been sources of economic power to many groups of individuals called Fadama Users Group (FUG). Fadama Users Groups according to Blench and Ingawa (2004) are farmers, pastoralists, fisher folk/fisher women, hunters and others (e.g., gatherers), who directly depend upon the natural resources of the Fadamas for their livelihoods. The enormous potentials for irrigated agriculture in the Fadama and flood plains are unquestioned. According to Baba and Singh (1998), the Fadama lands have high potentials and agricultural values several times more than the adjacent upland. Fadama development is a typical form of small scale irrigation practice characterised by flexibility of farming operations, low inputs requirement, high economic values, minimal social and environmental impact and hence conform with the general criteria for sustainable development (Akinbile et al., 2006). Furthermore, Akinbile et al. (2006) submitted that pumping water from wells in Fadama helps in controlling the water table and is thus, anti-water logging device. Similarly, pumping water from the wells increase infiltration and leaches harmful salts from the root zone, thereby providing additional basis for sustainable Fadama development. The NFDP was established consequent to the failure of large scale irrigated schemes, which
the country has pursued for the last 2 decades to yield the anticipated increase in food production (Baba and Singh, 1998).

Presently, the NFDP is widely being implemented in all the 36 states of the Federation and the Federal Capital Territory (FCT), which have been categorized into the core states and the facility states. The core states include Bauchi, Gombe, Jigawa, Kano, Kebbi, Zamfara and Sokoto, while the remaining states and the FCT constitute the facility states (Baba and Singh, 1998). In Osun state, 8,000 farmers in the state have benefitted from the phase III of the project. Some of the communities benefitting from this Fadama project include Egbedore, Ife-east/area office, Oriade, Ila, Odo-otin, Orolu, Atakumosa-west, Iwo, Ola oluwa, Irewole, Irepodun, Olorunda, Atakumosa-east, Ifelodun, Boripe, Boluwaduro, Isokan, Ife-central, Ife-south and Ede-north. The third National Fadama Development Project is funded by the World Bank, the Federal Government, State Government and Local Government to the tune of $450m. The objectives of Fadama III is to increase the incomes of Fadama users through empowering communities to take charge of their own development agenda and by reducing conflicts among Fadama resource users and supporting improved management and increase food production. The objectives of Fadama III are to substantially increase the income of Fadama lands and water resources users in our local communities. By increasing their income, it will help reduce poverty, increase food security and contribute to the attainment of the Millennium Development Goals. Unlike Fadama II that covered only 18 states, Fadama III covers the 36 states and the Federal capital territory. It targets poor rural folks, disadvantage groups that include women, widows, handicapped, the sick and the private sector.

According to the Project Implementation Manual of Fadama III (PIM, 2009), the strategic objectives of Fadama III are to enhance growth in all sectors other than oil in order to achieve increased food security, reduce poverty, and create employment in the rural areas. Also, Fadama III is to increase opportunities for rural economic development, and contribute to the realization of the agenda for a secured future. The target population of NFDP III includes 2.2 million rural farming households, including smallholder male and female farmers, pastoralists, fisher folks, traders, processors, hunters and gatherers, the disadvantaged and physically challenged groups, widows/widowers, the handicapped, the unemployed youths, aged and people living with HIV/AIDS (PLWHIV). Others are service providers, including government agencies, private operators and professional/semi-professional associations operating in the project. To achieve the strategic objectives of NFDP III and to reach the target population, viable FUGs and their apex FCAs were formed through which support were provided for acquisition of group-owned productive assets, inputs and rural infrastructure through the community driven development (CDD) approach. For FUG to benefit from this project, upfront payment of 30% beneficiary contribution for productive assets is required for 70% corresponding matching grants by the project, and 50% matching grant on inputs. On the other hand, vulnerable FUGs enjoy 100% matching grant for both productive assets and inputs and 15%
repayment from proceeds of activity is expected from them. For FCAs to benefit from infrastructural support, 10% beneficiary contribution is required for 90% matching grant by the project. The Fadama Community Association is an apex organization of economic interest groups (FUGs) which derive their livelihood from the shared natural resources of the Fadama land, 10 to 15 Fadama User Groups (FUGs) form a FCA. A Fadama User Group (FUG) is a group of persons (average of 10-15) who share common economic interest such as crop production, animal production, agro-processing, agricultural marketing, and so on. In Osun State, on the average, there are seven to eight FCAs in each of the twenty Local Government Area covered by Fadama III.

In order for any FCA/FUG to benefit from the project, certain guidelines have been put in place by the Osun State Fadama Coordination Office (OSSFCO). These include; payment of counterpart fund (10% for rural infrastructure, 30% for pilot asset acquisition and 50% for input support); farmers are instructed first to pay their counterpart funds to service providers that would execute such projects and inspection would be done before the counterpart fund from the NFDP III is released; all FUGs/FCAs are expected to open a bank accounts for FUEF (Fadama Users Equity Fund) savings and pay into such account once operations of activities commence; there is efficient monitoring and evaluation as well as record keeping.

According to the National Planning Commission (NPC, 2012), Nigeria’s development efforts have over the years been characterized by lack of continuity, consistency and commitment to agreed policies, programmes and projects, as well as an absence of a long-term perspective. Due to this, there has not been much improvement in the overall welfare of Nigerian citizens because of rising unemployment, inequality and poverty (National Planning Commission (NPC), 2012). Despite this assertion, the National Fadama Development Project (NFDP) III has played significant roles in infrastructural support and acquisition of productive (income generating) assets by able-bodied groups, women, unemployed youths and other vulnerable groups in Nigeria.

According to Akinbile (2007), Nigeria has had many intervention programmes in the agricultural sector, which have not had lasting impact on agricultural development nor yielded the expected result of sustained increase in food production. It is therefore, necessary to assess the NFDP to prevent the programme from suffering the same fate like the earlier ones. This study therefore, assessed the roles of Fadama activities on women empowerment and constraints militating against sustainable Fadama development in Nigeria and the study area. For instance, according to Akinbile et al. (2006), thousands of Fadama lands remain uncultivated due to the problem of accessibility or remoteness, which tends to inhibit the spread of new ideas and concepts of Fadama development. Also, according to Oladoja et al. (2008), some of the common drawbacks in the management of Fadama are the occurrence of marsh lands and swamps, which are difficult to work, thereby making the development and management of Fadama expensive and occasionally unhealthy. Baba and Singh (1998) noted that lack of post-harvest technologies, poor handling, poor road network and the lack of means of
preservation constitute a major constraint of Fadama products preservation. High yielding crop varieties are highly susceptible to diseases such as stem, leaf and root rot, blight, blasts, aphids and stem borer. Other problems identified include; pests such as Quelea quelea birds, migratory locusts, grasshoppers, insects and diseases whose devastating effects could cause crop losses as high as 25-30% (Oladoja et al. 2008). Ladele and Omotoso (2000) pointed out that urban agriculture in Nigeria has not been given much policy consideration. This has resulted in deficiencies in some technical and managerial skills of Fadama resources users. Produce from low land Fadama usually command high farm gate prices due to high demand for the produce at the time of low supply. Since farmers are generally encouraged to increase their income and consequently their outlook therefore, the need to improve their skills and knowledge in Fadama farming is of paramount importance.

This study made use of factor analysis for it is an important tool that provides a rich multivariate approach towards exploring the underlying features of multiple and interrelated variables, without any preconceived judgement (Hair et al, 1998; Field, 2005). Ahadzie et al (2010) observed that this tool is widely acknowledged as useful for screening and properly managing the interpretation of the too many variables often encountered in many research designs. Ahadzie et al, (2010) while drawing lessons from the results of a recently concluded research emphasised that factor analysis reinforces the potential of the tool towards helping to understand the complex relationship that exists amongst the many multiple variables often associated with research designs. Researchers have held that factor analysis is very useful for exploratory research, identification of underlying factors, screening of variables, data summarization, clustering of objects, sampling of variables, index building, and more importantly, establishing the construct validity of any potential measures without imposing any preconceived judgement (Stapleton, 1997; Hair et al, 1998; Norussis, 2000; Field, 2005).

**STUDY AREA**

Ede is a town in Osun state, southwestern Nigeria. It lies along the Osun River at a point on the railroad 180 km from Lagos. Ede is one of the older towns of the Yoruba people founded about 1500AD by Timi Agbale a hunter, is predominantly Muslims who make up to 90% of the population (Eades, 1980). It has an area of 11km² and population of 83,831 at the 2006 census (NPC, 2006). It lies between latitude 7° 31’ and 7° 55’ N and longitude 4° 15’ and 4° 40’ E. It is bounded in the North by Egbedore, to the South by Ayedade, to the East by Atakumosa and Osogbo and to the West by Ejigbo and Ayedire Local Government Areas of Osun State. Ede region accommodates the wetland areas of Ede North and Ede South Local Government Areas. It is drained by river shasha and Osun along and their tributaries.

Alluvial soils rich in Agriculture occur along the courses of rivers and streams in the study area (Gasu, 2013). These are soil types that derive their
comparatively high productivity from their water holding capacity; the concentration of nutrients washed down from the adjacent slopes and the great depth of easily worked fine alluvium (Areola, 1978). The area is characterized by tufted savannah grasses and dotted with trees especially oil palms (Symth and Mongometry, 1962). As far as the study area is concerned, ‘much of the work of the climatologists in describing climatic types must be in form of cautious deductions from general principles and short term observations’ (Oladokun et al., 2007). The annual rainfall is between 1500mm and 2000mm. Relative humidity is over 80% in the morning and falls between 50% and 70% in the afternoon. The mean annual temperature is about 27°C (Symth and Mongometry, 1962).

RESEARCH METHODOLOGY

The research made use of two types of data, primary and secondary data. The primary data was obtained by the administration of questionnaires to respondents and through field inspection and observation. This was achieved purposively by administration of 240 structured pre-tested questionnaires in a survey of 24 Fadama Users Groups (FUGs) whose representatives constitutes 6 Fadama Communities Associations (FCAs) in the study area. The administration of the questionnaire focus mainly on the FUGs which have more female users groups than males. 10 members each from 4 FUGs in the 6 FCAs were administered the questionnaires, totaling 240 questionnaires. The secondary data on the population of study area, climate and the socio-economic activities of the people was collected from already existing data which have been collected by other researchers, agencies relevant to the project under study which include; books, journals, magazines, newsletters, libraries and archives. The sample frame used for this research is the membership register of all the existing Fadama Users Groups (FUGs) whose representatives constitute Fadama Community Associations (FCAs) in the study area. There are eight (FCAs) out of which six were purposively selected. Each of these Fadama Community Associations contain ten to fifteen Fadama Users Groups (FUGs) from which four FUGs each were equally purposively selected with preference given to those with higher number of female members. Each of the Fadama Users Group consists of 9 to 15 members. Data analysis made use of Principal Component Analysis (PCA), tables and frequency distribution.

RESULTS AND DISCUSSIONS

The analysis in table 1 shows that Fadama in the study area is gender sensitive. The survey reveals that 80.4% are female while 19.6% of the respondents are male. This conforms to the views of Mgbada, 2000 and Rahman et al., 2004, that Women provide about 60-80 percent of agricultural labour force and contribute to well-being of their households through their income generating activities.
Table 1: Gender of respondents

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47</td>
<td>19.6</td>
<td>19.6</td>
</tr>
<tr>
<td>Female</td>
<td>193</td>
<td>80.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The results also showed that 74.6% of the respondents received an average monthly income of N18,000-N28,000, while 21.2% received below N18,000 and 4.2% received N29,000-N39,000 before the commencement of the programme (Table 2).

Table 2: Average monthly income before joining Fadama

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELOW 18,000</td>
<td>51</td>
<td>21.2</td>
<td>21.2</td>
</tr>
<tr>
<td>18,000-28,000</td>
<td>179</td>
<td>74.6</td>
<td>95.8</td>
</tr>
<tr>
<td>29,000-39,000</td>
<td>10</td>
<td>4.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows that 45.4% of the respondents earned an income of N29,000-N39,000 while 42.9% received N40,000 and above and 11.67% received N18,000-N28,000 before the commencement of Fadama. A comparison of Table 4.2 and Table 4.3 shows that before Fadama 74.6% earned an income of N18,000-N28,000 while during Fadama 46% and 42.9% earned N29,000-N39,000 and N40,000 and above respectively. The implications of this is that Fadama activities has made a remarkable improvement in the income of the participating farmers and if sustained could improve the livelihood of the participants, reduce poverty, create jobs and create value chain addition.

Table 3: Average Monthly Income after Joining Fadama

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,000-28,000</td>
<td>28</td>
<td>11.67</td>
<td>11.67</td>
</tr>
<tr>
<td>29,000-39,000</td>
<td>109</td>
<td>45.4</td>
<td>56.01</td>
</tr>
<tr>
<td>40,000 and Above</td>
<td>103</td>
<td>42.9</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 shows that 32.1% of the respondents were into cassava farming and processing while 16.7% were maize farmers. Similarly, 14.2% were tomatoes/pepper farmers while 13.3% of the respondents were into oil palm
processing. In the same vein, 12.5% were into poultry while 4.6% were vegetable farmers, 4.2% were into locust beans processing and 2.5% were fish farmers. These results were in concordance with the views of Ogungbile et al., (1991) cited in Ehiemere (2008) in a study of women in Muslim and non-Muslim areas of Northern Nigeria, who observed that the activities of women include land preparation, planting, harvesting, food processing, livestock and transportation. The findings also aligned with the work of Rahman et al., (2004) who reported that women were involved in food production, processing and marketing.

Table 4: Fadama Activities undertaken

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td>77</td>
<td>32.1</td>
<td>33.5</td>
<td>33.5</td>
</tr>
<tr>
<td>Leaf vegetable</td>
<td>11</td>
<td>4.6</td>
<td>4.8</td>
<td>38.3</td>
</tr>
<tr>
<td>Tomatoes/pepper</td>
<td>34</td>
<td>14.2</td>
<td>14.8</td>
<td>53.0</td>
</tr>
<tr>
<td>Maize</td>
<td>40</td>
<td>16.7</td>
<td>17.4</td>
<td>70.4</td>
</tr>
<tr>
<td>Oil palm</td>
<td>32</td>
<td>13.3</td>
<td>13.9</td>
<td>84.3</td>
</tr>
<tr>
<td>Fish production</td>
<td>6</td>
<td>2.5</td>
<td>2.6</td>
<td>87.0</td>
</tr>
<tr>
<td>Poultry (egg production)</td>
<td>30</td>
<td>12.5</td>
<td>13.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Locust beans processing</td>
<td>10</td>
<td>4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1 Benefits from Fadama activities

Fig. 1, shows that 16.2% of the respondents observed that the Fadama activities they were engaged in have helped in increased food production in
the study area. Those who opined that it was a source of working capital constituted 14.6% of the respondents closely followed by those who saw it as a major source of income who made up to 12.9%. The respondents who benefitted from the Fadama program by paying their children school fees and purchased electronic gadgets constituted 12.1% each. Some of the respondents saw Fadama as a better exposure while 5.0% had benefitted from it by building houses. However, some benefitted from the program by acquiring new knowledge through capacity building while few of them opined it increased social interaction. Similarly, 2.5% benefitted by buying okadas and cars from the program. All these activities could assist in the attainment of the Millennium Development Goals (MDGs).

<table>
<thead>
<tr>
<th>Table 5: Factor Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communalities</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Marital status</td>
</tr>
<tr>
<td>Educational level</td>
</tr>
<tr>
<td>Occupation</td>
</tr>
<tr>
<td>Average monthly income before joining famada</td>
</tr>
<tr>
<td>Are the female user groups more than the male user groups?</td>
</tr>
<tr>
<td>Average monthly income after joining fadama</td>
</tr>
<tr>
<td>Fadama activities undertaken</td>
</tr>
<tr>
<td>Source of labour</td>
</tr>
<tr>
<td>Source of finance</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

Table 5: shows that the value of communalities range from between 0 and 1 with higher observed values representing the fact that a greater share of common variance is explained by the extracted components. Communalities indicate how the indicators combined to identify components (Henry et al, 2003). The communalities ranged in value from 0.444 and 0.853 which could be considered to fall within an acceptable range. All the indicators proved highly explanatory of the Fadama components shown in table 5.
Table 6: Component Matrix

<table>
<thead>
<tr>
<th>Component Matrix</th>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td>-.571</td>
<td>-.219</td>
<td>-.136</td>
<td>.419</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-.154</td>
<td>.649</td>
<td>.611</td>
<td>.024</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>-.334</td>
<td>.625</td>
<td>.503</td>
<td>.198</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td>.268</td>
<td>.072</td>
<td>-.062</td>
<td>.602</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td>.855</td>
<td>-.178</td>
<td>.194</td>
<td>-.075</td>
</tr>
<tr>
<td>Average monthly income before joining famada</td>
<td>.578</td>
<td>.450</td>
<td>-.313</td>
<td>-.141</td>
<td></td>
</tr>
<tr>
<td>Are the female user groups more than the male user groups?</td>
<td>.779</td>
<td>-.245</td>
<td>.331</td>
<td>.051</td>
<td></td>
</tr>
<tr>
<td>Average monthly income after joining fadama</td>
<td>.669</td>
<td>.496</td>
<td>-.279</td>
<td>.066</td>
<td></td>
</tr>
<tr>
<td>Fadama activities undertaken</td>
<td>.769</td>
<td>-.351</td>
<td>.372</td>
<td>.014</td>
<td></td>
</tr>
<tr>
<td>Source of labour</td>
<td></td>
<td>.121</td>
<td>.586</td>
<td>-.246</td>
<td>-.345</td>
</tr>
<tr>
<td>Source of finance</td>
<td></td>
<td>-.435</td>
<td>-.264</td>
<td>.252</td>
<td>-.551</td>
</tr>
</tbody>
</table>

**Extraction Method:** Principal Component Analysis

Table 6 shows the result of the component matrix for indicators measurement in Ede Region. The absolute value of the coefficients for each indicator represents the degree of correlation between the component and the indicator. Therefore, large absolute values indicate a high level of correlation, while low values indicate a lower level of correlation. For the correlation to be considered significant at 0.01 level, a minimum value of 0.18 is required (following the Burt-Banks formula) but at best screened for those above 0.300 (Henry et al., 2003). Positive coefficients indicated the direction of the relationship between the indicator and the role of women in Fadama activities, hence as the value of the indicator increases, so does the value of the component. Negative coefficients indicated an inverse relationship between the indicators and the role of women in Fadama activities in Ede.

Table 7 shows four level components of PCA with Eigen values greater than 1.0 extracted using the factor loading of 0.50 as the bench mark of explained “Common Variance” to be considered representative of a common underlying dimension. The relatively high value of the loaded factors above (0.50) for more than seven variables lend support to the favourability of the sample size for the analysis in line with earlier studies by Ahadzie et al., (2010); Fadare and Gasu, (2011). The size of an Eigen value represents the amount of variance in the PCA explained by the component, hence the larger the Eigen value, the more the components are explained by the model’s indicators (Henry et al., 2003). With reference to the Eigen values, four variables were extracted because they had Eigen values greater than one. The variables
include; 1-gender which contributed 31.3%, variable 2-age contributed 17.6%, variable 3-marital status contributed 11.2% and variable 4-educational level contributed 9.4%. Variables 1-4 contributed 69.61% of the total variance that explains Fadama activities in the study area. The result shows that the four variables are the most important factors in assessing Fadama activities in the study area.

Table 7: Total Variance Explained

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>2</td>
<td>1.941</td>
<td>17.647</td>
</tr>
<tr>
<td>3</td>
<td>1.234</td>
<td>11.222</td>
</tr>
<tr>
<td>4</td>
<td>1.034</td>
<td>9.397</td>
</tr>
<tr>
<td>5</td>
<td>.922</td>
<td>8.379</td>
</tr>
<tr>
<td>6</td>
<td>.754</td>
<td>6.850</td>
</tr>
<tr>
<td>7</td>
<td>.635</td>
<td>5.773</td>
</tr>
<tr>
<td>8</td>
<td>.370</td>
<td>3.360</td>
</tr>
<tr>
<td>9</td>
<td>.288</td>
<td>2.615</td>
</tr>
<tr>
<td>10</td>
<td>.252</td>
<td>2.290</td>
</tr>
<tr>
<td>11</td>
<td>.124</td>
<td>1.125</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Componen Analysis

Table 8: PCA Components Extraction of Factor analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor 1: Livelihood support on gender</th>
<th>Factor 2: Characteristics of labour</th>
<th>Factor 3: Active working class</th>
<th>Factor 4: Educational level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.649</td>
<td>.611</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>.625</td>
<td>.503</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational level</td>
<td>.855</td>
<td>.503</td>
<td></td>
<td>.602</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td>.503</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly income before Fadama</td>
<td>.578</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of female user groups</td>
<td>.779</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly income after Fadama</td>
<td>.669</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fadama activities</td>
<td>.769</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source of labour</td>
<td></td>
<td>.586</td>
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<td></td>
</tr>
<tr>
<td>Source of finance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8 shows the factor analysis for four factors extraction where factors loadings considered significant in explaining indicators were set at 0.50. Results on the table 4.8 shows that five factors loaded on components 1 which were named-Livelihood support on gender, three factors loaded on component 2 named-Characteristics of Fadama labour, two factors loaded on component 3 which were named-Active working class while one (1) factor loaded on component 4 which was equally named Educational level. The combinations of various components named above (Livelihood support on gender, Characteristics of Fadama labour, Active working class and Educational level) constitute the combinations of factors that gave the most appropriate explanations underlying Gender and Fadama activities in Ede.
Region which was in line with earlier studies by Ahadzie, (2010) and Fadare and Gasu, (2011). The highly loaded factors on component one (Livelihood support on gender) in this study may indicate the presence of a viable livelihood support which is gender sensitive, which need to be explored for sustained growth.

SUMMARY OF FINDINGS

The Fadama project in the study area shows a gender-sensitive nature as illustrated by 80.4% female respondents in the study. As regards Fadama activities undertaken, majority 58.8% were into agro processing and 25.4% were into real farming. About 74.6% earned N18,000-N28,000 while 21.2% earned an average annual income of below N18,000 before joining the Fadama programme. When compared to income after joining Fadama, there was increase in their income level as 42.9% of the respondents received N40,000 and above and none of them receive below N18,000 minimum age. Similarly, 16.2% agrees that Fadama has increased food production, 14.6% sees it as a source of working capital while 12.1% benefitted from the program by paying their children school fees and purchasing of electronic gadgets. Similarly, the result of the PCA shows that four variables were the most important factors in assessing Fadama activities in the study area which contributed 69.61% of the total variance and include; 1-gender 31.3%, 2-age17.6%, 3-marital status 11.2% and 4-educational level 9.4%.

CONCLUSION

The highly loaded factors on component one (Livelihood support on gender) in this study indicate the need for the improvement of the overall livelihood support system of the rural dwellers to make Fadama a viable business and gender friendly. If the lessons from Fadama are anything to go by, then it should be extended to reach all other development strives that are geared towards poverty reduction and economic development. Therefore, agricultural production which is the main stay of the rural sector need to be seriously improved upon to bring meaningful development nearer to the people and improve their access to good things of life. Based on the findings of the study, it is evident that the Fadama program in Ede North Local Government has increased the participation of rural women farmers in agricultural production. The following conclusions were arrived at; that the program made appreciable impacts on gender, farmer’s income before and during Fadama. This shows that Fadama has helped to solve the problems of gender discrimination in Nigeria with the case of Ede North Local Government area of Osun state. The National Fadama Development Project (NFDP) based on the development of wet, irrigable land popularly referred to as ‘Fadama’ is a complete package that adopts the Community-Driven Development (CDD) approach to agricultural development and rural transformation. This study offers opportunities to government authorities and other stakeholders to share, influence and power its citizens using the CDD approach which can go
Gasu and Ajani

a long way to create jobs through value chain addition, reduce poverty and offer opportunity for all folks to earn a living and transform the whole rural landscape for sustainable living and advance the achievements of the Millennium Development Goals (MDGs).

RECOMMENDATIONS

The result of the factor analysis revealed a heavy loading of factors on component one which was named Livelihood support on gender which may indicate the presence of a viable livelihood support that is gender sensitive. Therefore, there is a need to strengthen this support system through funding, capacity building and the provision of basic infrastructure and facilities for Fadama to drive economic transformation of the study area and other regions of the nation.

For Fadama to drive the change there is need to review our agricultural practices especially the slash-and-burn agriculture, shifting cultivation and uncontrolled application of irrigation water and chemical inputs which may deplete or leach some basic cations out resulting in severe soil acidity which could render the activities unsustainable. This is so because despite the rich alluvial content of Fadama lands most of them are relatively poor in organic matter, cation exchange capacities and essential micro-nutrients such as nitrogen, phosphates and potassium. Therefore, the NFDP should carry out some aggressive environmental education and awareness campaign against activities that can lead to environmental degradation. This may own to the fact that ‘the environment, be it rural or urban has a maximum load of development it could carry’ (Olatubara, 2008). The environment carrying capacity should not be exceeded to avoid disturbing the environmental balance that could have grave consequences on the very existence of the populace. The NFDP needs to conduct extensive research in the Local Fadama Development Offices and other related research organizations into the activities and impacts of encroachment through real growth and expansion of rural towns and villages into adjoining Fadama lands which is depriving it of cultivable wetlands and to provide adequate resources for more intensive cultivation. Local governments should assist the Local Fadama Desk Offices (LFDO) to identify the core unemployed groups and those who are vulnerable such as young school leavers, unemployed artisans, ex-prisoners, persons living with HIV/AIDS, widows, retired persons- in their areas of comparative advantage to participate and benefit from the project. The study recommends that all participating local government areas in the state should ensure prompt and complete payment of the counterpart funds. The government could assist the Fadama farmers in subsidizing the cost of maintaining the irrigation facilities. The project should be replicated in other communities to help reduce poverty, create jobs, add value to farm produce, empower more women and advance the MDGs.
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INFLUENCE OF PROPERTY MARKET CYCLE ON COMMERCIAL OFFICE PROPERTY IN VICTORIA ISLAND, LAGOS STATE, NIGERIA

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Department of Estate Management, Federal University of Technology Akure, Nigeria

The paper seeks to explain the influence of market cycle on the quality of office property investment decisions advice given by property managers in Victoria Island Lagos, Nigeria. It identifies the nature of market cycle on office property in that location between 1995 and 2014, examines the factors influencing the property market cycles and subsequently determines their implications on the office property investment. The study was a survey research in which data were collected through well-structured close-ended questionnaire administered to both the office property managers / investors and office tenants with variables capturing factors on market cycle on a 5 point liker scale and weighted mean scores was employed to identified important factors. The findings identified four property market phases that were cyclical in nature within the period understudy. The property market depression period had started since late 1980s lasted till 1994, while there was recession between 1995 and 1997, recovery period was between 1998 and 2001, an upturn in rents to expansion began in 2002 and got to the peak in 2007, and slump/contraction began by 2008 to 2010, no evidence of deep depression, but rather a recovery leading to an upturn in rents since 2011 till 2014 the period of this study due to national policy of privately led growth in Nigeria economy coupled with general unemployment in the public service sector. This findings implied that market cycles dictates defensible and rational investment decisions of when to let, purchase or sell, start a new development or convert existing- use, or wait for ripe period. Hence, property managers or analysts must be well acquainted with the periods within the market and this must be well captured in their appraisal works and during counselling their clients in achieving their investment objectives.

Keywords: commercial office property, investment decision, Lagos, property market cycle

INTRODUCTION

Office property is a type of commercial property that its sub-units vary from high-rise office blocks mixed with shopping malls, purpose built

office complex to open halls (Olusola, 2008). It often constitutes investment for many real estate owners/ investors due to its highest profile property rating and promiscuity of location in Central Business Districts and sprawling office parks. At its most fundamental level, the demand for office space is tied to companies' business activities, requirement for office workers, and the average space per office worker for services such as Banking and Finance, Accounting, Insurance, Real estate services, Management, Administration and Medical services. As these "white-collar" jobs grow, there is greater demand for office spaces (Stephen and Steven, 2002).

Generally, office property is very germane to the overall economic and business activities of any growing city. It plays a very vital role in any economy as it generates substantial income and employs millions of people thereby supporting the nation’s growth and sustainability. However the growth and regular flow of income from office property investment is not bereft of being affected by the economic condition prevailing at any given time. Hence, the trend in office property market has always been influenced by various forces that are both internal and external to the property itself.

Property market cycle constitute one of these several forces that affect buying, letting, financing and returns accruing to the investors. The real estate market cycle can be traced to Whitten (1987) riding the inflation cycle, as four-phase cycle defined as (1) recession, (2) recovery, (3) expansion and (4) contraction (oversupply). Barras (1994) noted that the cycle is a logical sequence of recurrent events reflected in demographic, economic and other factors that affect supply and demand for property subsequently influencing the property market. The Royal Institution of Chartered Surveyors (RICS, 1999) described it as recurrent but irregular fluctuation in the rate of all property total return which also apparent in many other indicators of property activity but with varying leads and lag against the all property cycle. The Appraisal Institute (2001) explained it as the successive periods of expansion, peak, contraction and trough that characterize the activity of the real estate market. In Scott and Gu (2000), the property market cycle follows a predictable pattern that normally reveals three distinctive phases being boom followed by slump followed by recovery before the next boom commences. That is, if the property market cycle is unimpeded, it will always follow this pattern so a boom cannot precede another boom without first experiencing a slump followed by a recovery before the next boom can arrive (Kieran, 2008). This implies that real property market cycle often poses three or four phases and their length of time within each phase varies geographically among property types.

An analysis of the influence of this market cycle on the office property investment in Victoria Island area of Lagos state is examined in intervallic terms, owing to the fact that office property spaces have responded sensitively to the changes in economic conditions overtime. The area is chosen as a classical example of an area that developed rapidly. It
was originally designated as an upper-class residential area (Lawal, 2000). Many private companies, retail stores, commercial banks etc. aggregate in the metropolis due to overcrowding in the old business district on Lagos Island. The demand for commercial properties no doubt increased especially as the working group grew. An increased demand for office property causes an increase in rents/property values because of the forces of supply and demand.

In early 1990s, the property investors/owners are faced with some distortion within the office property zones with cases of abandoned, not fully let and vacant office spaces within Victoria Island and the returns expected being unrealized. By mid 2000s the same area began to witness sudden demand that outweigh the stock of offices supply for letting. Giving advice then without proper knowledge and understanding of the market cycle can be misleading. To forestall this scenario, when to expect downturn or upturn market in both office development and investment together with other possible risks and incidents investors are likely to face can be explained with the turns in the market cycle. This eventually leads to pertinent questions that include: what is the nature of market cycles within the last two decades on office property investment? What are the factors influencing the market cycles within the study area? and what are the implications of market cycles on office property investment decisions? Answers to these pertinent questions become the main thrust of this study.

LITERATURE REVIEW

Office property market cycles
The review of literature showed that studies on Nigerian office property market cycles are scanty. In fact, studies in the office property market analysis have not been extensively carried out in Nigeria (Olado, 2000). So far most of the research into property cycles has been limited to the residential sector and available ones were on Australia, China, USA and U.K. property markets. Earlier studies by Pyhrr and Born (1996), Pyhrr (1989, 1999), Barras (1994), Dispasquale and Wheaton (1996) and Baum (1996) offered a comprehensive treatment of the concept and key defining characteristics of commercial property cycles with no substantial empirical support.

The property market cycles have been noted as the results of two possible mechanisms. On the one hand, exogenous business cycle shocks – such as inflation rates and interest rates, finance chain etc. which exerts a cyclical influence on office property prices. On the other hand, there are intrinsic characteristics of the real estate market that tend to amplify these exogenous shocks, causing overproduction of properties and generating endogenous cycles. The two types of cycles often coexist as exogenous induced endogenous cycle and their relative importance may differ across sectors and regions.
Clayton (1996) described the property cycle as a logical sequence of recurrent events reflected in factors such as fluctuating prices, vacancies, rentals, and demand in the property market. However, there are distinctions in property cycles, one being the physical cycle of demand and supply which determines vacancy and that in turn, drives rents (endogenous) and the other being the financial cycle where capital flow affects prices (exogenous). Trass (2004) further explained the property market cycles as market occurrences that are predictable on long/short term patterns witnessed under three distinct stages known as boom, slump, and recovery. The cycles are predictable in that booms (expansion) are normally followed by slumps (contraction) and then market recovery, which gives rise to the next boom as the cycle continues.

Previous works highlighted the features of each of these phases as distinctive factors that market counsellors need to be conversant with and understand vividly in their time to time contact with investors, developers, and users of developed properties (Whitten, 1987; RICS, 1999; Appraisal Institute, 2001; and Trass, 2004). What is observed during the boom/expansion phase includes: demand continues at increasing levels, creating a need for additional space, low vacancy rates coupled with few mortgage/forced sales on debt financed property; new construction finance is easy to obtain and there are a number of new lending facilities making borrowing easier; rapid rental growth are experienced which some observers call ‘rent spike’ The cycle peak point is where demand and supply are growing at the same rate of equilibrium. Apart from this, the time it takes for a property to sell after being listed for sale reduces markedly; property prices rise; yields fall as prices rise proportionally more than rents rise; there are and investors borrow against their increased property values and spend this money on consumer. This period often turns most investors to speculators with the impression/expectations that price growth will continue and that there will be no subsequent slump phase, but later in the boom, the media turns its attention to the reduced affordability of property.

The second phase which is the period of contraction/slump commences after peak/equilibrium point. Most participants do not recognize this peak point as vacancy rates is at lowest initially, but as supply growth become higher than demand growth, vacancy rate rise back towards the long term absorption average. As more stock is released to the market, rental growth slows. The longer and bigger the preceding boom, the longer and harder the subsequent slump is likely to be. Market participants then realize that the market has turned down and their commitment to new construction should slow or stop.

The third phase is recession period occur when the market moves past the long term occupancy average with high supply growth and low or negative demand growth. A rational property owner when discovered that their rental rates are not competitive, then lower rents to capture tenants if only to cover some property running costs.
The recovery phase, being the last is always much shorter than the recession or slump phases. At the bottom point, occupancy is at its trough. What is observed during the recovery phase includes; increased rents and cash flows; the length of time to sell a property reduces; property prices begin to increase. As this continues, positive expectations about the market allow owners to increase rents at a slow pace. Eventually each local market reaches its long term occupancy average whereby rental growth is equal to real growth.

**Market cycle influence on office property investment**

Historically office property investment have been noted to have a cyclical pattern of returns normally due to the influence of office development cycle exacerbated by product of lagged relationship between demand and supply (Barras ,1994). The development cycle itself is a product of different stages that could be predictable but are rarely regular as the length and depth of the intensity of each stage within the cycle are influenced by the driving factors in the national economy and their effect on property demand and supply. The stage could be demand driven, conglomeration of external factors such as political, economic, investors’ confidence, vacancies, high/low interest, lending exchange and inflation rates (Oyebanji, 2003).

Returns from office property can thus be highly varied as the market tends to be sensitive to economic performances. That is, office property cycles are results of two possible mechanisms; exogenous business cycles (shocks) and endogenous property market (attributes). They both interact to cause condition that generates endogenous cycle in the property market. The patterns the cycle exhibit are therefore often differ across property sectors and cities/nations.

No doubt, office property have high operating costs due to the facilities that enhance the effectiveness and efficiency of the occupiers. So when a newly developed office stays longer in the market or when the letting period of newly developed property is prolonged, it can have substantial impact on the returns from the property.

However, in Nigeria, office property market has been observed to be largely speculative (Omuojine, 1994). Developers were noted for construction without demand analysis and pre-arranged tenants, but rather based on the anticipation of potential demand, which may not be feasible for several years due to time lag between when construction works are initiated and completed (Lewis, 1996). Apart from this, the market itself often lacks perfect information regarding the volume of new development in the market. The aftermath result is inaccurate data on supply and demand that can capture market analysis and predictions.

Dobberstein (2000) broadly classified factors responsible for real estate cycles into three namely, endogenous, exogenous and psychological influences. The endogenous are the imperfections in the property market that ranges from existence of time lag between when decision to develop metamorphosis to construction and the full absorption by the users. The
exogenous influences occur in form of demand shocks of different sizes arising from the movements in the main economic variables, structural changes, change in space –time dimension and the growing ecological consciousness in the nation. Apart from the two, the market participants due to their human nature have equally been found to have impact on the market cycles

Nevertheless the knowledge and understanding of the features of each stage within the market cycle of any property sectors often go a long way to reduce or prevent the risks of developing/investing, purchasing/selling, and letting/occupying office property within any locality, region and nation at large

SCOPE OF STUDY AND RESEARCH METHODOLOGY

Victoria Island (VI) is an affluent city situated within the boundaries of the Eti-Osa Local Government area of Lagos State. The Island was originally entirely surrounded by water - bordered by the Atlantic Ocean on the south, the mouth of the Lagos Lagoon on the West, the Five Cowry Creek to the North and swamps on the East. The colonial government began the process of filling in the eastern swamps to reduce mosquito breeding areas (Lagos Street Map, 2008).

Victoria Island was later designated as an upscale low density residential area. Failing infrastructure and overcrowding in the old business district on Lagos Island and a subsequent planning permission led to commercial property development and mass migration of commercial activities over the last twenty-five years. Today, Victoria Island is one of Nigeria’s busiest centres of banking and commerce, with most major Nigerian and international corporations headquartered on the Island (Lagos Master Plan, 1985).

This Victoria Island (VI) which has now assumed the modern Central Business Districts (CBDs) of Lagos metropolis, has been chosen because of its large percentage of rented office properties such as purposely built office complexes, shopping malls with mixed uses for banking spaces.

This study therefore covered office properties situated along major roads within the commercial axis and inner areas of Victoria Island. The research has been limited to market transaction over twenty (20) years taking into cognizance the fact that the economic trend in Nigeria within this period has fluctuated greatly and rental values of office properties have varied proportionately.

The research methodology adopted survey design while the target population includes investors/ owners of office properties, stocks of office properties and the firms of Estate Surveyors and Valuers managing the office properties in the study area. The property managers’ size of 260 (practicing in Lagos state) was obtained from the 9th edition of the directory of their professional bodies (NIESV and ESVARBON); while a
total of 260 office properties one from each firm was retrieved from their managing files. Data were collected through the two sets of close-ended questionnaire designed for the investors/office owners and their property managers. The data require from the property manager include: the characteristics of the office properties being managed, time taken to let, market position based on the market cycle indicators for those periods, factors responsible for the market cycle, frequency of their advice to developers/owners and market parameters used in giving their advice. The data were analysed using descriptive statistics such relative importance index on a 5-point liker scale of very important: 5, important: 4, Undecided: 3, Less important and unimportant for the factors of influence.

**DATA ANALYSIS AND DISCUSSION OF RESULTS**

In this study, the office property managers performed dual role, firstly as a provider of services relating to office property investment decisions in the market; and secondly as the advisers that carried out the lawful instructions of the investors/owners of property in both letting and management of the office property, Hence data needed from the office owners are obtained through their property managers.

**Table 1: Characteristics of Office Property under Management**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years of Managing Office Property</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 1 and 5 Years</td>
<td>38</td>
<td>15</td>
</tr>
<tr>
<td>Between 6 and 10 Years</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>Between 11 and 15 Years</td>
<td>60</td>
<td>23</td>
</tr>
<tr>
<td>Between 16 and 20 Years</td>
<td>46</td>
<td>18</td>
</tr>
<tr>
<td>Above 20 Years</td>
<td>74</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>100</td>
</tr>
<tr>
<td><strong>Number of Floors within the Property</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 1 and 5</td>
<td>58</td>
<td>22</td>
</tr>
<tr>
<td>Between 6 and 10</td>
<td>84</td>
<td>32</td>
</tr>
<tr>
<td>Between 11 and 15</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>Between 16 and 20</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td>Above 20</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>100</td>
</tr>
<tr>
<td><strong>Time Taken to Let Office Property</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 1 and 3 months</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>Between 4 and 6 months</td>
<td>72</td>
<td>28</td>
</tr>
<tr>
<td>Between 7 and 12 months</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>More than 12 months</td>
<td>38</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>100</td>
</tr>
</tbody>
</table>

Field Survey, 2014

In Table 1, most of the respondents have long years of managing office properties, as about 70 percent (23, 18; 28 %) have been managing office
property for more than a decade. This outcome suggests that the managers are well experienced in the management and market operation of the office property.

The physical structure of the office property in the study area are in many floor levels. More than 75 percent (6, 18, 21, 32, %) of this property have their number of floors above 6 storey buildings. This implies that the office properties in this location are purposely built for commercial activities and such confirms that the right type of real property is being studied.

The property market transactions period vary for new tenants to occupy vacant office spaces. The highest percentage of the respondents 36.92 perceive that it takes between 4 and 6 months to let an office property, while only 9 percent says an office property can be let within one month. This implies that an office property with several floors takes different periods to fully let all the floor spaces depending on the stage of the market cycles.

**Office Property Market Cycles**

In this relative importance index, the 5 point liker scale from very important to not important were ascribed with the values 5, 4, 3, 2, and 1 respectively and the responses of the property managers in each rating are multiplied by their ascribed values based on the formula in section 3 of the paper. The decision rule in the analysis of the Relative Importance Index (RII) is that, the variable that is very close to 1.00, has the highest importance. In Table 2 then, demand with the RII of 0.91 is ranked as the first indicator followed by supply: 0.86, then rent with RII 0.84 is ranked third while investor’s acceptance of the market situation is ranked last.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Very Important (5)</th>
<th>Important (4)</th>
<th>Uncertain (3)</th>
<th>Of less Important (2)</th>
<th>Not Important (1)</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>690</td>
<td>312</td>
<td>42</td>
<td>60</td>
<td>0</td>
<td>0.85</td>
<td>2</td>
</tr>
<tr>
<td>Demand</td>
<td>900</td>
<td>240</td>
<td>42</td>
<td>12</td>
<td>0</td>
<td>0.92</td>
<td>1</td>
</tr>
<tr>
<td>Vacancy</td>
<td>270</td>
<td>424</td>
<td>18</td>
<td>116</td>
<td>24</td>
<td>0.66</td>
<td>5</td>
</tr>
<tr>
<td>Rent</td>
<td>500</td>
<td>544</td>
<td>0</td>
<td>48</td>
<td>0</td>
<td>0.84</td>
<td>3</td>
</tr>
<tr>
<td>Investors’ acceptance of market</td>
<td>240</td>
<td>296</td>
<td>36</td>
<td>204</td>
<td>24</td>
<td>0.62</td>
<td>6</td>
</tr>
<tr>
<td>Rate of Return</td>
<td>550</td>
<td>368</td>
<td>48</td>
<td>48</td>
<td>18</td>
<td>0.79</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014

Table 3 gives an insight into the market position of the office property within two decades spanning from 1995 to 2014 in Victoria Island of Lagos State. Data relating to the market indicators for each year are obtained from the office property management files of those respondents that have being in the market property management practice since the year 1990. The study recognize four phases within the market cycles for these two decades (periods between 1995 and 2014). The market position eventually shows a cyclical waves that begins with recession (between...

Table 3: Office Property Market Cycle Position for Two Decades in Victoria Island (between 1995 and 2014)

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</thead>
<tbody>
<tr>
<td>Supply</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Demand</td>
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<td></td>
<td></td>
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<tr>
<td>Vacancy Rate</td>
<td></td>
<td></td>
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<tr>
<td>Rate</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Recession</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Recovery</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Market Position</td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Factors Responsible for Office Property Market Cycles

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Very important</th>
<th>Important</th>
<th>Uncertain</th>
<th>Of less importance</th>
<th>Not important</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nation Economy</td>
<td>750</td>
<td>288</td>
<td>78</td>
<td>24</td>
<td>0</td>
<td>0.88</td>
<td>1</td>
</tr>
<tr>
<td>Government Policy control &amp; Enforcement</td>
<td>90</td>
<td>480</td>
<td>96</td>
<td>144</td>
<td>18</td>
<td>0.63</td>
<td>4</td>
</tr>
<tr>
<td>Excessive level of construction</td>
<td>150</td>
<td>336</td>
<td>132</td>
<td>144</td>
<td>30</td>
<td>0.61</td>
<td>6</td>
</tr>
<tr>
<td>Psychological Imbalance</td>
<td>90</td>
<td>48</td>
<td>96</td>
<td>252</td>
<td>72</td>
<td>0.43</td>
<td>8</td>
</tr>
<tr>
<td>Long length of lease</td>
<td>120</td>
<td>336</td>
<td>78</td>
<td>156</td>
<td>48</td>
<td>0.56</td>
<td>7</td>
</tr>
<tr>
<td>Employment level</td>
<td>180</td>
<td>312</td>
<td>114</td>
<td>180</td>
<td>18</td>
<td>0.62</td>
<td>5</td>
</tr>
<tr>
<td>Level of Income</td>
<td>330</td>
<td>528</td>
<td>96</td>
<td>36</td>
<td>12</td>
<td>0.77</td>
<td>2</td>
</tr>
<tr>
<td>City Planning &amp; Development of Infrastructure</td>
<td>250</td>
<td>320</td>
<td>120</td>
<td>100</td>
<td>40</td>
<td>0.64</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014

It must be noted that supply of office property throughout these two decades were on the increase, but the demand and the vacancy rates changes differently across the years. Investors or their fund managers need to take caution and study these two elements that fluctuate in order to avoid ill-conceived decision that may not be worthwhile in the short term or long term basis.

Table 4: Factors Responsible for Office Property Market Cycles

In table 4, among the factors responsible for market cycles, the overall economy situation of the nation having has the highest RII of 0.88 is ranked first, followed by level of income of RII 0.77; while city planning
and development of Infrastructure ranked third and psychological imbalance of the investors ranked eighth, the last. The ranking of these factors equally reveal the level of knowledge and understanding of the market cycles by the respondent.

POLICY RECOMMENDATIONS AND CONCLUSION
This study has provided useful hints on the relevance of property market cycles in the office property investment market. It has been empirically deduced that demand and supply factors are key indicators of commercial office property market cycles, and their condition determine each of the stages that can be experienced in the market cycle. Hence, the property managers must have the knowledge of the market cycle in order to give appropriate advice that is time specific to their clients/property owners during letting and management of the office property.

The determination of the market position was based on the decision rule earlier established in theory concerning the features expected in each phase of the market cycles. It must be noted that the cyclical nature of the cycle experienced in the study area was steep because of long period of expansion phase between 2002 and 2007 periods. Each phases are not proportionately uniform in this study, hence the advice to give at a particular period or years must be empirically defensible and justified.

Apart, the factors responsible for the market cycles have been found to include state of the national economy, income changes and financial deregulation; and city planning and development of infrastructure. Hence, decision to invest on office property development must take cognizance of these exogenous variables and demand patterns during the government policies implementation period. Government policy formulation on construction industry, economic reforms and empowerments must draw their strength from research findings and the professionals in the built environment must be involved in the implementation of their economic development policies.

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MANAGEMENT OF MULTI-TENANTED PROPERTIES IN ABEOKUTA

Ibrahim T. Akogun

Department of Estate Management, University of Ilorin, Ilorin, Nigeria

Due to the fact that the occupiers of multi-tenanted properties are usually from different backgrounds, dissimilar aspirations and dispositions, lots of problems were encountered by the landlord, tenants and managers usually with gruesome effects that cannot be easily forgotten by the stakeholders. This study examines the associated problems with a view to proffering pragmatic recommendations. The secondary data was derived from archival sources and content analysis of different research findings in relation to property management around the world. For primary data, 52 property managers in Abeokuta were surveyed by personally administered questionnaire; 45 were returned and found useful for this study, giving a response rate of 86.54%. Data gathered were analysed by frequency distribution, percentage and relative importance indices. Findings of the study revealed the inherent problems to include rent default, tenant selection, irregular payment of rates and occupation taxes, overcrowding, tenants and landlords’ frustrating attitude and facilities deterioration. Multi-tenanted property management requires special skills of estate management profession as the task is fraught with a number of problems which should be addressed carefully by the manager in order to secure a guaranteed optimum returns to landlords, quite enjoyment to tenants and long life to the property facilities and services.

Keywords: Abeokuta, estate agent, estate surveyor, multi-tenanted property, property management.

INTRODUCTION

Property management was carried out unconsciously and unprofessionally especially before Nigeria attained her independence. Before independence, the approach to property management was traditional in every aspect. In fact, the situation has not changed especially in rural communities. For example, man carried out simple repairs or maintenance work in the houses made of mud and thatched roof. Thus, when roots of a tree in front of a house has grown too wide, infringing into the building foundation, the owner either cuts the roots or pull down the tree. Palm fronds were cut

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from the bush to replace the old and defective ones on the thatched roof to check water leakages during raining season (Olayonwa, 2000).

Property management especially of high rise building which are mostly multi-tenanted thus becomes purely a professional matter. It became necessary to employ professionally trained estate managers to look after the properties (Oyedele, 2013). Hence, many privately owned high rise buildings are now in the management portfolio of many professional firms. Also, the government through its various agencies has taken cognizance of professional services.

Today, real property management goes beyond mere collection of rent. A property manager is involved with managerial problem solving and decision making. He also performs several activities and tasks involving planning, organising, directing and controlling with respect to the portfolio of real estate assets being managed on behalf of his clients (Thorncroft, 1965; Adebiyi, 1987; Odudu, 1987). This is important since one of the features of real property that distinguishes it from other investment media is its requirement to be managed. Because of the increasing pace of technological development or innovations resulting particularly in the construction of standard structures in our cities, there is need for a trained manager who is able to cope effectively and efficiently with management problems arising from the latter. Multi–tenanted properties such as residential houses present the greatest management challenge to the surveyor. The author’s observation of nonchalant attitude of a good number of tenants regarding the management of multi-tenanted properties prompted the choice of this topic.

Rental housing is now seen as a vital component in accommodating large number of families in developing countries. In the Nigerian urban centres, the increase in urban population through both migration and natural increase, has been absorbed to a large extent by the rental market. There is thus a need for the examination of the policies on rental housing in particular, the problematic issues in the rental market such as the quality of rental housing stock and management of the available rental properties (Ballesteros, 2004). The aim of this study is to assess the problems associated with the management of multi-tenanted properties in Abeokuta and suggest pragmatic recommendations towards solving the problems. To achieve this goal, the paper is structured into four parts. The first part deals with the introduction, conceptualisation and theoretical basis detailing the meaning of property management, scope of property management, multi-tenanted properties and associated management problems and tenancy agreement. The second part details the research method adopted for the research and the study area. The third part deals with data analysis and discussions detailing the sample characteristics of respondents, management problems of multi-tenanted properties in Abeokuta and discussion of results. The fourth part of the paper deals with conclusion and recommendations.
CONCEPTUALISATION AND THEORETICAL BASIS

Meaning of Property Management: Review
The definition of property management depends on the perspective from which the concept is viewed. In effect, landed property management is the management of land and buildings in such a way as to secure the maximum advantage (Odudu, 1987). It can be defined as the direction, nursing, sometimes the overall control of policy of an interest in landed property with a view to obtain a maximum return. The return may be in the form of financial benefit, social benefit, prestige, political power or a combination of these benefits Ajagbe (1993). Narains Corp. (2007) defined property management as “the range of functions concerned with looking after buildings, including collection of rents, payment of outgoings, maintenance including repair, provision of services, insurance and supervision of staff employed for services, together with negotiations with tenants or prospective tenants”. Smeby (2012) defined property management as “the science of getting maximum value from the investment made in assets by assuring proper utilization, preventing loss and pilferage and all other aspects of security-related issues, scheduling timely maintenance, tracking physical location, maintaining proper insurance coverage, and scheduling depreciation write-offs.”

Property management is a wide subject and may not be adequately explained by mere application of a definition. As a discipline, it concerns itself mainly with decisions on planning, control and use of land with the primary aim of securing optimum returns. The management of real properties requires a written management agreement between the property owner and the manager. The management agreement is a comprehensive and detailed agreement outlining the responsibilities of both the owner and the property manager (Nwuba, 1994; Barlowe, 1978; Thorncroft, 1965).

Property management is necessary in both private and public properties to keep them in a tenantable condition and good state of health. Internal parts of properties as well as the external parts require proper maintenance to keep their qualities intact and enhance their values. Without programmed property management, decay will set in and property will depreciate in value. Property management can therefore be defined as the process of keeping a property in a good state of health, devoid of decay and in other to enhance the value of the property, yielding optimum returns on investment. A good property manager must be proactive, sincere, unbiased against the tenants and landlord, knowledgeable and ready to live above board (Oyedele, 2013).

Scope of Property Management
The property manager is concerned chiefly with the interpretation and implementation of the owner’s policies in practice and at times, gives advice on the probable effects of alternative courses of action, which might be proposed. However, the property manager must protect the interest of his client by ensuring financial and legal protection, protection of useful
life of the property and against unforeseen events (Hemuka, 1990). Property managers offer a variety of extensive services and shoulder varying degrees of responsibility in the performance of their duties to the owners and tenants. Property management responsibilities relate to the overall operation of property investments. These include (Adebiyi, 1987; Odudu, 1987; Nwuba, 1994; Nwankwo, 1995; Friedman et al, 1997; Olayonwa, 2000; Colorado State, 2005; Ibrahim, 2014):

i. Determination of rental values, collection of rents, keeping and rendering accounts for rents collected.

ii. Keeping property records and register that will provide necessary data on the property. This includes details of ownership and tenants, location, address, details of rent reviews, option to renew, long range diary of events, etc. The records should be kept in a manner that the events could be picked up and acted upon in a good time.

iii. Dealing with selection of tenants, renewals, termination, negotiating and agreeing terms and ensuring that tenancies/leases/sub-leases are appropriately documented and where consents are required ensuring that such consents are obtained.

iv. Ensuring that covenants both in a head-lease, in a certificate of occupancy or other forms of conveyance, are observed and performed including payment of ground rent and other development charges.

v. Dealing with tenement, general, water rates, ensuring collection from those liable to pay and those payments are made promptly to the relevant authorities.

vi. Advising on adequate insurance policy for the property, reviewing the sum insured at required intervals and ensuring that the premiums are paid regularly.

vii. Dealing with maintenance and repairs, which are the responsibility of owners and ensure that whoever has such liabilities undertakes them.

viii. Where services are provided such as in blocks of flats or in other multi-occupied properties, ensuring that such services are run to the satisfaction of both the owners and tenants. This will also involve the determination and collection of maintenance fund otherwise called service charge and sinking fund or provision for future replacement of some services like lift, lights and pumps.

ix. Selection and supervision of staff engaged directly and exclusively for a given property. This will consists mainly of porters, lift operators, cleaners, electrical and mechanical technicians. Where these services are contracted to specialised organizations; the property manager will negotiate, agree terms and enter into service contracts.
x. Periodic inspection is an important part of management control. Their frequency would depend on the length of the lease, value of the reversion to the landlord and finally the class and type of tenants.

xi. Other management functions such as reviewing and advising on redevelopment, refurbishing and re-adaptation, on disposal, acquisition and conservation of properties.

In summary, the effective execution of the activities enumerated above will guarantee that the property is managed in such a way as to ensure security and regularity of adequate returns on the investment, that the property fulfils the purpose, need and requirements of the users, that the property is in good state of repairs and regular maintenance, and that the property has a long economic lifespan.

**Multi-Tenanted Properties and Associated Management Problems**

Multi-tenanted properties comprise many tenants in occupation at a particular time in a particular place with a common goal to occupy such property. On the residential side, building owners or owner associations rely on property managers to care for properties that include Tenement buildings, Apartment buildings, Multi-family housing, and Condominiums. For both commercial and residential facilities, the management companies typically take care of all tenant and building services. They manage leasing and rent collection, advertising and marketing, facility maintenance and grounds keeping, utilities, and all other aspects of day-to-day operation (DMP, 2014). More im for the security dealer, the property manager is also responsible for the security of the general facility and common areas, as well as for each tenant’s space.

The problems associated with management of multi-tenanted properties identified in literature include rent collection, repairs, dilapidation, bad behaviour, tenant selection, security, overcrowding, subletting, lease and service charge administration, etc (Watts, 2014; Snyder 2012; fmworld 2014). To prevent problems, the smart building owner will focus on more than technology. Indeed, one key to security in multi-tenant buildings is also the oldest, lowest-tech option available that is, talking. “Experts say that good communication between owner and tenants is the foundation for effective security in multitenant office buildings” (Snyder 2012).

Property is a good investment because of its immobility, relatively stable rate of appreciation and lesser risks of management. It is also a scarce basic need and is ever in demand especially in countries like Nigeria where demand is higher than supply. Property is a means to many ends as it is consumed for numerous reasons; residential, commercial, office, recreation etc. Some tenants prefer to stay closer to their places of work while others prefer to stay closer to their children’s schools. The numerous benefits of housing have made properties to be a need that man cannot do without. There are inherent investment benefits in property than any other investment because of its seemingly easy transaction process. Given the nature of the research, research question to be addressed is “what
problems influence the management of multi-tenanted properties in Abeokuta and what are the ways to solve the problems.

**Tenancy Agreement**
A tenancy agreement outlines what the landlord and tenant have agreed to. The landlord and tenant must sign the tenancy agreement and the landlord must give the tenant a copy before the tenancy begins. This is a legally binding contract. It is important this is completed accurately and carefully (MBIE, 2013; Lagos State Government, 2011). A verbal tenancy agreement could also be legally binding. This means you might have to do what you have agreed, even if you haven’t signed anything. For example, a landlord might not be able to change his mind if he tell a prospective tenant he can have the place. In the same way, if a tenant says he will take the place or if he pay some money, he might have to go ahead with the tenancy.

A basic tenancy agreement must contain the full names of both the landlord and tenant, the address for service of the landlord and tenant, the contact addresses of the landlord and tenant, the address of the property, the signature and date of the parties, the date the tenancy begins, the date the tenancy will end (if it is for a fixed term), whether the tenant is under 18, how much bond the tenant is paying, how much rent will be paid and how often, how the rent will be paid (the place or bank account number), a list of any chattels (like a washing machine or furniture) that the landlord is providing, a copy of the body corporate rules (if the premises are part of a Unit Title). The tenancy agreement can also contain the number of people who can live in the house, details of any letting fee, whether the tenant can transfer the tenancy to someone else, where the tenant can park their car, whether the tenant can have a cat or a dog or other pets.

**The Study Area**
Abeokuta is located in the South – West part of Nigeria, it lies between the longitude 3° 21’ E and latitude 7° 9’ N. It is 80 kilometres South of Ibadan the Oyo State capital, 73 kilometres North of Lagos. Abeokuta, a historical Yoruba town was founded by a group of people known as LISABI CIRCA in 1830 which has a beautiful blend of anxiety and contemporary architecture. The town derives its name from the fairly massive “Olumo” rock and granite hills which are enthralling fitness of the topography of this Egba location. Abeokuta, the capital of Ogun State serves as a seat of administration and a centre for commercial activities. All developments associated with urban centres in Nigeria are found in Abeokuta. Property development and management activities are very active in the city as various types of properties are constructed and many other properties under construction – public and private, residential, commercial, industrial, recreational, institutional, transportation, religious and agricultural. Fully registered estate surveyors as well as non-registered estate agents are found in large numbers practicing real estate brokerage in the city. The geographical location of Abeokuta with proximity to Lagos state is a huge advantage to its socio-economic development. The population of the city which is ever increasing and cosmopolitan on a
gradual basis, is presently put at 593,140 (NPC, 2014). The reason for the choice of Abeokuta for the study is the fact that the property market is very active and the practice is fraught with a range of problems which require proper examination and urgent solutions.

RESEARCH METHOD

To achieve the aim of this study, data were collected from secondary and primary sources. The secondary data were obtained from textbooks, conference and seminar papers, internet, dailies, and other research materials that reported property management in Nigeria. The primary data were mainly the opinion of the professional estate surveyors and selected agents on the management strategies and problems of multi-tenanted properties. The categories of professionals surveyed were the Fellow, Associate, Graduate and Probationer members of the Nigerian Institution of Estate Surveyors and Valuers working in different private and public establishments in Abeokuta. These categories of surveyors totalling 52 were found to participate fully in property management practice either as a company or private individual practice, in the city. The Fifty-two property managers were surveyed by personally administered questionnaire. Thus a total of 52 questionnaire were administered out of which 45 were returned and found useful for this study, giving a response rate of 86.54%. The data collected were analysed by frequency distribution, percentages and Relative Importance Indices.

RESULTS

Sample Characteristics of Respondents

The sample characteristics for the property management surveyors that were surveyed are shown in Table 1. The analysis indicated that 11.11% of the respondents were over 50 years old, 15.56% averaged 41 to 50 years, 55.56% averaged 31 to 40 years while 17.78% were less than 30 years of age. 40% were the principal partners in their firms, 24.44% were estate officers while 35.56% were branch managers. About 16% have more than 20 years’ experience of the practice, another 16% have between 16 and 20 years, 13.33% have between 11 and 15 years, 22.22% have 6 to 10 years while 33.33% have less than 6 years’ experience in the practice of estate surveying. About 27% had BSc degree, 51% had HND while 22% had additional qualifications at masters level. About 36% were Associates, 7% were fellows while 56.82% were graduates and probationer members of the Nigerian Institution of Estate Surveyors and Valuers. The scope of practice of the respondents indicated that all (100%) engaged in property management and estate agency, 62.22% engaged in property valuation, 44.44% engaged in feasibility appraisals and 71.11% engaged in property development.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Less than 30 Years</td>
<td>8</td>
<td>17.78%</td>
</tr>
<tr>
<td></td>
<td>31 – 40 Years</td>
<td>25</td>
<td>55.56%</td>
</tr>
<tr>
<td></td>
<td>41 – 50 Years</td>
<td>7</td>
<td>15.56%</td>
</tr>
<tr>
<td></td>
<td>Over 50 Years</td>
<td>5</td>
<td>11.11%</td>
</tr>
<tr>
<td>Positions in their firms</td>
<td>Principal</td>
<td>18</td>
<td>40.00%</td>
</tr>
<tr>
<td></td>
<td>Branch Manager</td>
<td>16</td>
<td>35.56%</td>
</tr>
<tr>
<td></td>
<td>Estate Surveyor</td>
<td>11</td>
<td>24.44%</td>
</tr>
<tr>
<td>Years of experience</td>
<td>3 – 5 Years</td>
<td>15</td>
<td>33.33%</td>
</tr>
<tr>
<td></td>
<td>6 – 10 Years</td>
<td>10</td>
<td>22.22%</td>
</tr>
<tr>
<td></td>
<td>11-15 Years</td>
<td>6</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>16 – 20 Years</td>
<td>7</td>
<td>15.56%</td>
</tr>
<tr>
<td></td>
<td>Over 20 Years</td>
<td>7</td>
<td>15.56%</td>
</tr>
<tr>
<td>Academic and Professional Qualifications</td>
<td>B.Sc</td>
<td>12</td>
<td>26.67%</td>
</tr>
<tr>
<td></td>
<td>HND</td>
<td>23</td>
<td>51.11%</td>
</tr>
<tr>
<td></td>
<td>M.Sc / MBA</td>
<td>10</td>
<td>22.22%</td>
</tr>
<tr>
<td></td>
<td>Probationer / Graduate</td>
<td>26</td>
<td>57.78%</td>
</tr>
<tr>
<td></td>
<td>Associate</td>
<td>16</td>
<td>35.56%</td>
</tr>
<tr>
<td></td>
<td>Fellow</td>
<td>3</td>
<td>6.80%</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Property valuation</td>
<td>28</td>
<td>62.22%</td>
</tr>
<tr>
<td></td>
<td>Property management</td>
<td>45</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Estate agency</td>
<td>45</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Feasibility study</td>
<td>20</td>
<td>44.44%</td>
</tr>
<tr>
<td></td>
<td>Property development</td>
<td>32</td>
<td>71.11%</td>
</tr>
</tbody>
</table>

Management Problems of Multi-Tenanted Properties

The problems associated with the management of multi-tenanted properties identified in literature review were subjected to empirical tests by sampling the opinion of the property management surveyors in the study area. Their responses were analysed and ranked as presented in table 1 below. The responses of the property managers revealed that the first ten problems in order of relative importance were Default in payment of rent, Problem of choice of good tenants, Improper use of premises, Low management fee, High management costs, Poor return/rents, Overcrowding, High tenant turnover, Associated with low income earners in residential developments, Poor class / difficult tenants and Unnoticed evacuation / abandonment of premises. The next ten problems were Illegal activities on premises, uncooperative attitudes of tenants, Unauthorized visitors on premises, Improper refuse disposal, Prone to slum clearance / demolition, Unacceptable conversion of premises, Refusal to honour notices, Difficult to sell, Default in payment of rates and taxes and Prone to excessive abuse by public authority.
### Table 2: Problems Associated with Management of Multi-Tenanted Properties

<table>
<thead>
<tr>
<th>S/N</th>
<th>Problems</th>
<th>Responses (N = 45)</th>
<th>∑W</th>
<th>RII</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SA</td>
<td>A</td>
<td>U</td>
<td>D</td>
</tr>
<tr>
<td>1</td>
<td>Problem of choice of good tenants</td>
<td>15</td>
<td>12</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Default in payment of rent</td>
<td>15</td>
<td>21</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Default in payment of rates and taxes</td>
<td>3</td>
<td>18</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Default in payment of service charge</td>
<td>0</td>
<td>27</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Deterioration of facilities</td>
<td>0</td>
<td>21</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Absentee tenants</td>
<td>3</td>
<td>21</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Uncooperative attitude of tenants</td>
<td>3</td>
<td>22</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Disregard for other tenant’s rights</td>
<td>3</td>
<td>15</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Low response to repair obligations</td>
<td>3</td>
<td>21</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>Fighting among tenants</td>
<td>3</td>
<td>12</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Refusal to honour notices</td>
<td>3</td>
<td>18</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Dirty environment</td>
<td>3</td>
<td>15</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Improper refuse disposal</td>
<td>3</td>
<td>18</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>Improper use of premises</td>
<td>9</td>
<td>21</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>Unacceptable installation of gadgets</td>
<td>3</td>
<td>18</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>16</td>
<td>Unacceptable conversion of premises</td>
<td>12</td>
<td>9</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>Unlawful transfer of premises</td>
<td>7</td>
<td>14</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>18</td>
<td>Unnoticed evacuation / abandonment</td>
<td>14</td>
<td>11</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>19</td>
<td>Overcrowding</td>
<td>6</td>
<td>17</td>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>Illegal activities on premises</td>
<td>6</td>
<td>21</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>21</td>
<td>Unauthorized visitors on premises</td>
<td>6</td>
<td>18</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>22</td>
<td>Poor return/rents</td>
<td>6</td>
<td>23</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>23</td>
<td>Low management fee</td>
<td>8</td>
<td>19</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>24</td>
<td>Generally difficult to manage</td>
<td>3</td>
<td>12</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>Difficult to let when vacant</td>
<td>6</td>
<td>9</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>26</td>
<td>Difficult to sell</td>
<td>7</td>
<td>14</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>27</td>
<td>High management costs</td>
<td>6</td>
<td>24</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>28</td>
<td>High tenant turnover</td>
<td>6</td>
<td>18</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>29</td>
<td>Poor class / difficult tenants</td>
<td>6</td>
<td>18</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>30</td>
<td>Associated with slum development</td>
<td>3</td>
<td>21</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>31</td>
<td>Prone to outbreak of disease</td>
<td>2</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>32</td>
<td>Prone to excessive abuse by public authority</td>
<td>2</td>
<td>24</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>33</td>
<td>Prone to slum clearance / demolition</td>
<td>6</td>
<td>21</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>34</td>
<td>Associated with low income residence</td>
<td>3</td>
<td>26</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>35</td>
<td>Illicit relationship among tenants/occupiers</td>
<td>0</td>
<td>10</td>
<td>14</td>
<td>19</td>
</tr>
</tbody>
</table>
The last sets of the problems in order of relative importance were Associated with slum development, Unacceptable installation of gadgets, Low response to repair obligations, Disregard for other tenant’s rights, Absentee tenants, Unlawful transfer of premises, Default in payment of service charge, Deterioration of facilities, Dirty environment and Fighting among tenants. Other problems that rarely occur were outbreak of disease, Generally difficult to manage, Difficult to let when vacant, and Illicit relationship among tenants/occupiers. It should be noted however, that all problems must be avoided as one problem may generate another if adequate care is not taken promptly.

$$RII = \sum_{A \times N} W$$

RII = relative importance Indices; EW = sum of weight for each factor; A = highest weight, N = total number of respondents

DISCUSSION OF RESULTS

Majority of the problems confronting multi-tenanted property management were situated in literatures pointing to the fact that they are more or less universal. However, pragmatic solution to the problems require urgent actions taken by the property managers for the stakeholders (landlords, tenants and property managers) to enjoy optimum returns and enjoyment of their interests in the properties. It is also imperative that the manager should be proactive so that effective action can be taken even before the problems occur. Further studies can be conducted on other areas of property management using single family residence and non-residential properties as case studies in different parts of the world.

CONCLUSION AND RECOMMENDATIONS

Property management is fraught with a number of problems which should be addressed carefully by the manager in order to achieve optimum returns for the investor. Multi-tenanted property management requires special skills of estate management profession involving careful selection of management procedures, technical tactics of tenant selection, effective supervision, routine inspection and monitoring of tenants’ activities in properties and effective planning and control activities to guarantee optimum returns to landlords, quite enjoyment to tenants and long life to the property facilities and services.

In order to reduce the incidence of rent default, property managers should be very critical in their tenant screening and selection process. They should be very mindful of the prospect’s ability to pay not only the first rent, but also the subsequent year’s rents. Proof of stable employment,
good credit history and reliable source of income could be possible indices for evaluating prospective tenants. Guarantee of good behaviour from reputable referees should be obtained from prospective tenants.

Lease agreement should always be carefully worded and properly administered on tenants before giving possession of the premises at the beginning of tenancy. It should also state clearly the terms and modalities for renewal or termination of tenancy. Optimum rents should be fixed to encourage landlords, while prospective tenants should be advised to take properties with easily affordable rents considering their obligations under the tenancy vis-à-vis their income level. Frequent inspection periods should be organized to facilitate effective monitoring of the lessee and his activities with regards to the properties and neighbours; early detections of problem sources can be observed and averted. Property managers are recommended to act promptly in making contact with tenants when early sign of a breach of tenancy is noticed. Property managers should endeavour to establish cordial relationship with tenants to allow absolute freedom of expression, friendly dealings and resolution of seeming problems. It is essential to develop improved communication system and support for all vulnerable tenants to avert problems that could aggravate the tenancy default wherever possible.

Tenants should be made to pay security deposits as it is done in developed countries. This deposit is kept by the manager and used to carry out any necessary repairs at the expiration of the lease. This will save the landlord from incurring unnecessary costs of repairs. However, the manager must ensure that the money is kept properly for this purpose, and any balance that remains are remitted to the tenant.

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MANAGEMENT POLICIES FOR ACCESSIBLE ENVIRONMENT IN SENIOR HIGH SCHOOLS

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In Ghana, governments and stakeholders of education over the years have been interested in drafting policies that are geared towards increasing Senior High School (SHS) student enrolment and infrastructural development without regard to how these facilities provided are accessed by PWD. Inspired by the initiative to incorporate Persons with Disability (PWD) into mainstream education, the study sought to identify and examine the management policies employed in managing facilities in selected second cycle institutions to make them accessible to PWD, specifically mobility impaired persons. The knowledge of PWD in the schools and stakeholders of education about the existence of the Persons with Disability Act, 2006, Act 715 was also assessed. The research focused on three schools in the Kumasi metropolis. Data collection was done through interviews as well as the administration of questionnaires. The simple random sampling technique was used for questionnaire administration in this research. Purposive sampling was used for the interviews. Furthermore, personal observations were employed in the study. Data was also collected from secondary sources. The study revealed that there were no management policies pertaining to PWD in the schools; there was poor coordination amongst stakeholders in addressing management issues; disability unfriendly facilities were still predominant in all the schools; and majority of the respondents were ignorant about the existence of the PWD Act, 2006, Act 715. The advocacy for a barrier free environment has now taken a new dimension through the ultimatum given by the drafters of the Persons with Disability (PWD) Act, 2006, Act 715 to ensure that public buildings in Ghana are disability friendly. Based on the findings, it is recommended that there must be advocacy for the strict enforcement of the provisions of the PWD Act, 2006, Act 715. Trained facilities managers should be allocated to Senior High Schools (SHS) schools in predetermined zones.

Keywords: facilities management, inclusive education, Kumasi, mobility impairment, persons with disability, Persons with Disability Act, 2006, Act 715, senior high schools

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INTRODUCTION

Agyemang and Amakie (2004) stated that education is about excellence and unsatisfactory facilities will affect the ability of Senior High Schools (SHS) to achieve this mission. Agyemang and Amakie (2004) further argued that facilities management activities in SHS in Ghana have traditionally focused on the performance of only the physical building systems and repair works, without detailed consideration of how they might be managed to better support teaching and learning activities. According to the International Facility Management Association (2007 cited in Miller, 2007), facility management (FM) is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, process, places and technology.

It suggests that an organization’s operational requirement can be met through effective and concurrent management of all the disciplines outlined under FM. This is to say that, the short fall of one component can negatively affect an organization’s productivity level. The extent to which facilities management (FM) is a component of the strategic management of SHS facilities is vital to the way in which knowledge is produced, managed, disseminated, assessed and controlled.

Over the years, the educational sector of Ghana through government policies has recorded changes in respect of student enrolment and quality. Public SHS were established to ensure equal access to quality education especially by the poor and vulnerable in the society. Usually, beneficiaries pay less tuition fees and are advantaged in terms of availability of educational infrastructural facilities compared to what is normally seen in the private sector.

However, Persons with Mobility Impairment (PMI) who should fall within the category of the beneficiaries are rather denied this benefit. Usually, they are unable to access and use facilities in SHS. Therefore, they at times resort to hawking on streets to fend for themselves and other dependants as they grow up and raise a family. Unfortunately, management activities are carried out without taking into consideration the section of the populace who are physically challenged in the schools. Wellington (1992) reports that, it is not a common practice for PWD to be active users of public buildings and spaces owing to the traditional conception of the disabled as a person who has to be dependent. This form of social exclusion and discrimination has, over the years, led to agitation for legislation and programs in many countries of the world to protect the rights of PWD.

In this regard, a number of countries, particularly in the developed world, have in recent years enacted regulatory frameworks in the form of PWD legislation: planning and building regulations which require public buildings to be accessible (Varol and Ercokun 2006). In Ghana, the statutes include the 1992 Constitution of Ghana, the Labour Act, 2003, Act 651 and the recently enacted PWD Act (2006) Act 715 are worthy of note. Section 7
of the PWD Act states that; ‘A person who provides service to the public shall put in place the necessary facilities that make the service available and accessible to PWD. However, what is seen in most SHS does not reflect the intention of the PWD Act (2006) Act 715. Whereas some old buildings and facilities remain disability unfriendly, the new and ongoing construction projects have no signs of adherence to the Act. However, section 8 of the PWD Act (2006) Act 715 provides that;

A person who contravenes Section 1,2,3,4,6, or 7 commits an offence and is liable on summary conviction to a fine not exceeding fifty penalty units or to a term of imprisonment not exceeding three months or to both.

The situation aforementioned necessitated the study of Facility Management (FM) in the selected SHS in Kumasi. The study sought to identify and examine the management policies pertaining to PWD employed in the schools. It examined the impact of the relevant statutes pertaining PWD on the management of the schools’ facilities. It also examined the role of the facilities manager (if any) in ensuring that real properties that are restructured or put up conform to relevant statutes on PWD. It assessed how PMI in these institutions cope with the use of the schools’ facilities. Finally, recommendations were made on the need for a proficient management of facilities in the schools to reflect the intention of the statutes pertaining to PWD.

**Mobility impairment**

According to the Equality Act, (2010), the definition of mobility impairment requires that the effects which a person may experience must arise from a physical or mental impairment. However, whether a person is disabled or not disabled for the purposes of the Act is generally determined by reference to the effect that impairment has on that person’s ability to carry out normal day-to-day activities (ibid). It can be temporal or permanent; progressive, regressive or static; intermittent or continuous (WHO, 1999). Thus basically, to be able to describe something as impairment, it must inhibit or limit or interfere with activities which are considered normal.

Problems faced by individuals with mobility impairments include poor muscle control, weakness and fatigue, difficulty walking, bending, lifting objects, climbing up on step stool, sensing or grasping due to pain or weakness (Bullet, 2002). Twisting motions may be difficult or impossible for people with many types of physical disabilities such as cerebral palsy, spinal cord injury, arthritis, multiple sclerosis and muscular dystrophy (Thorpe, 2002).

According to Kane, et al. (2002, p.150), ‘In one way or another, whether in height, weight, strength, speed of movement or dexterity, everyone is different. Universal accessibility is the integration of these differences into one design philosophy that caters for everyone. It aids independent living and therefore reduces the social exclusion experienced by people with mobility problems, including wheelchair users, elderly people, pregnant women or people with young children, people with sensory or cognitive
problems, and those with temporary injuries, amongst others’. Not only should designers consider the needs of the end-users but also the character and location of the estate (ibid).

**SHS education and accessibility issues in Ghana**

According to Antwi (1992), secondary education does not only train people for entry into the professions to provide middle-level manpower necessary for economic development, but also to prepare those who can proceed to universities and other forms of higher education. The Report of the Committee on Review of Education Reforms (2002), De Castro and Tiezzi (2003) and Ankomah (1991) were of the same view regarding the importance of secondary education in Ghana. The importance of secondary education accounts for the attempt made by government, Non-Governmental Organizations (NGOs) and private individuals in providing it to reach many young individuals in the country. This has been in the form of scholarships, educational system reforms, establishment of schools and provision of educational facilities to schools.

In this regard, GES in 2005/2006 academic year introduced the Computer School Selection and Placement System (CSSPS) of admission into secondary school, to perfect the admission system. This system is seen to be a more democratic method of selection where the students are made to select schools of their choice, after which the GES through the system places the students in one of the schools chosen. According to Konadu (2010), the system takes into account only merit, talent and ability of the students. Thus Konadu’s findings did not feature accessibility issues for PWDs. Access to education for many persons with disability in Ghana is practically an urban phenomenon, which is even quite recent (Annor, 2002, cited in Kyei-Dompim, 2010).

Also Danso et al (2012) revealed that, the Ghana Education Service (GES) has an all-inclusive policy that seeks to provide education for all schoolchildren, including students with disabilities, and this has led to the establishment of specialist secondary schools such as Okuapeman Senior High School, Wa Senior High School for the Deaf and Mampong Akwapem Senior High Technical School. The aim was to provide a congenial, safe and an all-inclusive environment and specialist training for the students in these schools. However, the reality is that the built environments in most of these specialist schools include buildings which are not disability-friendly, making the establishment of these schools redundant. They added that due to the poor performance of the specialist secondary schools in the country none of them belongs to the list of elite secondary (Category ‘A’ and ‘B’) schools provided by the GES. Thus, there is no motivation for PWDs to choose such specialist schools. The Ministry of Education released an inclusive education policy which provides that no person shall be denied admission to SHS facilities on the basis of his/her special needs. Statistics from the Ministry of Education revealed that since the end of 2011, the Inclusive Education programme has expanded from 29 districts in seven regions to 46 districts in all ten regions. However, in 2012/2013 the number of pupils in mainstream basic schools recorded as having
special education needs fell by 16% (Education Sector Performance Report, 2013). Thus, a subsequent fall in PWDs enrolment in SHS should be expected as confirmed by Danso et al (2012) and other researchers on the subject.

Hallak (1977) opines that the quality of educational system depends on the quality of teaching staff. Konadu (2010) maintains that, it is a truism that the process of recruitment and selection of senior secondary school tutors, their placement and induction services conducted for them invariably determine the quality of instruction given in the institution. Konadu's work was able to establish that the GES posted tutors to public schools. However, the policies that went into posting of staff particularly PWDs were not featured in the work.

Therefore, much is left to be desired in the effort of stakeholders of education to ensure equalization of opportunities for PWDs in respect of policies to enhance enrolment and provision of quality education.

**Facility management (FM) in SHS**

According to the International Facility Management Association (2007 cited in Miller, 2007), facility management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process, and technology. Also, Balch (1994) states that facilities management seeks to meet both the operational requirements of the business activity; the provision of catering, communications, office furniture and equipment, and to fulfil the requirements to maintain the building itself, such as cleaning, heating and lighting, and the maintenance of the building fabric in terms of its redecoration and repair both internally and externally. The facility manager's job is to create an environment that encourages productivity, is safe, is pleasing to customers, meets building regulations, and is efficient. The term "facility" covers a wide range of buildings, complexes, and other physical entities. The only thread common among these entities is the fact that they are all places.

Jensen (2008) states that, the new European Facility Management standard expresses that the field of Facility Management can be grouped around client demands, which can be summarized under two main heading – the first being Space and Infrastructure and the second being People and Organization.

However, Miller (2007) states that, the skills of a facility manager can be broken down into two sections, the hard skills — tasks performed through physical or technological means — and the soft skills — tasks performed through mental intuitiveness. The hard skills include; electrical wiring and power distribution, carpentry, plumbing and water-works, operation and maintenance of Heating Ventilation and Air Conditioning (HVAC) system, spatial planning, civil and structural engineering principles . The soft skills include; customer relations, contractor coordination and support, team-building, technical judgment, time management, business continuity and financial awareness.
Adesina (1990) stressed the importance of an organization and mobilization of all the human and material resources in a particular system for the achievement of identified objectives in the system. In the school system, Adesina (1990) identified human resources as “all the men and women from the principal to the gate-man”. Material resources, he said were monetary and non-monetary including the physical assets example, land, equipment and building. It is, therefore, appropriate for Heads of educational institutions to ensure that these resources are utilized effectively to achieve the institutions’ desired goals.

Conversely, a research conducted by Agyemang and Amakie (2004) argued that facilities management activities in SHS in Ghana have traditionally focused on the performance of only the physical building systems and repair works, without detailed consideration of how they might be managed to better support teaching and learning activities. Also findings from a research conducted by Danso et al (2012) revealed that most of the building elements inspected in the schools understudied were not disability friendly. Groce (2002) and Kyei-Dompim (2010) findings were not different from the revelation from Danso et al (2012). They all advocated for a barrier free environment for PWDs considering the architectural design and provision of facilities accessible to PWDs which is also featured in the 2013 Inclusive Education Policy by the Ministry of Education. However, a research gap is left in respect of stakeholder’s contribution in achieving this aim and especially ensuring continuous use of the facilities.

According to Konadu (2012), in 1999, the national education forum called for the establishment of national education trust to service all levels of education. This step gave birth to the establishment of the Ghana Education Trust Fund (GETfund). The proceeds from the fund are invested in all levels of education in the country: it builds educational infrastructure, provides transportation, awards scholarship to some students and advances grants to beneficiary institutions. According to the parents, NGOs, Communities, Chiefs, Old Students Associations are other stakeholders which contribute money for the provision of more resources such as transport, building, textbooks, exercise books, school uniforms, desks, chairs, writing materials, library, sports computers, pay for educational visits, implementation of school programmes directly and indirectly (Commonwealth Secretariat, 1993; Owusu, 1998; Konadu, 2012; Asiedu-Akrofi, 1978). Whereas these researchers established the efforts to improve education in Ghana by some stakeholders, what seemed to be absent are their efforts specifically geared towards accessibility for PWDs in SHS as advocated by the Inclusive Education Policy by the Ministry of Education.

Pratt (1990) provides that, ideally, schools need to be designed so that they can subjectively be extended upwards or outwards and also that the interior spaces can be altered without major rebuilding. He concludes that almost any teaching environment can be modified with respect to five main elements, each of which is significant for learning. These are
personal space, spatial organization, noise, illumination and aesthetic quality.

However, Ukeje (1992) states that in constructing school buildings, certain educational specifications ought to be considered in the plan. These include the educational philosophy, nature of various activities to be provided, class size, aims and method of teaching and learning envisaged, how broad and how valid the curriculum will be, learning laboratories and libraries needed, the possibility of using the school for other community purposes. Konadu (2012) maintained that when these all-important facilities are provided, they have to be maintained to ensure their continuous usage. Therefore, to add more knowledge to findings by Agyeman and Amakie (2004), Danso et al (2012), Groce (2002) and Kyei-Dompim (2010) this research aims at identifying the authority in charge of managing SHS facilities. Also, with the advent of the global call for a barrier free environment for PWDs in all public buildings, this research aims at examining the role of stakeholders of education in ensuring that SHS facilities are made accessible to PWDs while they are managed to ensure continuous use.

Laws regarding PWDs

According to the ISO (2009), accessibility includes ease of independent approach, entry, evacuation, and or use of a building and its services and facilities by all of the building’s potential users with an assurance of individual health, safety, and welfare during the course of their activities. In order to monitor and enforce accessibility in public buildings, building instruments are required to assess the standard of accessibility that should be achieved. A number of these instruments have been developed over the years (Mace, 1998) and they include the British Standard 8300 (BS8300) (BSI Group, 2010), Americans with Disabilities Act Accessibility Guidelines (ADAAG) (United States Access Board, 1990) and a joint product by the United Kingdom, United States of America and Lebanon (Solidere, 2004).

There are laws enacted internationally and locally regarding PWDs. These laws recognize the need for the full participation and equality of disabled persons in the community. Emphasis is however placed on the aspects of the laws which deal with access to PMI. These include: the International Building Code of 2009 consisting of principles as to how structures are to be put up. Chapter 11 contains provisions that set forth requirements for accessibility of buildings and their associated sites and facilities for people with physical disabilities. Others include: the, the 1992 Constitution of Ghana. Article 29(8) of the Constitution provides that law makers of Ghana are given the mandate to enact such laws aimed at protecting the rights of PWDs. Until the enactment of the PWD Act (2006), Act 715, in Ghana, there had not been a specific legislation in place to protect PWDs in any way.

Therefore, it is not surprising that in 2006 a law was passed advocating for the development of facilities to meet the needs of the physically
challenged. Sections 6 and 7 of the Act provide that owners of places where the public has access should provide appropriate facilities and services to make the place accessible to PWDs. There are sanctions in place for any private or public facilities provider who goes contrary to the provisions of the PWD Act (2006), Act 715 particularly, sections 6 and 7.

Article 24 of the United Nation Convention on the Rights of PWDs provides that ratifying states are charged with ensuring an inclusive education system at all levels. However, Duguay (2010) maintains that, aside from South Africa, there has been limited research on the implementation of recent disability legislation and policy in sub-Saharan Africa. In Ghana, the Ministry of Education has an Inclusive Education Policy which aims at addressing PWD accessibility at all levels of education in Ghana (Ministry of Education, 2013). The policy promotes a barrier free design and PWD admission in SHS, however, it doesn't provide a clear cut PWD policy directive on SHS selection, student placement, and posting of tutors. Kin Lau et al (2014) maintained that assessment of disability inclusiveness generally involves several criteria. However, most existing inclusiveness assessment models only address accessibility issues in design and construction stages of the whole life cycle of built environment. They identified such assessment models as complicated and technical. They advocated Building management and operations as another effective assessment model. Danso et al (2012) and Danso et al (n.d.) also focused only on some building elements on SHS facilities and some monumental public buildings in Accra respectively in relation to legislative instruments regarding PWDs. While acknowledging the efforts of these researchers, this study tackles the research gap left in respect of the extent of awareness of these PWD legislative instruments to the responsible agencies, authorities and PWDs in their quest to foster PWD accessibility to facilities in SHS. Also, this research aims at examining PWD policies relating to accessibility but did not specifically relate to the architectural design of facilities in the schools as adopted by other researchers. Examples include policies on recruitment of PWD staff, admission and accommodation for PWD students amongst others. Finally, findings from earlier researches revealed that very few PWDs are admitted and retained in SHS. Thus, a research gap is left in respect of how the students retained in the schools cope with the use of the facilities in the schools which have already been identified as disability unfriendly.

METHODOLOGY

The data collection process required a preliminary survey in order to construct the sampling frame. This aided in making advance decisions that helped in specifying the geographical scope of the study, the method and procedure for collecting and analysing data from the field. A reconnaissance survey was conducted which helped the researchers to draft a comprehensive research design.
The sources of data for this research were both primary and secondary sources. The primary data were obtained from the field through interviews and the administration of structured questionnaires. The questionnaires and interviews mainly contained questions concerning the respondents' knowledge about laws relating to PWD and how stakeholders of education and authorities in the schools have applied them in drafting management policies for the school. It also concerned PMI views of the friendliness or unfriendliness of facilities in their respective schools. Data obtained from the interviews were mainly gathered as qualitative data for an improved analysis of the problem. Furthermore, personal observation was employed to ascertain the physical state of the structures in the schools. The secondary sources of data included books, journals, legal instruments regarding PWD, papers, reports, articles and published or unpublished thesis relevant to the study.

The research concentrated on three (3) Senior High Schools (SHS) within the Kumasi Metropolis. These are Kumasi Anglican Senior High School (KASS), Kumasi Wesley Girls Senior High School (K W E Y G E Y H E Y) and T, I, Ahmadiyya Senior High School (AMASS). These schools were chosen based on recent educational policies introduced by stakeholders of education such as the Ghana Education Trust fund (GETFund), Inclusive Education (2013) by the Ministry of Education and the government regarding infrastructural development and student enrolment in the Metropolis. KASS is a beneficiary of the model school initiative by ex-president Kufuor's Administration to develop selected deprived schools in each region of Ghana. AMASS and K W E Y G E Y H E Y were selected out of ten (10) beneficiaries of the 2009/2010 Ghana Education Trust fund (GETFund) project in Ashanti region, to arrest the problem of inadequate classroom and student accommodation resulting from the shift from four to three year SHS duration. Therefore, all the three schools have new structures being developed whilst the old structures are also being renovated.

The simple random sampling technique was used for questionnaire administration in this research. This method was chosen by the researchers because there was the need to allow each member of the population to have an equal and a fair chance of being chosen. This guaranteed that the sample chosen was representative of the population. Therefore, with an average population of 500 students and 30 teaching and non-teaching staff in each school, the questionnaires were administered to 150 students and 10 staff members for each school. However, an average of 148 questionnaires administered to the students was fully completed whilst the10 administered to teaching and non-teaching staff were all fully completed in all the schools.

For the interviews, purposive sampling method was used. This method was chosen because the researchers considered the interviewees as having detailed knowledge in the topic being researched. The Special Education Officer at GES and the Metro Engineer at KMA were interviewed based on their specialized roles in the built environment in relation to PWD. Eight
(8) PWDs in the three schools were also interviewed, three (3) from KASS, three (3) from K WEY GEY HEY and two (2) from AMASS. These were the only PMI presented to the researchers by the authorities as none of the schools had records of the particular number of PWD (PMI) in the schools.

**Method of data analysis**

Data analysis is a practice in which raw data is ordered and organized so that useful information can be extracted from it. Analysis of the data was done using both qualitative and quantitative analytical techniques. The raw data collected was checked, coded and analyzed by using Microsoft Excel. The programs enabled the researchers to display and analyze data in tables and figures. Frequencies and percentages were also used to describe the outcome of the study.

Tables, percentages and write-ups of the data gathered among others were used in the case of the quantitative data, while descriptions were used in the case of the qualitative analysis.

**Research questions**

i. What is the impact of the relevant legislation pertaining to PWDs on the management of facilities of the schools?

ii. What management policies pertaining to PWDs are employed in the schools?

iii. What is the role of the facilities manager (if any) and stakeholders in ensuring that facilities in the schools conform to legislation on persons with disability?

iv. How do mobility impaired persons in these schools cope with the use of the schools' facilities?

**RESULTS AND DISCUSSION**

**Awareness of the PWD Act 2006, Act 715**

All the heads interviewed said they had no knowledge of the existence of the Act. Therefore, there will certainly be a short fall in drafting management policies for PWD. Furthermore, 87.5% of the PWD respondents interviewed in the three schools had no knowledge of the existence of the PWD Act (2006) Act 715. The remaining respondent who was a tutor knew of the existence of the PWD Act (2006) Act 715 but had no knowledge of its contents. Therefore, with these persons who are beneficiaries of the PWD Act (2006) Act 715 being oblivious of its existence, it will be difficult for them to advocate their right of equalization of opportunities.

The Head of Special Education Unit and the Estate Manager at GES assured the researchers of their in-depth knowledge of the PWD Act (2006) Act 715. They reiterated that several meetings had been held with stakeholders on different platforms especially with the Federation of Disabled Persons on account of the Act. The Metro Engineer at the KMA
disclosed to the researchers that he had no knowledge of the existence of the Act.

**Policies pertaining to admission of PWD in the schools**

Out of a total of 100% (10) questionnaires administered to teachers in each of the three schools, 8 respondents representing 80% at KASS, 80% (8) of respondents at AMASS and 70% (7) of respondents at K WEY GEY HEY did not know about any policy of the GES on admission and placement of PWD in SHS. However, the authorities in all the schools said they had such a policy. Upon further enquiries about the exact policies they had, they provided that all students assigned to their schools were admitted without any form of discrimination at all.

The Special Education Officer at GES also added that generally, there should not be any form of discrimination when it comes to placement of PWD into SHS. They can be admitted into any school but because the facilities are just not friendly to the PWD, some persons never get the opportunity to further their education there. It was also found out that the GES Educational Policy (2013) featured admission for PWD but did not have a clear cut policy directive on SHS selection and placement for PWD. Also, it has no provision for sanctions to be given for non-adherence of the policy by educational institutions. Although admission to all schools is mainly based on academic performance of students, the GES school categories from which the students make their choices have nothing to do with the friendliness or unfriendliness of the school’s facilities to PWD. Therefore, PWD students make their choices and are posted to schools without due regard to accessibility of the schools’ facilities.

**Policies regarding posting of PWD staff to SHS**

The authorities in the three schools provided that the GES Regional Office was responsible for posting all teaching staff but not all non-teaching staff. However, there were no policies covering the employment of non-teaching PWD staff. The Special Education Officer at GES revealed to the researchers that, there is a tax waive of 2-5% given to any institution which will employ PWD. However, this tax waive does not apply to public educational institutions because they are tax exempt. The only policy available was the Disability Allowance Guide, a monetary allowance given to all staff with disabilities in SHS.

Therefore, considering the findings provided above, it can be seen that PWD are not specially regarded in the schools’ policy formulation. However, the PWD Act, (2006), Act 715 at the national level and the UN Convention on the Rights of PWD at the international level both outline the need for the application of relevant management policies in educational institutions. The PWD Act, (2006) Act 715 seeks to ensure that there is absolutely no discrimination against PWD in respect of admissions of students into SHS. Also, Article 5(3) of the UN Convention of the Rights of PWDs provides that ‘in order to promote equality and eliminate discrimination, state parties shall take all appropriate steps to ensure that reasonable accommodation is provided to PWD’. 
The facilities manager is expected to draft management policies that establish a link between the people, built environment, process and technology. However, none of the schools had a Facilities Manager. Neither did the GES nor the schools have well documented records on the number of PMI in the schools. This is further confirmed by the Ghana Education Sector Performance Report (2013) where the Ministry of Education admitted that there were inconsistencies in recording the number of children with special needs. The only point that related to PWD staff in the Inclusive Education Policy (2013) was on staff professional development which did not particularly relate to the welfare of PWD staff.

**Management of the schools’ facilities**

The study revealed that there was no facilities manager responsible for the management of the schools’ facilities. Management of the schools facilities was done by the headmaster, senior house master and headmistress at KASS, AMASS and K WEY GEY HEY respectively. However, all the authorities given the task of facilities management in their respective schools admitted that they had no qualification regarding estate/facilities management.

An interview with the Officer in charge of Special Education indicated that management of facilities in SHS is done by the Regional Estate Officer. The Regional Estate Officer confirmed this assertion. However, none of the authorities interviewed in the schools identified the Regional Estate Manager as the person responsible for managing facilities in the school. These points to the lack of coordination between the Estate Manager at GES and the authorities in charge of managing the schools’ facilities. However, the Inclusive Education Policy (2013) advocates for an effective collaboration between stakeholders of education in respect of PWD accessibility in SHS which is contrary to the findings of this study. The lack of supervision by the Estate Manager at GES on the school authorities who have no training in estate management/FM can lead to problems regarding functionality of the built environment.

**Recent construction projects and policies to enhance their accessibility.**

All the respondents in the schools confirmed that there had been construction as well as renovation of facilities on school premises in the past 7 years since the enactment of Act 715. Some developments were still on-going in the three schools. The facilities included dormitories and classroom blocks.

According to the Special Education Officer at GES, all schools are inspected. However, the issues considered are not related to accessibility of the facilities to the disabled in a specific way. The inspection conducted borders more on feeding, sleeping, working and learning facilities for all manner of persons in the schools. The PWD are not specially considered to ensure that they are well catered for. Inspection of the SHS is carried out by the appropriate staff of GES and KMA. However, at KMA, issues about accessibility are not considered at all during inspections. The Metro
Engineer further stated that, the designs provided by the Funds and Procurement Management Unit of the Ministry of Education are not barrier free. Conversely, District Development funded projects consider PWD but due to insufficient funds, the upper floors of such projects are not made barrier free. The researchers were informed that the Parent Teachers Association (PTA) and authorities of most schools in the Metropolis do not seek permission from the Assembly before commencing projects. Therefore, the Assembly is not involved in most of the PTA funded projects until they have encountered problems. Also, GETFund has its own building consultants therefore; the Assembly complements the consultants in construction projects.

After an interview with the headmistress and senior housemistress, the researchers learnt that the Methodist Church and the PTA collaborate with the school management to make decisions on new projects. At KASS, the headmaster said he acts together with different people on different platforms. Decisions are not made by him alone but together with whoever finances the projects be it KMA, GES or PTA. At AMASS, the headmasters position was not different from what was provided by the headmaster at KASS.

The situation may not change even when approval is sought from the KMA and the GES because, issues concerning barrier free facilities in buildings are not regarded in their inspections. This revelation continues to confirm the lack of coordination amongst the authorities and stakeholders of education on issues concerning PWD accessibility in SHS.

**Decision to be a day student or a boarder.**

The total number of PWD respondents interviewed in the three schools was eight (8). Apart from the tutor at AMASS who was posted to the school by GES, all the students chose the schools based on the academic performance of the schools. Their options for deciding on their schools had nothing to do with the nature of the school’s facilities. At KASS, one (1) respondent who was a PMI temporarily was a day student. He chose to be a day student because he thought it would be difficult to access the washrooms because he was in Plaster of Paris and had wing crutches. The other two respondents were boarders but attributed it to the fact that their place of residence is far from the school. At K WEY GEY HEY, all three respondents were boarders. One respondent said her place of residence was outside Kumasi and that is what informed her decision to be a boarder. The other two (2) respondents offered no explanation. They just wanted to be boarders. At AMASS, the tutor is non-resident and the student was a day student.

The schools had no particular policy regarding accommodation for students with disabilities. The choice of accommodation was left in the hands of the students who usually chose to be boarders because they resided outside Kumasi. These students had no choice than to cope with the facilities in the schools as discussed below.
Level of friendliness of common areas
Kin Lau et al (2014) maintained that assessment of disability inclusiveness generally involves several criteria. As stated earlier, most researches have focused on an assessment criteria based on the architectural design in relation to PWD building codes and legislative instruments. Based on their findings an inference was made regarding the state of the facilities in relation to PWD population in the schools. However, they did not consider the subjective opinions of how PWD retained in the schools cope with the use of the school’s facilities. Therefore, the tables below show how PWDs cope with the use of some common areas in the schools by providing their view of the friendliness of those areas.

Table 1: Level of Friendliness of Common Areas by 2 PMI at AMASS

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>MEANS OF ACCESS</th>
<th>NATURE OF FRIENDLINESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Classroom Block (Four Storey)</td>
<td>Stairs to all floors and a ramp on the ground floor.</td>
<td>Quite unfriendly=1 person</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very unfriendly=1 person</td>
</tr>
<tr>
<td>Exam hall (last floor on the four storey new classroom block)</td>
<td>Stair</td>
<td>Very unfriendly=2 persons</td>
</tr>
<tr>
<td>Classroom block (under construction)</td>
<td>Stair</td>
<td>Very unfriendly=2 persons</td>
</tr>
<tr>
<td>Sick bay and counseling Office</td>
<td>Stairs</td>
<td>Very unfriendly=1 person</td>
</tr>
<tr>
<td></td>
<td>No stair, flat screeded ground with an uncovered drainage gutter.</td>
<td>Friendly=2 persons</td>
</tr>
<tr>
<td>Dining Hall</td>
<td>Uncovered drainage gutter right in front of the facility.</td>
<td>Quite friendly=2 persons</td>
</tr>
</tbody>
</table>

Generally, the two PMI interviewed at AMASS had a problem with at least a facility (Table 1). Even with the blocks that were recently constructed and those which were still under construction, the respondents found them to be very unfriendly. It was also found out that their examination hall was on the last floor of the newly constructed 4storey block which was very unfriendly to the respondents. Though, they did not use any form of walking aid, they found the use of that particular block very stressful. Also, none of the facilities in the school had a standard ramp as its means of access.

At K WEY GEY HEY, most of the structures were recently constructed by GETFund. Most of the facilities had ramps together with stairs as their means of access (Table 2). However, even with the provision of ramps on the new class room, it was not totally friendly to the respondents. Therefore, stakeholders in the built environment should not only be interested in the provision of such user friendly facilities but must adhere to the appropriate national and international standards during their provision.
Table 2: Level of Friendliness of Common Areas by 3 PMI at K Wey Gey Hey

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>MEANS OF ACCESS</th>
<th>NATURE OF FRIENDLINESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly hall</td>
<td>Flat concrete grounds with an uncovered drainage gutter.</td>
<td>Quite unfriendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quite friendly=1</td>
</tr>
<tr>
<td>New classroom block</td>
<td>Predominantly half turn stair to all the floors, a ramp to the ICT centre and the library.</td>
<td>Quite friendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very unfriendly=1</td>
</tr>
<tr>
<td>Washroom</td>
<td>Stairs</td>
<td>Quite unfriendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unfriendly=1</td>
</tr>
<tr>
<td>Walk way and compound</td>
<td>Undulating concrete stretch on the walk way and the compound is rammed earth.</td>
<td>Unfriendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very unfriendly=1</td>
</tr>
<tr>
<td>Administration</td>
<td>The western side has stairs whilst the eastern side has ramps.</td>
<td>Very friendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Friendly=1</td>
</tr>
</tbody>
</table>

On the other hand, most of the facilities in KASS were friendly to PMI (Table 3). This can be attributed to the fact that most of the facilities which are necessarily used by them have both ramps and stairs as their means of access.

Table 3: Level of Friendliness of Common Areas by 3 PMI at KASS

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>MEANS OF ACCESS</th>
<th>NATURE OF FRIENDLINESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly Hall</td>
<td>Ramps and Stairs</td>
<td>Very friendly=1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Friendly=2</td>
</tr>
<tr>
<td>Dining Hall</td>
<td>Ramps and stairs</td>
<td>Very friendly=3</td>
</tr>
<tr>
<td>Library</td>
<td>Rough terrazzo ground with a covered drainage gutter in front.</td>
<td>Quite friendly=1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Friendly=2</td>
</tr>
<tr>
<td>Staff Common Room-Annex</td>
<td>Stairs</td>
<td>Very unfriendly=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unfriendly=1</td>
</tr>
<tr>
<td>Staff Common Room-Main</td>
<td>Stairs</td>
<td>Friendly=3</td>
</tr>
</tbody>
</table>

In an interview with the senior house master, it was revealed to the researchers that the provision of the ramps were the personal initiative of the contractors. The school had no agreement with the contractor for its provision. The contractor did not just consider the current users of the facility but also the fact that there could be temporal PMI. Therefore, other contractors should emulate the example of this contractor by including such facilities in their designs when offering their bids for contracts.

CONCLUSION

Facilities Management (FM) is geared towards ensuring that the people, process, structures and technology co-ordinate well to ensure functionality of the built environment to meet the expectation of clients and customers. It should be made a major aspect of the management of SHS.

From the findings of the study, it is seen that society seems oblivious to the needs of PMI. Stakeholders of education are more concerned about providing infrastructural facilities and increasing student enrolment in SHS other than considering accessibility of the facilities. There is virtually low knowledge about the existence of the PWD Act (2006), Act 715 and limited PWD policies to enhance accessibility in the built environment.
Surprisingly, the situation is not different for the PWD who are determined to pursue higher education whom the PWD Act (2006), Act 715 caters for. In this respect, they are unable to actively advocate for their right to have a barrier free environment. They face the hurdle of combining the difficulty in their ability to use these facilities with learning under the same conditions and worse still, sit under the same examination conditions at the time allotted to them to complete their studies.

The findings of this research prove that, despite the efforts of stakeholders of education in ensuring a barrier free design and equalization of opportunities for PWD in SHS in the Kumasi Metropolis, much is left to be desired in terms of sensitization, PWD policy formulation, implementation and enforcement, coordination amongst stakeholders of education and proficient management of SHS facilities to meet PWD accessibility desired goals.

Therefore, no person’s pursuit of higher education should be cut short because of inaccessibility to these structures. PMI should not drop out of school because they cannot access facilities. The facilities should be made disability friendly so that PWD can be very independent in their use of facilities. Through this, it would be easy for PMI to be integrated into the regular SHS system. Government and all stakeholders should be up and doing in this regard.

RECOMMENDATIONS

Based on the findings of the study, the researchers propose the following recommendations to ensure that facilities in SHS are managed to make them friendly to be used by PMI.

First, the Ghana Society of the Physically Disabled (GSPD) filed a motion on notice, praying the Human Rights Division of the High Court to restrain three local airlines (Antrak Air, Starbow Air, and Africa World Travel) from discriminating against persons with disabilities by way of refusing to sell flight tickets to them. Joined to the action was the Ghana Civil Aviation Authority, who the applicant wish the court would restrain from overlooking, and or refusing to ensure that the other respondents comply with Section 28 (1) of the Persons with Disability Act, 2006 (Act 715) (Daily Graphic, 2014). Following this development in the transport sector, there must be advocacy for the PWD Act (2006), Act 715 to take its full effect. Immediate steps should be taken to enforce all provisions and strict sanctions should be meted out where it is discovered that adherence to the Act is lacking. This can be done by organising workshops and seminars by and for all stakeholders of education namely the District Assemblies, Ghana Education Service, the Ghana Federation of the Disabled and all other bodies and policy makers concerned with PWD. They should be properly sensitized on their roles in the pursuit for a barrier-free society. Awareness of the Persons with Disability Act (2006) Act 715 should be created and increased. This will help the stakeholders
draft PWD policies on issues such as student accommodation, admission, SHS school selection, staff posting and construction projects geared towards enhancing accessibility issues in the built environment.

Second, there should be an enhanced coordination between the KMA and the GES to ensure that detailed inspections on the structures in SHS be carried out and serious consideration must be given to barrier-free designs and facilities before they are approved as usable. This can be done by ensuring that designs submitted by bidding contractors have barrier free building elements with due regard to acceptable building codes and standards.

Third, every SHS should be allocated a facilities manager who is cognisant with issues pertaining to PWD. If however, this will not be feasible or attainable now, SHS can be grouped into zones with regard to their locations and trained facility managers allocated to the schools in the various zones. They should be involved in the day to day management of the facilities, good records keeping management, a liaison with GES especially during SHS schools selection, admission and staff posting and not just be called upon when things take a turn for the worse.

REFERENCES


MANAGING RETENTION IN RESIDENTIAL BUILDING PROJECTS IN SELECTED STATES IN NIGERIA

Lekan M. Amusan, Joy Nkolika-Peter, Ayo K. Charles, Afolashade Oluwatobi and Ignatius O. Omuh

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Residential building projects consist of complex interrelated subsystems of cost centers which often require huge financial commitment. The huge financial commitment therefore makes monitoring the disbursement and flow of financial resources a worthwhile task. Therefore in order to maximize fund on various cost centers, client and project actors often exhibits restraint in fund disbursement in order to ensure value for fund already released. However, it is the proper management of the process of fund release and retention of some funds that determines the value for money expected on the projects. It is against this background that this study was centered on managing project retention fee in residential building projects in Lagos state, Ogun state, Abuja (F.C.T.) and Port Harcourt in Nigeria. A random sampling technique was used in the study, a population size of 250 residential building projects was used for the study from which sample size of 120 was chosen. Moreover, a structured questionnaire in Likert scale 1-5 was used for the work. Mean Item Score was used to generate the agreement index for the parameters influencing the retention fee management process. It was discovered that most deducted retention percentage is 5% of the project cost. Also, the type of intervention system often used as alternative intervention system was studied, the most advocated intervention system is paying interest on retention when delayed, followed by release of retention on line item basis. There should be adequate compensation for the fund tied down. However the following intervention system could be used: release of retention fee on line item basis, introduction of letter of credit, application of bond as alternative of retention fee, application of performance bond, financial security package, the use of escrow account for retention fee, use of payment bond and performance bond among others. The combination of two or three or all of them should guarantee adequate management of the fund. However, there are challenges often encountered in the fund administration these includes; delay in the release of fund, reduction in contractors fee and retention fee reduces contractors profit if all the retained fund is used to remedy bad work among others. Factor Analysis

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in Regression Analysis of SPSS software was used to generate factors for a suitable fee management model by reducing the factors to their Coefficients and Eigen Values. The model would assist clients and project actors in management of project elements retention fee on residential building sites.

Keywords: factor analysis, project management, residential building project, retention

INTRODUCTION

Understanding the retainage concept
The practice of retainage has its origin in the United Kingdom industry at the outset of railway system construction in 1840’s. There was massive construction then, and it created environment that encourage all entrants to practice construction in order to meet the surging demand. The inability of many of the companies to perform lead to insolvency, this situation then influenced the rail road companies to develop system of keeping back 20% of the contractors payments to guarantee performance and offset completion cost on should the company default (Specialist Engineering Construction Groups (SECG), 2002). Retention commonly referred to as retainage is a concept used to describe the amount of money often kept back on construction project. Holmes (2014) described it as the percentage amount of payment money held back from contractors’ project fee. The benchmarking, configuration and structuring of the fee is the responsibility of the contractor to the subcontractor, client to contractors or those paying for the work to be done. Also, Cherrine (2014) viewed retainage as amount of money earned but not paid out immediately. Construction project can be divided into elements with accompanied elemental cost implications, the retention fee therefore indemnify contractors against financial loss in situation of adverse financial condition.

Purpose of retention and retainage amounts
Retention provides the project owner the opportunity to obtain value for his money with full understanding of the fact that the contractor or builder must complete the work if he is to be completely paid for his or her work. Retention plan often calls for the withholding of 5 percent to 10 percent of payment until the work is finished as promised. Also, according to Holmes (2015) and Joint Contracts Tribunal (1998), retention is also centers on items on punch list; this refers to items that will vary after completion of a project, retention would ensure completion of the items in its entirety; for instance, if an owner award a contract of constructing a four bedroom flat at ₦20,000,000, or ₦ 4,000,000 for maintenance service. The builder would not receive 20 percent of what was completed until the completion of the whole project elements. The 20 percent of the fund would be released after project completion.
Limitation of retention bond and retention fee
A retention bond is a formal agreement between the sub-contractor and a third party. The bond involves surety that acts as guarantor between contractor and sub-contractor. In an ideal situation, retention bond only takes effect if the sub-contractor fails to effect the practical completion or remedy a defect. Hawkswel (2014); Hughes; Gray and Murdoch (1997) and MacCartney (1992) were of the opinion that retention bond allows contractor the opportunity to rectify any identified defects within an agreed period, hence, it is a good thing to include retention clause in the administration of a project.

However, retention fee is not applicable in all situations; one of such situations is the store materials handling. Construction retention plan must not be enforced on construction workers that handle store materials, Also, materials suppliers should not be enforced to follow retention plan since they must complete their work before the commencement of works, the reason for it is that they must be paid up front with no retention plan in place. Finally, retention plan is limited in correcting situation of dishonesty and disingenuous about contractors’ work.

CONCEPTUAL FRAMEWORK
This work adopts random sampling technique to collate data. The study started by defining the concept of retention drawing from strong concept that needed to be explained. Literature review was carried out to situate the work in the light of previous researches so as to establish and whip into line the opinion presented in this study. In deploying the random sampling technique, structured questionnaire was used designed in Likert scale 1-5, this was used to harvest respondents’ opinion. The locations chosen for the study are Abuja, Lagos state and Port Harcourt in Nigeria. The location was chosen in view of the fact that they are noted for agglomeration of different cadres of construction companies. The data analyzed was processed using the following dichotomies: scope of retention fee application on project elements on selected projects, challenges of retainage practice as peculiar to the sampled projects intervention systems in retention fee administration, impact of retention fee on projects and project participants and model for managing retainage fee on building construction projects.

Hedonic model was presented that could help in managing retention on residential construction sites using regression analysis. Conclusions and recommendation were drawn from the outcome of the research drawing strength from previous research works.
REVIEW OF RELATED LITERATURE

In this section summary of relevant literature was presented, the literature items cut across the retention and hedonic model that was presented for managing the retention on building project.

A study was carried out by Specialist Engineering Contractors Group (SECG) (2002) on the use of retention in the construction industry in the United States of America. The study was conducted on sites with residential and commercial projects. 150 questionnaires was used to collate information from the respondents which are engineers. The study noted that cases of default was common among residential building contractor who were engaged on private projects as compared to public buildings. It was further reported that due process was followed on government projects than the private projects.

However, it was discovered that the practice of retention has tendency of inducing hardship on contractors and subcontractors profitability. Robert (2002) carried out a study on industries’ profit margin and capability to withstand their money being retained in United States of America. Financial data from 120 companies was collated through questionnaire administration and analyzed for their averages for comparison and benchmarking. In a study conducted by Robert in 1972, it was noted that contractors earned approximately 6% profit on each dollar of revenue, by 1986, the profit margin oscillated around 2% of total revenue, therefore an owner retaining 10% on work installed is typically withholding up to five or three times the contractor’s profit on the project.

Moreover, Holmes (2014) studied retention on engineering projects in two (2) selected African countries: Nigeria and South Africa, the study adopted random sampling technique and combination of interview and questionnaire administration. The study explored the extent of retention application on selected private and public works. The study among other things discovered that majority of private projects did not practice retention while retention was in practice in most of the public construction projects. Incidence of delay payment of retention was noted on few projects that adopt the system. The study recommended an integrated approach to retention management on sites.

Similarly, Hawskwel (2014) explored problems of retention on selected sites in Dalet, Spain, the study used combination of interview and questionnaire administration. Construction professionals were used as a sample on the selected 85 projects among the top rated factors are: insufficient fund, communication breakdown and communication breakdown.

However, opinions on retainage is subjective, it depends on the philosophical point of view and contractual position with which it is being considered. The disparity between the public and private agencies was examined in a study carried out in Florida by Ahmad and Barnes in 1994. Ahmad and Barnes (1994) studied retainage in the United States
(Florida), fifty five (55) general contractors and thirty eight (38) public agencies were used in the study. Questionnaire administration was used in the study. It was discovered that the two groups agreed that 10% retainage was common and that it encourages front end loading and had a consensus on periodic release of the fund. It was noted that 88% of the contractors felt that retainage adversely impacted profitability while only 19% share the opinion, 87% agreed that retainage protects the owner, the contractors felt that retainage increased the possibility of contractors entering into insolvencies, in Hughes, Hilderbradt and Mudock (2000) “the impact of contract duration on the cost of cash retention” it was submitted that cash retention is a common means of protecting an employer from a contractor’s insolvency as well as ensuring that contractors finish the work that they start, also it was in their opinions that contractors withhold part of payments due to their sub-contractors. According to the study, larger contracts tend to be subjected to smaller rates of retention. Finally it was submitted that through calculating the cost of retention as an amount per year of a contract, retention would be far more expensive for firms whose work consists of short contracts considering the small capital involved.

The second segment of the review was focus on literature that positioned the best approach to modeling variables such those involved in retention management.

In a 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).

Finally, 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.

ANALYTICAL FRAMEWORK

Structured questionnaire was used to collate respondents’ opinion. The data was validated using content analysis. Mean item score method was used to determine agreement index of the variables measured in the study. Data was processed using simple percentages, ranking etc.

The response from questionnaire was loaded onto the statistical package for social science students (SPSS) software, the factors were subjected to factor rotation so as to ensure emergence of stable criteria which would be used in modeling and represent relationship among the thirty variables regarded as retainage fee modelling parameters. The resultant factors were then subjected to stepwise multiple regression analysis to establish pattern of relationships among them taking into consideration their communality sizes and their Eigen Values. Factors rotation was used in this study to identify the relationship of individual variables to the set of common factor synthesized; Oblim rotation can be used to achieve this. Therefore, Oblim rotation approach was adopted.

RESEARCH DESIGN AND METHOD

A platform was set for the research through comprehensive literature search to establish the current state of knowledge in order to put the work into proper perspective. Random sampling technique was used to gather information from population of site managers, project directors, construction managers, maintenance engineer and facility manager. One hundred and fifty questionnaires were administered and one hundred and twenty were returned and used for the analysis. Samples of respondents were taken from Lagos state, Ogun state, Abuja (F.C.T.) and Port Harcourt. These locations were chosen as a result of high concentration of construction activities taking place there. The distributed questionnaire was designed in Likert scale 1 to 5, the respondent were requested to express their opinion in the degree tabulated on the questionnaires. A scale 1 to 5 was adopted, with 1 representing “strongly disagree (SD)” 2 –
Agreement index of the respondents was generated using the relation
\[ M.A.I = \frac{5S.A + 4A + 3S.D + 2D + 1N}{5(S.A + A + S.D + D + N)} \]

where \( M.A.I = \text{Mean Agreement Index} \quad A= \)

Agreement variable \( i = \text{Lower boundary}, \quad j = \text{Upper boundary} \)

\( N = \text{Frequency of Variable} \quad \Sigma = \text{Summation Notation} \).

**Model Development**

Different researchers have used diverse methods to generate models to measure parameters in construction operation. Chan and Tam (2000) used combination of multiple regression analysis and factor analysis. Roston and Amer (2006) adopted weighted average, factor analysis, Pareto and stepwise multiple regression analysis. Also, Abdel Rasaq et al; (2001); Ling (2005) used calculated Pearson’s correlation coefficient, and weighted average approach. However for the purpose of this work, this research work adopted combination of stepwise multiple regression methods and factor analysis for data reduction. The response from questionnaire was loaded onto the statistical package for social science students (SPSS) software, the factors were subjected to factor rotation so as to ensure emergence of stable criteria which would be used in modeling and represent relationship among the thirty variables regarded as retainage fee modelling parameters. The resultant factors were then subjected to stepwise multiple regression analysis to establish pattern of relationships among them taking into consideration their communality sizes and their Eigen Values.

**Factor Extraction:**

Percentage of total variance obtained from each of the independent variables (the thirty-nine (39) variables (sub factors) were examined). Each variable was standardized to have variance of 1, while total variance was given by the sum of each variable which totaled thirty-nine (39). Chan and Tam (2000), Roston and Amer (2006) adopted two approaches to determine the factors to be included in the model. They used Screeplot and Eigen value approach. Chan and Tam (2000) submitted that in Eigen value approach, only variable with Eigen value greater than one (1) should be included in the model formation. In screeplot approach, there is differential relationship pattern among variables; there is always a distinct demarcation between large variables on steep slope and gradual trailing off scores of the rest variables. This usually occurs at the variable, where \( K \) is the true number of variables Chan and Tam (2000). However, this study adopted Eigen value and regression coefficient approach. Eighty-two percent of (82%) the total variance is attributed to the first 20 variables where these variables have an Eigen value greater than 1. Other twelve (12) variables account for only about 38.25% of the total
variance. This shows that a model with 20 factors should be robust enough to represent the data

**Factors Rotation**

Factors rotation was used in this study to identify the relationship of individual variables to the set of common factor synthesized; Oblim rotation can be used to achieve this. Therefore, Oblim rotation approach was adopted. On the other hand, Rostom and Amer (2006), used variance rotation methods, and were able to discover each variable with a single factor. Table 7 shows the relationship of the variables to the common factors, the new factors and elements related to each factor. The new set sixteen (16) factors that emerged after rotation is presented in Table 9.

**RESULTS AND DISCUSSION**

**Analysis of data/discussion**

Table 1: Scope of retention fee application on project elements on selected projects

<table>
<thead>
<tr>
<th>S/N</th>
<th>RETENTION FEE ARC OF COVERAGE</th>
<th>AGREEMENT INDEX</th>
<th>PERCENTAGE</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>10% and above for the contract sum of total elements cost throughout duration</td>
<td>24</td>
<td>20.00</td>
<td>3rd</td>
</tr>
<tr>
<td>ii</td>
<td>10% till 50% completion on elements and 5% on the remainder</td>
<td>40</td>
<td>33.33</td>
<td>1st</td>
</tr>
<tr>
<td>iii</td>
<td>10% till 50% on the total elements cost then none on the remainder</td>
<td>16</td>
<td>13.33</td>
<td>4th</td>
</tr>
<tr>
<td>iv</td>
<td>5% on the contract sum of the elements throughout the contract duration</td>
<td>34</td>
<td>28.33</td>
<td>2nd</td>
</tr>
<tr>
<td>v</td>
<td>5% till 50% then none on remainder</td>
<td>8</td>
<td>6.67</td>
<td>7th</td>
</tr>
<tr>
<td>vi</td>
<td>3% on the contract sum of total elements throughout the contract duration</td>
<td>9</td>
<td>7.50</td>
<td>6th</td>
</tr>
<tr>
<td>vii</td>
<td>1% on the contract sum of total elements throughout the contract duration</td>
<td>10</td>
<td>8.33</td>
<td>5th</td>
</tr>
</tbody>
</table>

Source: 2015 Survey

Scope of application of retention fee on selected projects is presented in Table 1 above, the first parameter (10% till 50% completion and 5%) on the remainder of project cost, was ranked 1st by 33.33% of respondents; application of 5% on the contract sum throughout the contract duration was ranked 2nd by 28.33% of total respondents relative to 10% and above for the contract sum throughout duration which was ranked 3rd by 20% of the respondents. Also, another parameter (10% till 50% then none on the remainder) was ranked 4th by 13.33% of the respondent while 1% on the contract sum throughout the contract duration was ranked 5th with 8.33%. The application of 10% till 50% completion and 5% on the remainder of the total project cost remain popular opinion that cut across substantial number of the respondents. The implication of this trend is that clients on the project sampled adopts payment of retention fee on the work in stages until the 50% of the work is done, then the remaining 50% is left for the defect liability period. The 50% would then be released after the period.
Also, in practice is the art of leveraging 5% on the total project cost and keep till the end of the project when it would be restored.

However, unpopular among the respondents are; 1% on the contract sum throughout the contract duration, which was ranked 6th, the 3% on the contract sum throughout the contract duration, ranked 6th and 5% till 50% then none on remainder which was ranked 7th supported by 6.67% of the respondents. The implication of this is that the system is not popular in Nigeria though being practiced by few persons.

Table 2: Intervention systems in retention fee administration

<table>
<thead>
<tr>
<th>S/N</th>
<th>RETENTION FEE INTERVENTION SYSTEMS</th>
<th>AGREEMENT INDEX</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Application of bond as alternative of retention fee</td>
<td>3.54</td>
<td>4th</td>
</tr>
<tr>
<td>ii</td>
<td>Financial security package</td>
<td>3.50</td>
<td>6th</td>
</tr>
<tr>
<td>iii</td>
<td>Introduction of letter of credit</td>
<td>3.56</td>
<td>3rd</td>
</tr>
<tr>
<td>iv</td>
<td>Deployment of payment bond</td>
<td>3.00</td>
<td>8th</td>
</tr>
<tr>
<td>v</td>
<td>Escrow retention fee by lodging in escrow account</td>
<td>3.50</td>
<td>6th</td>
</tr>
<tr>
<td>vi</td>
<td>Application of performance bond</td>
<td>3.52</td>
<td>5th</td>
</tr>
<tr>
<td>vii</td>
<td>Release of retention fee on line item basis</td>
<td>3.58</td>
<td>2nd</td>
</tr>
<tr>
<td>viii</td>
<td>Release of retainage fee at early part of construction work</td>
<td>2.76</td>
<td>9th</td>
</tr>
<tr>
<td>ix</td>
<td>Payment of interest on retention fund when over delayed.</td>
<td>3.67</td>
<td>1st</td>
</tr>
</tbody>
</table>

Source: 2015 Survey

Intervention systems in retention fee payment operation is illustrated in Table 2. Payment of interest on retention fund when over-delayed was advocated by a great percentage of the respondents, thereby ranked 1st with mean score of 3.67. There should be adequate compensation for the money tied down during delayed payment. The prospect of paying interest on tied down fund would serve as deterrence to undue delayed retention fee payment. This is an intervention approach on occasion of delayed retention fee payment.

Also, retainage fee can be released on line item basis. Line item release of retention fee is a practice whereby funds are released when a separately identifiable portion of the work is satisfactorily completed.

Serial release of the retention fee for portions of the work which task has been completed would be favoured by this option which was ranked 2nd by the respondents. According to Stockenberg (2002), this intervention system would prevent undue delay in payment of works often completed early in the course of project execution. Furthermore, Introduction of letter of credit in place of retainage fee was ranked 3rd while Application of bond as alternative of retention fee was also ranked 4th. Therefore, bond can be used as a substitute to retained fund.

Moreover, application of performance bond ranked was ranked 5th while Escrow retention fee by lodging in escrow account was ranked 6th. Alternatively retention fund can be lodged in an account called escrow account to prevent unwarranted expenditure or diversion of retained...
funds. This practice allows funds to be kept out of reach of creditor should the owner experience financial difficulties. An Escrow account generally involves two types of expense that must be borne by one of the parties. This includes the administration cost and cost of running or financing the escrowed fund.

Table 3: Challenges of retainage practice as peculiar to the sampled projects

<table>
<thead>
<tr>
<th>S/N</th>
<th>CHALLENGES OF RETAINAGE PRACTICE</th>
<th>AGREEMENT INDEX</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Retention fee is often delayed</td>
<td>3.86</td>
<td>1st</td>
</tr>
<tr>
<td>ii</td>
<td>Retention fee is not often released in accordance with the contract</td>
<td>3.45</td>
<td>7th</td>
</tr>
<tr>
<td>iii</td>
<td>Release of retention fee is often dependent on circumstances beyond contractors' control</td>
<td>3.85</td>
<td>2nd</td>
</tr>
<tr>
<td>iv</td>
<td>Employers often seek to withhold retention fee due to wrong interpretation of works information</td>
<td>3.84</td>
<td>4th</td>
</tr>
<tr>
<td>v</td>
<td>Holding back of retainage fee to reduce the resultant payable amount on final contract payment</td>
<td>2.50</td>
<td>9th</td>
</tr>
<tr>
<td>vi</td>
<td>Retention fee instigates lack of trust in the contractor</td>
<td>3.60</td>
<td>5th</td>
</tr>
<tr>
<td>vii</td>
<td>Non introduction of Retention fee improves relationship on project</td>
<td>3.50</td>
<td>6th</td>
</tr>
<tr>
<td>viii</td>
<td>Retainage fee has tendency of reducing contractors’ profit</td>
<td>3.40</td>
<td>8th</td>
</tr>
<tr>
<td>ix</td>
<td>Contractors could lose the retention money if all is used for repair work</td>
<td>3.85</td>
<td>2nd</td>
</tr>
</tbody>
</table>

Source: 2015 Survey

Some of the challenges often encountered in retention fee administration is presented in Table 3. “Retention fee is often delayed”, presented as one of the challenges of fund management was ranked 1st with mean index value of 3.86. In construction industry, according to Cherrine (2014), Delay is one of the challenges encountered in retainage fee payment; it was discovered that retention fee could be delayed by days, weeks, months or even years. Similarly, Contractors could lose the retention money if all is used for repair work was ranked second (2nd) with mean index value of 3.85, also, Release of retention fee is often dependent on circumstances beyond contractors’ control was ranked 2nd with mean index value of 3.85. In the light of this the fund could be kept in an escrow account to prevent unwarranted expenditure as a way out.

Moreover, Employers often seek to withhold retention fee due to wrong interpretation of works information was ranked 5th with mean index of 3.60, while Retention fee instigates lack of trust in the contractor was ranked 6th with mean index value 3.5. Above all, one should guard against delaying the contractor retainage fee to prevent project disharmony. In the light of the above, if those challenges are carefully considered and managed, it is likely that the negative aspect of retention fee can be eliminated.
Table 4: Impact of retention fee on projects and project participants

<table>
<thead>
<tr>
<th>S/N</th>
<th>IMPACT OF RETENTION FEE ON PROJECT AND PARTICIPANTS</th>
<th>AGREEMENT INDEX</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Sharp practice by the contractors in a bid to cushion effect of retention fee in likely situation of non-payment of retention fee.</td>
<td>3.89</td>
<td>4th</td>
</tr>
<tr>
<td>ii</td>
<td>Retention fee has attendant consequence of reducing contractors’ fee.</td>
<td>3.90</td>
<td>2nd</td>
</tr>
<tr>
<td>iii</td>
<td>Retention fee reduces contractors profit if all sent at defect liability period</td>
<td>3.88</td>
<td>7th</td>
</tr>
<tr>
<td>iv</td>
<td>Retention fee discourages potential contractor for a project</td>
<td>3.50</td>
<td>8th</td>
</tr>
<tr>
<td>v</td>
<td>During defect liability period retained fund speeds up the rate of completion of works</td>
<td>3.92</td>
<td>1st</td>
</tr>
<tr>
<td>vi</td>
<td>Tendency to get retained fund speeds up the completion of defects by contractor</td>
<td>3.90</td>
<td>2nd</td>
</tr>
<tr>
<td>vii</td>
<td>Retention fee instills in contractor sense of responsibility to the client or professionals.</td>
<td>3.80</td>
<td>6th</td>
</tr>
<tr>
<td>viii</td>
<td>Retention fee creates awareness about constraint to perform maximally on a project</td>
<td>3.89</td>
<td>4th</td>
</tr>
</tbody>
</table>

Source: 2015 Survey

In Table 4, the parameter (iv) (During defect liability period retained fund speeds up the rate of completion of works) was ranked 1st with mean index value 3.92. Tendency to get retained fund speeds up the completion of defects by contractor and Retention fee has attendant consequence of reducing contractors’ fees were ranked 2nd with mean index value 3.90 respective. Sharp practice by the contractors in a bid to cushion effect of retention fee in likely situation of non-payment was also ranked 4th with index magnitude of 3.90 among others. Antidote to the above challenges is following standard best practice.

Parameters of model for managing retention fee is presented in Table 5 above. The parameters were analyzed for their respective Agreement index. It was discovered that releasing retention fee on line item basis has highest Agreement Index of 3.95. The rate of subscription to the release of retention fee on line item basis has the highest frequency. It was a common opinion among the respondents that retention fee should be paid on those items that are lined up for execution and has experienced remarkable progress and success. Also, respondents are of the opinion that introducing Retention fee would improves relationship on project and correct interpretation of works information by employer could prevent undue delay of contractors fund were ranked 2nd respectively with agreement index of 3.93. Retention fee would to a great extent improve level of relationship among clients and their contractors or builders. Contrary to the pre-retention fee era whereby contract are executed based on mutual trust, which makes enforcement for compliance to remedy defects difficult, thereby causes tension. Introduction of retention fee has been widely believed to improve relationship on projects; particularly the
agreement to the limit of individual responsibility as far as the brokerage and administration of the fee is concerned.

Similarly, another three factors, Timely payment of retainage fee has tendency of enhancing contractors’ profit, All Contractors retention money should not be used for repair work and Prompt payment of retention fee were analyzed and all rounded off with agreement index of 3.92 and therefore were ranked 4th.

<table>
<thead>
<tr>
<th>Table 5: Model for managing retainage fee on building construction projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/N</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>i</td>
</tr>
<tr>
<td>ii</td>
</tr>
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<td>iii</td>
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<td>iv</td>
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<td>xiii</td>
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<td>xiv</td>
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<td>xv</td>
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<tr>
<td>xvi</td>
</tr>
<tr>
<td>xvii</td>
</tr>
</tbody>
</table>

Source: 2015 Survey

It was revealed from the analysis that Timely payment of retainage fee and Prompt payment of retention fee has tendency of enhancing contractors’ profit. Time and money are two indivisible project variables that are closely dependent, therefore there is a school of thought that believed that “Time is Money and Money is Time”. Therefore, the more a builder stayed on a project the more the money being tied down and liable to lose value or depreciates. Therefore, if the retainage fee is paid as at when due it relieves the builder the pain of money depreciation, and enhance builders profit, therefore ranked fourth.

Furthermore, one of the factors listed in Table 5 (All contractors’ retention money should not be used for repair) was also ranked fourth. It is a fact that the intention for entering into business is profit making, once the defect liability stage has commenced, restraint should be exercised in
order not to expend the entire retainage fee in remedying work defect. This has tendency to cause attrition or disharmony between client and the builder therefore should be discouraged.

Table 6 Factor Rotation of Parameters for Retention Fee Management Model

<table>
<thead>
<tr>
<th>S/N</th>
<th>VARIABLES</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Prompt payment of Retention fee</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>Contractor situation should be taken into consideration</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Correct interpretation of work information by client/employer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>iv</td>
<td>Non-holding back of retention fee</td>
<td>0.984</td>
<td>0.988</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Administration of retention fee should engender trust in contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi</td>
<td>Introduction of Retention fee</td>
<td></td>
<td></td>
<td></td>
<td>0.988</td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>vii</td>
<td>Introduction of retention fee to improve relationship</td>
<td></td>
<td></td>
<td></td>
<td>0.999</td>
<td>0.999</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>viii</td>
<td>All contractors’ retention money should not be used for repair work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.999</td>
<td>0.999</td>
<td>1.00</td>
</tr>
<tr>
<td>ix</td>
<td>Application of bond as alternative to retention fee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>Financial security in exchange of retainage fee</td>
<td>1.00</td>
<td>0.997</td>
<td></td>
<td>0.997</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td></td>
</tr>
<tr>
<td>xi</td>
<td>Introduction of letter of credit in place of retention fee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>xii</td>
<td>Deployment of payment bond</td>
<td>0.985</td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xiii</td>
<td>Escrowing of retention fee in escrow account</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>xiv</td>
<td>Application of Performance bond</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>xv</td>
<td>Release of retention fee</td>
<td></td>
<td></td>
<td>0.986</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>xvi</td>
<td>Release of retainage fee at early stage of work</td>
<td>0.971</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>

Finally, two other factors, (Application of financial Bond as alternative to Retainage Fee and Application of Performance bond to activate Retention fee) were scored with agreement index of 3.90 and ranked 7th. It was advocated that Performance bond can be used as alternative to retention or retainage fee. Performance bond is project package that could serve as compensation in lieu of default in project performance. The bond could be in place which depicts the intention to perform by the builder and could be administered legally depending on term of agreement. The mode of performance bond management is unique relative to the retention or retainage fee.

Factor rotation of parameters for retention fee management model is presented in Table 7. The table contain the benchmarked parameters that could be used to manage Retention fee on a project. The parameters had been analyzed for their respective agreement index already and had been ranked. The parameters were further reduced to a sizeable number using Factor analysis. The resultant factors were examined, considering the
magnitude of their Eigen Value using Co-efficient of 0.9 to 0.1 as boundary limit.

The following factors emerged with reference to the Eigen values and variables with the 0.9 -1.0 Eigen coefficient dichotomy; F1, F2, F4, F6, F9, F11, F14, F15, F16.

\[
0.980F_1 \quad \text{(For Optimum Retainage Fee Management Performance)}
\]

\[
0.988F_4 + 0.985F_9 + 0.982F_11 \quad \text{(For Moderately Retainage Fee Management Performance)}
\]

\[
0.99F_4 + 0.99F_6 + 0.99F_{14} + 0.99F_{15} + 0.99F_{16} \quad \text{(For High Retainage Fee Management Performance)}
\]

Fig.1: Benchmarked Model Parameters for Result Oriented Retention Fee Management

**Model Interpretation**

The interpretation of Factors F1 to F16 as contained in the structure of the model is as follow:

F1 -------- Correct interpretation of work information by client/employer

F3-------- Non-holding back of retention fee; Introduction of retention fee to improve relationship, all contractors’ retention money should not be used for repair work

F4-------- Application of bond as alternative to retention fee;

F6-------- Introduction of retention fee to improve relationship; all contractors’ retention money should not be used for repair work

F9-------- Deployment of payment bond

F11-------- Financial security in exchange of retain-age fee

F14, F15, F16 -------- Financial security in exchange of retain-age fee; Application of performance bond as alternative to retainage fee.

Three dichotomies were presented by the model within the context of 0.1 representing minimum and 1.0 representing maximum effect; the optimum effect retainage fee management code, the moderate effect retainage fee management and high effect retainage fee management. Factor F1 (correct interpretation of work information by client/employer) should guaranteed optimum effect on retainage fee management if observed. Furthermore, combination of three different factors (F4, F9, F11) would produce a moderate retainage fee performance. The factors includes:
application of bond as alternative to retention fee; Deployment of payment bond and financial security in exchange of retain-age fee.

However, combination of the following factors would induce highest positive effect, F3, F6, F14, F15 and F16. The factors includes; (non-holding back of retention fee; introduction of retention fee to improve relationship, all contractors’ retention money should not be used for repair work’); Financial security in exchange of retain-age fee; and application of performance bond as alternative to retainage fee. The combination of some or all of the factors guaranteed result oriented retainage fee management system.

CONCLUSION

The aim of the research work has been achieved, the study has presented issues that border on the management and administration of retention fee on selected construction projects. In Table 7.1. it was discovered that most deducted retention percentage is 5% of the project cost. Also, the type of intervention system often used as alternative intervention system was studied. Payment of interest on the retention fund on occasion of delayed payment was advocated, this is to be remedied with interest on the delayed fund. There should be adequate compensation for the fund tied down. However the following intervention system could be used: release of retention fee on line item basis, introduction of letter of credit, application of bond as alternative of retention fee, application of performance bond, financial security package, the use of escrow account for retention fee, use of payment bond and performance bond among others. The above toed the line of submission of Cherine (2014), Hawskwel (2014), Holmes (2014) and Ahmad and Barnes (1994). The combination of two or three or all of them should guarantee adequate management of the fund. However, there are challenges often encountered in the fund administration these includes; delay in the release of fund, reduction in contractors fee and retention fee reduces contractors profit if all the retained fund is used to remedy bad work among others, this as well is in agreement with Ahmad and Barnes (1994). Also, Hawkswel (2014); Hughes; Gray and Murdoch (1997) and MacCartney (1992) were of the opinion that retention bond allows contractor the opportunity to rectify any identified defects within an agreed period., hence, it is a good thing to include retention clause in the administration of a project which this study advocated.

Moreover, a model was presented that could help in the retention fee management on project works. The model toed the line of submissions of developing hedonic models in Picard, Antoniou and Adré de Palma (2010), Amusan; Joshua; Adegbenjo and Owolabi (2012), Rustom and Amer (2006), Bowel, Cattel and Kakia (2008).

However, according to the outcome of the analysis, combination of some factors contained in the model would induce highest positive effect, that is, F3, F6, F14, F15 and F16. These factors include; (non-holding back of
Amusan et al.

retention fee; introduction of retention fee to improve relationship and all contractors’ retention money should not be used for repair work). Also, financial security in exchange of retain-age fee; and application of performance bond as alternative to retainage fee. The combination of some or all of the factors guaranteed result oriented retention management system on residential and public construction projects.

REFERENCES


MEASURES TO IMPROVE THE PERFORMANCE OF CONSTRUCTION PROJECTS IN SOUTH AFRICA

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Department of Construction Management and Quantity Surveying, University of Johannesburg, Doornfontein Campus, Johannesburg, 2028, South Africa

Construction projects are complex, risky and time-consuming undertakings that are usually commissioned by governments and delivered by national and international participants with a variety of cultural differences, backgrounds, political systems, and languages. The South African construction industry operates in a uniquely project-specific and complex environment, combining different investors, clients, contractual arrangements and consulting professions. It impacts directly on communities and the South African public at large, and its improved efficiency and effectiveness will enhance quality, productivity, health, safety, environmental outcomes and value for money. Therefore, this paper will investigate measure that can be used to improve the performance of construction projects in the South Africa construction industry. Data for this paper were obtained from a structured questionnaire was distributed to construction professionals both from contracting companies, consultant offices and public owners sectors. Findings from the questionnaire surveys revealed that the measures to be taken for the improvement of the performance of construction projects in Gauteng, South Africa, include: proper project planning and scheduling, use of effective project management techniques, clear information and communication channels, adherence to construction drawings and specifications, proper material procurement, adequate planning, effective strategic planning, proper project implementation and management, frequent coordination between the construction team, use of appropriate construction methods, site management and supervision amongst others. The study contributes to the body of knowledge on the subject of measures to improve the performance of construction projects in the South Africa construction industry.

Keywords: construction project, project performance, South Africa

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INTRODUCTION

The construction industry plays an indispensable role in the South African economy, and is a significant contributor to economic growth (CIDB, 2012; Stats SA, 2010; Windapo and Cattell, 2013:65). The construction industry is the sector of the economy that is responsible for the planning, design, construction, maintenance and eventual demolition of buildings and works. It is essentially a service industry, obtaining its inputs and outputs from various sectors of the economy with which it is interrelated and interlinked, often in quite complex ways (Selleh, 2009: 10).

Construction projects are complex, risky and time-consuming undertakings that are usually commissioned by governments and delivered by national and international participants with a variety of cultural differences, backgrounds, political systems, and languages (Shore and Cross, 2005; Othman, 2013:731). As a result of these complexities, the South African construction industry is facing several problems and challenges which result in poor performance of construction projects.

Construction projects attract high levels of public attention and political interest due to the substantial cost, direct and indirect impact on the community, environment, and budgets (Capka, 2004; Van Marrewijk et al., 2008; Othman, 2013: 731). Compared with many other industries, the construction industry is subject to more risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures (Flanaganand Norman, 1993; Akintoye and MacLeod, 1997; Smith, 2003; Zou et al, 2012:2).

On the one hand and due to their unique nature and characteristics, construction projects require high design knowledge and technical skills, competent human resources, professional managerial capabilities and large-scale investment (Flyvbjerg, et al., 2003; Frick, 2006; Sturup, 2009; Othman, 2013:731). This however is not the case with developing countries such as South Africa, which suffers from having a shortage in providing these essential knowledge, skills, capabilities, and finances, which ultimately challenge performance of construction projects and the development of the construction industry (Othman, 2013:731). Marx (2012:119) further states that the construction industry impacts directly on communities and the South African public at large, and its improved efficiency and effectiveness will enhance quality, productivity, health, safety, environmental outcomes and value for money. Therefore this paper seeks to discover the measures and steps that can be taken by the South African construction industry to improve its performance and eliminate and minimise all current problems and challenges faced by the industry.
CHALLENGES FACING THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

Challenges at industry level
Construction industries in all countries face many difficulties and challenges (Gale and Fellow, 1990; Ofori, 1990; Selleh, 2009: 11). However, the problems facing the construction industry in developing countries, such as South Africa, are significantly more fundamental, more serious and more complex. In developing countries, these difficulties and challenges sit alongside the general situation of socio-economic stress, chronic resource shortage and general inability to deal with key issues (Ofori, 1990; Salleh, 2009:11). The construction industry, in developing countries, faces conditions of uncertainties and risk; these risks include: Instability, scares resources, relatively unskilled labour, labour performance and productivity, low levels of productivity, overruns and excessive wastage, poor infrastructure, fraudulent practices and inability to adopt best practice (Selleh, 2009:12-14). The construction industry master plan (CIMP) further elaborates that that challenges facing the industry today include enhancing quality and productivity besides high labour and material prices, inefficient and ineffective methods and practices, inability to attract and develop local workforce, inability to provide total integrated solutions and difficulty in securing timely and adequate funding (CIMP.2008:6).

Mismatches between available skills and required skills, is also one of the major challenges facing the construction industry; according a report by CIDB (2004), skills supplied to the market through the Further Education and Training (FET) System were in many cases not appropriate to the needs of the construction industry, resulting in a skills gap and a decline in the capacity of the professional sector within the construction industry. van Wyk (2003) submits that the high number of industry participants who have no education, let alone a degree, is a serious impediment to the development of the South African construction industry (Windapo and Cattell, 2013:66 ;Mbande, 2010; CIDB, 2004; van Wyk, 2003).

The National Construction Council (NCC) further states that the inefficient and deteriorated state of the South African construction industry with poor performance has detrimental effects to the development of the industry. Weaknesses, problems and constraints hampering the performance and development of the industry include (NCC, 2005; 8):

- Low capacity and capability of the local contractors and consultants due to weak resource base and inadequate experience;
- Inadequate and erratic work opportunities, inappropriate contract packaging of works which favour foreign firms in donor funded projects, low public investment in infrastructure projects and over dependence on donor funding;
- Inefficient and non - transparent procurement systems Corruption and financial mismanagement in public/private sectors;
• Lack of supportive institutional mechanisms in terms of financial credit facilities, equipment for hire and professional development;
• Unfavourable donor conditions which tend to marginalize local construction enterprises;
• Unfavourable tax regime;
• Poor working environment, including low standards of safety and occupational hazards on construction sites;
• Weak and non-facilitative policies and regulatory framework;
• Low productivity and quality; and
• Low technological base

The CIDB (2010:40) report indicated that the major contributors to poor quality of construction in South Africa are likely to be procurement related barriers. Such procurement related barriers include:
• fraud and corruption, or 'political interference' (including cronyism and nepotism);
• the procurement and delivery model (such as the 'design by employer' model);
• the use of procurement systems based on price and preference only, and not taking into account functionality (or quality); and/or
• Insufficient information to be able to select professional services and/or contractors based on quality criteria.

**Challenges at national level**
Existing literature, found in Windapo and Cattell (2013:66-70) revealed the following challenges that are said to influence the performance, growth and development of the South African construction industry:
• Public-sector capacity (Mbande, 2010; Milford, 2010; SA Construction Industry Status Report [Stats SA], 2004)

Mbande (2010), and Windapo and Cattell (2013:67), detect that there is a shortage of skills within the South African skills sector and in state-owned enterprises. According to the CIDB (2004), public-sector capacity is a key constraint on infrastructure delivery and sustainable growth in the South African construction industry. Milford (2010) observes that the lack of public-sector capacity has led to an inefficient and cumbersome process of funding construction projects by the government and in some cases, backlogs of more than six months in payments to contractors. The CIDB (2011) continue to suggest that specific issues of concern are the quality of tender documents and specifications and the management of change orders. The CIDB report notes that these factors are a reflection of the
procurement capability of clients and their agents (Windapo and Cattell (2013:67)

- Procurement practices and the capacity for sustainable empowerment (Black Economic Empowerment [BEE] News, 2009; CIDB, 2004)

The CIDB (2004) further reports that, the existing preferential procurement environment is a challenge as it encourages historically disadvantaged professionals to establish their own firms rather than join established companies. This fragmentation, according to the report, has reduced the depth and breadth of expertise that can be consolidated within medium and large companies through access and experience on specialised and diverse projects.

- Communication and Technology (CIDB, 2007)

South Africa has reasonable access to the latest technology; however, the prevailing levels of technology within the country and overseas tend to limit the scope of the projects that can be undertaken at any one time, with the material, equipment and personnel available. Therefore construction companies are encouraged by government to employ more labour to boost the economy and alleviate poverty, thus increasing the technology gap between South Africa and the rest of the world, resulting in the slow development of the South African construction industry

According to Emuze and James (2013:45), communication is one of the factors that affect the performance of construction project as it affects all aspects of construction work to some extent. Without effective communication among people, work progress would become an uphill task in construction. However, despite the advantages of information and communication technology (ICT), the use of paper as a form of communication is still the main medium of information transfer and sharing within the South African construction industry (Emuze and Smallwood, 2012:6). This medium of communication exposes an organisation and the entire supply chain to errors, because it is extremely difficult for clients and contractors to obtain up-to-date information and virtually impossible to resolve processes such as requests for information (RFIs) within the required time (Sommerville and Craig, 2006: 89; Emuze and Smallwood, 2012:6).

- Availability of suitable land for construction (Boshoff, 2010; van der Merwe, 1997)

Boshoff (2010) highlights that while there is an extensive supply of public land; private land is not readily available in South Africa. The total area of land within each cluster that can be developed is further limited by such factors as topography and soil conditions (van der Merwe, 1997). Furthermore, there are many land claim issues in the courts, zoning issues and heritage sites, all of which combine to make the price of available land inhibitive, thereby delaying development processes.
Increases in the costs of building materials (BER, 2011; Stats SA, 2010b; CIDB, 2004; van Wyk, 2003)

Materials account for as much as 60% of total project costs (Bourne, 1981; Haskell, 2004). South Africa produces its own strategic materials and relies on imported equipment. Therefore, increases in material costs within the industry are a cause for concern. The CIDB (2007) report on the Building and Construction Sector in South Africa notes that the prices of volatile building materials such as steel, cement, sand, copper, timber, polyvinyl chloride (PVC) pipes, bitumen and masonry increased by up to 100% between October 2000 and 2006. Stats SA (2010) and BER (2011) reported price increases ranging from 70%–241% between 2000 and 2010. In addition, BER (2011) determined that the prices of building materials increased linearly at an average rate of 70% between 2002 and 2010 and that all building material prices increase overall up to 2008, when the material prices reached their peak. According to van Wyk (2003), significant growth in the construction industry is dependent upon price stability in material costs, which have increased at rates higher than the inflation rate. The effects that increases in building material prices have on the construction industry, including the inability of developers to deliver affordable housing, high tender valuations and poor construction industry performance (CIDB, 2007; Cockayne, 2011).

Statutes and regulations (SA Construction Industry Status Report [Stats SA], 2004).

The CIDB (2004) report states that since 1994, the South African Government has passed more than 1,000 pieces of legislation, which have in turn spawned numerous regulations, giving the impression of over-regulation. These laws have affected tender and procurement procedures, employment and labour practices, BEE, planning permissions and controls, skills development and training and business practices. As a result, the development approvals and zoning processes of local authorities are slow and lead to unnecessary holding costs for developers (CIDB, 2004).

Challenges on a global level

Globalisation/critical global issues (Lewis, 2007; Raftery et al., 1998)

Lewis (2007) highlights the impact of globalisation on the construction industries in developing countries and the areas in which global trade perpetuates economic underdevelopment, thereby posing a challenge to the development of the construction industries in those countries. Furthermore, the current global economic recession and its effect on the world economy pose a challenge to the performance of the construction industry in South Africa.
METHODOLOGY

Data for this paper were obtained from a well-structured questionnaire that was distributed to construction professionals such as Architects, Quantity surveyors, Structural engineers, Electrical engineers, Mechanical engineers, Civil engineers, Project Managers, Construction managers and construction project managers, from contracting companies, consultant offices and public owners sectors. The questionnaire was designed based on information emanating from reviewed literature. Data collection was through self-administered questionnaires, which were distributed by hand and by Email in the research environment, the Gauteng province. Out of the 160 distributed questionnaires, 131 were received back which represents 82% of the return rate, these formed the basis of this study. From the literature reviewed it was evident that project delivery in South Africa was poor, the study therefore identified measures that can be implemented to improve the performance of construction projects in South Africa. Using a five point Likert scale, the respondents were asked to rate the levels of agreement on each of the possible measure that can be taken to improve the performance of construction projects in Gauteng, South Africa. The studied factors were ranked based on the mean item score. A higher mean item score represents a higher ranking.

Mean item score
The five-point scale was transformed to mean item score (MIS) for each of the factors of causes and effects as assessed by the respondents. The indices were then used to determine the rank of each item. The ranking made it possible to cross compare the relative importance of the items as perceived by the respondents. This is the method used to analyse the collected data from the issued questionnaires in this study. Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement (Sukamolson, nd: 20). After the questionnaire is completed, each item may be analysed separately or item responses may be summed to create a score for a group of items. Hence, Likert scales are often called summative scales.

The computation of the relative mean item score (MIS) was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. This was based on the principle that respondents’ scores on all the selected criteria, considered together, are the empirically determined indices of relative importance. The index of MIS of a particular factor is the sum of the respondents’ actual scores (on the 5-point scale) given by all the respondents’ as a proportion of the sum of all maximum possible scores on the 5-point scale that all the respondents could give to that criterion (Pilot and Hungler, 1995:33). Weighting were assigned to each responses ranging from one to five for the responses of ‘strongly disagree’ to ‘strongly agree’ and ‘Extremely unlikely’ to ‘Extremely likely’. This is expressed mathematically below. The mean item score (MIS) was calculated for each item as follows;
MIS= \(1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5\) \(\sum N\) Equation 1.0

Where;

\(n_1\) = Number of respondents for extremely unlikely or strongly disagree;
\(n_2\) = Number of respondents for unlikely of disagree;
\(n_3\) = Number of respondents for neutral;
\(n_4\) = Number of respondents for likely or agree;
\(n_5\) = Number of respondents for extremely likely or strongly agree;
\(N\) = Total number of respondents

After mathematical computations, the criteria are then ranked in descending order of their mean item score (from the highest to the lowest).

**FINDINGS AND DISCUSSIONS**

Table 1 Scoped Literatures and Ifa Sages Categories Synthesis

<table>
<thead>
<tr>
<th>Recommendations to improve performance of construction projects</th>
<th>(\bar{x})</th>
<th>(\sigma X)</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper project planning and scheduling.</td>
<td>4.52</td>
<td>0.652</td>
<td>1</td>
</tr>
<tr>
<td>Make use of effective project management techniques</td>
<td>4.52</td>
<td>0.641</td>
<td>1</td>
</tr>
<tr>
<td>Clear information and communication channels.</td>
<td>4.49</td>
<td>0.602</td>
<td>2</td>
</tr>
<tr>
<td>Adherence to construction drawings and specifications.</td>
<td>4.45</td>
<td>0.638</td>
<td>3</td>
</tr>
<tr>
<td>Ensure Proper material procurement.</td>
<td>4.44</td>
<td>0.612</td>
<td>4</td>
</tr>
<tr>
<td>Adequate planning</td>
<td>4.43</td>
<td>0.636</td>
<td>5</td>
</tr>
<tr>
<td>Effective strategic planning.</td>
<td>4.41</td>
<td>0.645</td>
<td>6</td>
</tr>
<tr>
<td>Proper project implementation and management</td>
<td>4.41</td>
<td>0.682</td>
<td>6</td>
</tr>
<tr>
<td>Frequent coordination between the construction team.</td>
<td>4.39</td>
<td>0.679</td>
<td>7</td>
</tr>
<tr>
<td>Use of appropriate construction methods</td>
<td>4.38</td>
<td>0.703</td>
<td>8</td>
</tr>
<tr>
<td>Site management and supervision.</td>
<td>4.38</td>
<td>0.677</td>
<td>8</td>
</tr>
<tr>
<td>Timely supply of material</td>
<td>4.36</td>
<td>0.673</td>
<td>9</td>
</tr>
<tr>
<td>Have complete and suitable design at the right time.</td>
<td>4.35</td>
<td>0.751</td>
<td>10</td>
</tr>
<tr>
<td>Minimize dispute between all parties</td>
<td>4.35</td>
<td>0.749</td>
<td>10</td>
</tr>
<tr>
<td>Allocation of adequate project duration</td>
<td>4.34</td>
<td>0.726</td>
<td>11</td>
</tr>
<tr>
<td>Allow for material price escalation in original tender document</td>
<td>4.32</td>
<td>0.878</td>
<td>12</td>
</tr>
<tr>
<td>Good workmanship</td>
<td>4.32</td>
<td>0.722</td>
<td>12</td>
</tr>
<tr>
<td>Appointment of highly experienced design team</td>
<td>4.31</td>
<td>0.750</td>
<td>13</td>
</tr>
<tr>
<td>Practise sufficient risk management</td>
<td>4.31</td>
<td>0.782</td>
<td>13</td>
</tr>
<tr>
<td>Appointment of highly experienced technical team</td>
<td>4.30</td>
<td>0.703</td>
<td>14</td>
</tr>
<tr>
<td>Use suitable construction methods to suit specific project.</td>
<td>4.26</td>
<td>0.715</td>
<td>15</td>
</tr>
<tr>
<td>Conduct Frequent progress meeting.</td>
<td>4.25</td>
<td>0.851</td>
<td>16</td>
</tr>
<tr>
<td>Ensure collaborative working in construction.</td>
<td>4.23</td>
<td>0.776</td>
<td>17</td>
</tr>
<tr>
<td>Appointment of experienced contractors</td>
<td>4.22</td>
<td>0.878</td>
<td>18</td>
</tr>
<tr>
<td>Use proper and modern construction equipment.</td>
<td>4.21</td>
<td>0.857</td>
<td>19</td>
</tr>
<tr>
<td>Proper implementation of local regulations</td>
<td>4.17</td>
<td>0.746</td>
<td>20</td>
</tr>
<tr>
<td>Speedy decision making process</td>
<td>4.14</td>
<td>0.923</td>
<td>21</td>
</tr>
<tr>
<td>Decrease number of variation orders</td>
<td>4.08</td>
<td>0.993</td>
<td>22</td>
</tr>
<tr>
<td>Ensure Up-to-date technology utilization.</td>
<td>3.95</td>
<td>0.904</td>
<td>23</td>
</tr>
</tbody>
</table>

\(\sigma X\) = Standard deviation; \(\bar{x}\) = Mean item score; R = Rank
These findings were in agreement with findings obtained by Emuze (2011:230), Olomolaiye (1990), Ailabouni and Gidado (2012:134), Kazaz and Ulubeyli (2006) as well as Ayodele and Alabi (2011:142) in these studies on measures that can be taken to improve the performance of construction projects; adequate documentation and transfer of knowledge; total quality management of all processes; good organisational culture among project partners; robust open information sharing among project team, good supervision and site management, material management, work planning, supervision, site layout and technical education and training, keeping costs within budget and keeping to the schedule are the most effective ways of improving project performance. Mohammed and Isah (2012:785) indicated that, adequate planning; coordination; and proper monitoring of the construction projects by an experience and qualify professionals should be encourage to improve the performance of construction projects. Ayodele and Alabi (2011:142) informs that to reduce project abandonment and consequently improve project performance, the following must occur; adequate project planning, adequate funding for the projects, proper cost control during project implementation, timely payment by client. In a study conducted in the Nigerian construction industry, Waziri (2012:1383) discovered that effective project planning, controlling and monitoring were the most prominent methods to improve the performance of construction projects. All these findings were in support the findings of this paper on measures that can be taken to improve the performance of construction projects in South Africa.

CONCLUSION

The objective of this paper was to establish measures that can be taken to improve the performance of construction projects in South Africa. Reviewed literature revealed the following as recommendations to improve the performance of construction projects: adequate documentation and transfer of knowledge; total quality management of all processes; good organisational culture among project partners; robust open information sharing among project team, good supervision and site management, material management, work planning, supervision, site layout, technical education and training, adequate project planning, adequate funding for the projects, proper cost control during project implementation, timely payment by client. The findings from this paper, which were to establish ways to improve the performance of construction projects in South Africa, revealed that; proper project planning and scheduling, make use of effective project management techniques, clear information and communication channels, adherence to construction drawings and specifications, ensure Proper material procurement, adequate planning, effective strategic planning, proper project implementation and management, frequent coordination between the construction team., use of appropriate construction methods, site management and supervision,
timely supply of material, have complete and suitable design at the right time, minimize dispute between all parties, are the most effective ways to improve the performance of the construction projects in South Africa, according to currently active professionals in the South African industry.

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METHODS TO ASSESS THE EFFECTIVENESS OF NATURALLY VENTILATED CLASSROOMS IN GAUTENG, SOUTH AFRICA

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There is a tendency to reduce ventilation rates and natural or hybrid ventilation systems to ensure the conservation of energy in school buildings. However, high indoor pollutant concentration, due to natural or hybrid ventilation systems may have a significant adverse impact on the health and academic performance of pupils and students. Reviewed evidence shows that this can be detrimental to health and wellbeing in schools because of the learner density within a small area, eventually indicating that CO\textsubscript{2} concentrations can rise to very high levels (about 4000 ppm) in classrooms during occupancy periods. In South Africa's naturally ventilated classrooms, it is not clear whether the environmental conditions are conducive for learning. In addition, natural ventilation will be minimized given the fact that in cold, wet or windy weather, doors and windows will commonly remain closed. Evidence from literature based studies indicates that the significance of ventilation techniques is not understood satisfactorily and additional information concerning naturally ventilated schools has to be provided for better design and policy formulation. To develop a thorough understanding of the environments in classrooms, many other parameters have to be considered as well, such as outdoor air quality, CO\textsubscript{2} concentrations, temperature and relative humidity and safety issues that may be important drawbacks for naturally ventilated schools. The aim of this paper is to develop a conceptual understanding of methods that can be implemented to assess the effectiveness of naturally ventilated classrooms in Gauteng, South Africa.

A theoretical concept with an embedded practical methodology have been proposed for the research programme to investigate the relationship between ventilation rates and learning in schools in Gauteng, a province in South Africa. It is important that existing and future school buildings must include adequate outdoor ventilation, control of moisture, and avoidance of indoor exposures to microbiologic and chemical substances considered likely to have adverse effects in South Africa. Adequate ventilation in classrooms is necessary to reduce and/or eradicate the transmission of indoor pollutants.

Keywords: carbon dioxide (CO\textsubscript{2}), classroom, Gauteng, natural ventilation

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INTRODUCTION

Buildings contribute significantly to ensuring the success of human activities. At present it is estimated that most people spend the majority, on average about between 75 - 80% of their time in indoors (Essah, 2009), often in shared spaces. Significantly, the time spent indoors has raised increasing concern about indoor air quality and its impact on health. Amongst the different building categories, Santamouris et al., (2008) allude to the fact that, there is much concern about air quality in school buildings. This is because schools present a much higher occupancy density than any other buildings. Comparatively, there being four to five times as many occupants per unit of area (1.8 - 2.4m²/person) than in a typical office building (10m²/person) (Clements-Croome et al., 2008). Coupled with this has been recent studies showing that schools have significant indoor environmental problems, while ventilation levels are below the recommended rates (Mendell and Heath, 2005; Daisey, et al., 2003; Seppanen, et al., 1999; Synnefa, et al., 2004). High indoor pollutant concentration may have a significant adverse impact on the health of pupils (students), given that children are much more vulnerable to indoor pollutants (Santamouris et al., 2008). According to Clements-Croome et al. (2008), a review of over 300 articles investigating the aspects of indoor air quality (IAQ), ventilation and building-related health problems in schools has shown that ventilation is inadequate in many classrooms; the main cause of health symptoms.

Mendell and Heath (2005) review evidence that certain conditions commonly found in US schools have adverse effects on the health and the academic performance of more than 50 million US school children. They propose that existing and future school buildings must include adequate outdoor ventilation, control of moisture, and avoidance of indoor exposures to microbiologic and chemical substances considered likely to have adverse effects. In a similar study in South Africa schools, the question is asked by Gibberd and Motsatsi (2013) if the environmental conditions in South African classrooms are conducive for learning? They conclude that “environmental conditions in the case study classrooms do not achieve the environmental standards defined by American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) and South African Bureau of Standards (SABS), suggesting that the classroom does not provide an environment that promotes productivity and comfort for particular summer conditions, and therefore is unlikely to be conducive for learning”. In another study by Richardson (2014), scientists studying the role of room ventilation in tuberculosis (TB) transmission found that students in Cape Town, South Africa, spend almost 60 percent of their day in poorly ventilated rooms hence a high percentage remain at risk of TB transmission. The bottom line is the literature is confirming the need for adequate ventilation in classrooms to reduce and/or eradicate the transmission of indoor pollutants.

In this paper a theoretical concept of ventilation rates, carbon dioxide (CO₂) concentrations in schools is discussed. By definition ventilation rate
is a measure is the air change rate (or air changes per hour). The aim of this research is to develop a theoretical concept of methods that will be implemented to assess the effectiveness of naturally ventilated classrooms in South Africa. This paper forms the initial stages of the research which is on-going and hence at the time of writing this paper no results have been acquired. For the purpose of this study, ‘schools’ is defined to include only the basic educational system (that is both primary and secondary schools).

**Background**

Since 2009, education in South Africa is governed by two national Departments, namely the department of Basic Education (DBE), which is responsible for primary and secondary schools, and the department of Higher Education and Training (DHET), which is also responsible for tertiary education and vocational training. The DBE department deals with public schools, private schools (also referred to by the department as independent schools), early childhood development (ECD) centers, and special needs schools. The public schools and private schools are collectively known as ordinary schools, and comprise roughly 97% of schools in South Africa ([http://www.education.gov.za/](http://www.education.gov.za/)).

In 2013, there were 30,027 established public and registered independent education institutions, of these 25,720 were ordinary schools and 4,307 were other institutions — namely, ECD centres and special schools. The categorization of the total number of ordinary schools is illustrated in Table 1.

<table>
<thead>
<tr>
<th>DBEs</th>
<th>Schools</th>
<th>Learners (L)</th>
<th>Educators (E)</th>
<th>Ratio (L:E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>14,558</td>
<td>384,092</td>
<td>197,258</td>
<td>2</td>
</tr>
<tr>
<td>Secondary</td>
<td>6,098</td>
<td>3,895,909</td>
<td>143,862</td>
<td>27</td>
</tr>
<tr>
<td>Combined &amp; Intermediate</td>
<td>5,064</td>
<td>2,209,647</td>
<td>83,903</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>25,720</td>
<td>6,489,648</td>
<td>425,023</td>
<td>15</td>
</tr>
</tbody>
</table>


Considering the fact that approximately 13% (i.e. learners and educators—table 1) of the population of South Africa (i.e. 52.98 million people as of 2013) are in schools and hence according to Richardson (2014) they spend 60% of their time in this environment, understanding the ventilation strategies in this schools becomes even more significant.

Table 1 is better visualized when schools within the provinces with detailed analyses as illustrated in Table 2. The choice of data presented is due to the fact that this is the latest version of the documentation published in 2015.

From Table 2 and Figure 1, the main rural provinces tend to have proportionally more schools with fewer learners than the more urbanised provinces, which tend to have proportionally fewer schools with more
learners (http://www.education.gov.za/), this is an indication of higher population density. Figure 1 shows that in 2013, Gauteng (17.1%) and Kwazulu-Natal (23%) had the total number of learners and educators in both ordinary and independent schools. Though not representative in this paper, the government report in 2013 (http://www.education.gov.za/) indicates that, Gauteng had the largest proportion of learners, educators and schools (i.e. 10.8%, 20.7% and 22.4%, respectively), making the Gauteng province the ideal province to roll out the proposed in this context. It must be noted that at this point in time how a typical school or classroom in Gauteng looks like is not known. In a research by Gibberd and Motsatsi (2013), the classroom setup was generalised. Moving forward this would be investigated to develop a more comprehensive data set.

Table 2. Number of schools, learners and educators in the ordinary and independent school sector, by province in 2013

<table>
<thead>
<tr>
<th>PROVINCE</th>
<th>ORDINARY PUBLIC SCHOOL SECTOR</th>
<th>INDEPENDENT SCHOOL SECTOR</th>
<th>Total</th>
<th>Percentage of Total L &amp; E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Schools</td>
<td>Learners</td>
<td>Educators</td>
<td>Ratio(L:E)</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>5,402</td>
<td>3,601,005</td>
<td>85,337</td>
<td>50</td>
</tr>
<tr>
<td>Free State</td>
<td>1,327</td>
<td>649,896</td>
<td>33,721</td>
<td>27</td>
</tr>
<tr>
<td>Gauteng</td>
<td>2,006</td>
<td>1,999,542</td>
<td>98,937</td>
<td>32</td>
</tr>
<tr>
<td>Kwazulu-Natal</td>
<td>5,087</td>
<td>2,708,073</td>
<td>91,285</td>
<td>81</td>
</tr>
<tr>
<td>Limpopo</td>
<td>3,024</td>
<td>1,692,106</td>
<td>54,708</td>
<td>50</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>1,768</td>
<td>1,025,849</td>
<td>33,330</td>
<td>21</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>55</td>
<td>279,445</td>
<td>8,725</td>
<td>22</td>
</tr>
<tr>
<td>North West</td>
<td>1,351</td>
<td>770,240</td>
<td>25,185</td>
<td>21</td>
</tr>
<tr>
<td>Western Cape</td>
<td>1,498</td>
<td>1,001,450</td>
<td>32,347</td>
<td>31</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24,155</td>
<td>11,975,844</td>
<td>361,029</td>
<td></td>
</tr>
</tbody>
</table>

Source: http://www.education.gov.za/
Fig. 1. Percentage distribution of learners, educators and schools in independent schools, by province, in 2013

INDOOR ENVIRONMENT

According to Santamouris et al., (2008) few studies are available about the ventilation levels and the carbon dioxide (CO$_2$) concentration in schools. Most studies (for example work by Wargocki et al., 2002, Mendell and Heath 2005, Croome et al, 2008, Gibberd and Motsatsi, 2013) conclude that schools do not meet the ventilation levels foreseen by the ASHRAE standard, while the indoor CO$_2$ concentration usually exceeds the threshold of 1000 ppm (Clements-Croome et al, 2008).

In the study by Santamouris et al., (2008) it is noted that most of the available information on air flow levels and the associated CO$_2$ concentration in schools comes from measurements performed in mechanically ventilated classrooms. However, air flow surveys in mechanically ventilated schools usually measure the mechanically supplied outdoor air and may not account for air infiltration into the building. From this study and other reviewed literature (Clements-Croome et al, 2008) it is observed that there is limited information available about the air flow and CO$_2$ concentration in naturally ventilated schools, as in the case of schools in South Africa (SA). This is because of the difficulty in controlling airflow rates from natural ventilation sources, unlike mechanical ventilation which can be controlled and or optimised to a design standard.

The investigation of air quality in classrooms helps us to characterise pollutant levels and implements remedial measures. It must be noted that all ventilation systems expend energy and all over the world there is a trend to save energy by reducing ventilation rates. However, we need to establish the minimum acceptable level of fresh air required for the health of building occupants (in this instance schools).

In schools, the supply of adequate fresh air, and hence perceived acceptable air quality, should be high on the list of priorities to help ensure healthy working conditions for learning. No pollutant should be present in sufficient quantities to cause adverse health effects or irritation to occupants (Clements-Croome et al, 2008). The widely investigated and reported type of indoor air pollutants as discussed in most literature include: ambient air pollutants (e.g. CO$_2$, carbon monoxide etc); bio aerosols (bacteria, viruses, etc); physical pollutants, (radon, asbestos; heavy metals- mercury and cadmium); particulates (including dust, man-made mineral fibers and respirable suspended particulates) and VOCs. The above mentioned pollutants can cause diseases like asthma, allergy, infections, inflammation, and SBS symptoms (Jones 1999; Wargocki et al., 2002) and they can also reduce performance and productivity (Mendell and Heath 2005). Clements-Croome et al, (2008), also hints that indoor pollutants, such as human body odour may also cause occupants to become
uncomfortable within their indoor environments. Others arise from emissions from materials, badly maintained ventilation systems, dust mites, fungi, and processes within the building. Sources of outdoor air pollution are from traffic, industrial processes, construction activities, and combustion systems.

Amidst all the known pollutants, high levels of CO₂ have been shown to cause a negative influence on pupils’ learning ability (Griffiths and Eftekharí, 2008; Bakó-Biró, et al, 2012). As a result Ventilation should be supplied to limit the level of CO₂ in all teaching and learning environments so that when it is measured at seated head height, during the continuous period between the start and finish of teaching on any day, the average concentration should not exceed 1500 ppm.” This is a boundary value and states that at any time, including when teaching, the pupils and teachers should have the freedom to lower the CO₂ concentration to 1000 ppm (CIBSE guide B, 2005), through ventilation methods (both natural and/or mechanical). The standard requirements for ventilation rates and CO₂ concentrations; for effective productivity in classrooms worldwide, is illustrated in Table 3. These are values that have been benchmarked by the various bodies to indicate the acceptable requirements within a building.

Table 3. Standard requirements of ventilation rates and CO₂ concentrations

<table>
<thead>
<tr>
<th>STANDARDS</th>
<th>Ventilation Rates (l/s/person)</th>
<th>CO₂ Levels (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHRAE (USA)*</td>
<td>7.4</td>
<td>1000</td>
</tr>
<tr>
<td>CIBSE (UK)**</td>
<td>8</td>
<td>1000 (1500 max)</td>
</tr>
<tr>
<td>BISRIA (UK)***</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>SABS (South Africa)</td>
<td>7.5</td>
<td>942****</td>
</tr>
</tbody>
</table>

*ASHRAE Application 2011; ** CIBSE Part B; ***BSRIA, BG 9/2011; ****Gibberd and Motsatsi (2013 ppm- parts per million

As illustrated in Figure 2, it is envisaged that these standards will be comparative and representative of schools in Gauteng, typically that of SABS. Measurements taken from ongoing studies benchmarked against ASHRAE values (representative.
THEORETICAL CONCEPTS

As discussed by Santamouris *et al.*, (2008), ventilation in schools may be provided by natural or mechanical means. Natural ventilation (NV) is very common in mild climates as in the case of South Africa which is not noted for severe winters or extremely hot summers. As discovered by Santamouris *et al.*, (2008) Most of the national regulations in mild climates do not require the use of mechanical systems but considers that window opening can provide the necessary ventilation rates. However, in naturally ventilated classrooms very limited and often confusing information is available regarding the ventilation patterns and its effects on the associated IAQ. In general, natural ventilation in schools is assumed to be associated with lower symptom prevalence although ventilation rates may be lower than in mechanically ventilated schools, hence investigations have been confined to mechanically ventilated classrooms (Santamouris *et al.*, 2008). Based on work by Gibberd and Motsatsi (2013), Richardson (2014) and the research team visualisation, the integration of mechanical ventilation is not representative of schools in Gauteng hence SA. Their arguments are sound since the climatic conditions and the existing school design configurations allow for naturally ventilated schools. As a result detailed investigation is required to assess the ventilation rates in classrooms as well as its impact on pupils’ performance.

As stated and used in studies by Santamouris *et al.*, (2008) and Clements-Croome *et al*, (2008), investigating the ventilation rates in classrooms have been by simple tracer gas decay mechanisms (a typical graph illustrated in Figure 2). However, in the context of this research, it is envisaged that to develop a thorough understanding of the environments in classrooms, other parameters have to be considered as well. Notably, outdoor air quality, CO$_2$ concentrations, temperature and relative humidity and safety issues that may be important drawbacks for naturally ventilated schools. These parameters to date have not been considered holistically or
integrated together to investigate the environment within naturally ventilated classrooms hence it is evident that the significance of ventilation techniques is not understood satisfactorily. Obtaining such information would provide information concerning naturally ventilated schools that would provide the basis for a better design for schools and policy formulation. On the basis of this, the sections that follow present the theory for two methods that would be used to obtain the ventilation rates and transfer phenomenon in classrooms.

**Experimental Procedures: proposed**

The method discussed in this section is governed by tracer gas decay techniques. Generally, infiltration and ventilation rates in school buildings are either measured using tracer gas techniques, or are calculated indirectly based on measurements of the metabolic CO\textsubscript{2} concentrations. The use of decay tracer gas technique is based on measuring the decrease rate of a tracer gas released and dispersed uniformly in a given space. This technique as discussed by Liddament (1996), Turner and Bearg (1989) and Essah (2009) requires the following:

a) an open plan space with air flowing between the specific room and the external environment

b) a perfect mixing of the tracer gas in the space

c) an accurate estimation of the effective volume of the room

A generalised tracer mass balance equation which forms the essence of the decay method of tracer gas measurements as discussed by Essah (2009) is summarised as follows:

\[ V \frac{dC}{dt} = Q[C_e - C_t] + F \]

(1)

\( V \) is effective volume of enclosure, m\textsuperscript{3}; \( Q \) is specific air flow rate through enclosure, m\textsuperscript{3}s\textsuperscript{-1}; \( C_e \) is external concentration of tracer gas; \( C_t \) is internal concentration of tracer gas at time \( t \); \( F \) is production rate of tracer by all sources within the enclosure,

Developing equation 1 further equations 2 and 3 are obtained, from which the ventilation rate in the classroom (or zone) is derived as in the case of equation 4

\[ \ln C_t - \ln C_o = -\frac{Q}{V} t \]

(2)

Therefore plotting \( \ln(C_t) \) against \( t \) will give a straight line with gradient \( -\frac{Q}{V} \)
\[ C_t = C_0 e^{-Nt} \]  

(3)

where

\[ N = \frac{Q}{V} = \text{Air change rate per unit time} \]  

(4)

Given that classrooms are an uncontrolled environment where opening of windows and doors is very common, tracer gas decay techniques have been usually employed to measure the infiltration rate in schools either during the non-occupancy period, or under closed openings static conditions (Santamouris et al., 2008). Carbon dioxide generated by occupants is commonly used as the tracer gas to measure the ventilation rates. This method would therefore be used in the ongoing impending to investigate the trends in school buildings, especially in a single zone (volume). Other tracer gas techniques; constant, pulse and continuous are not suitable for this investigation because of the laborious (on time, equipment and cost) and rather complex algorithm required (Essah, 2009). The decay method is noted to have the limitation below,

- This technique is not suitable for long term airflow measurements, because the concentration falls too low to be measured after 2 – 3 hours and repeated injection is needed.

However in the context of this research, it serves as an advantage to some extent since any gas introduced (in this instance exhalation of CO₂ from occupants) does not linger in the background to cause a lasting effect

**Transport of pollutants from adjacent classrooms**

What we introduce to this research that has not been studied is the flow patterns from adjustment rooms. Understanding this is vital because it demonstrates the possible transfer of pollutants (or practically diseases) from one zone to the other. This principle originates from previous research work by Essah (2009). Flow directions are as illustrated in Figure 3, assuming two classrooms side- by-side (adjacent).
Fig. 3. A wire-frame view of the two virtual classrooms located adjacent to each other.

It is assumed that there are no reverse flows and the flows are driven mainly by natural ventilation mechanisms. Considering a 2-dimension view of figure 3 with detailed illustration of flow paths (figure 4), proposed algorithms adapted from Essah (2009) and Essah and Sanders (2010) have been developed for this research.

Fig. 4. Projected distribution of air flow patterns in the two virtual classrooms.

Taking into account the two classrooms and air movement paths, the following assumptions were made during the derivation of the flow algorithms.

a) Gases in the classrooms 1 and 2 are well mixed
b) CO₂ as a tracer gas is not absorbed on material surfaces within the classrooms
c) There is no back flow from classroom 1 to classroom 2

Definition of parameters in figure 5

$V_2$ and $V_1$ are volumes in m³ of the warm and cold sections respectively

$X$'s airflows in m³/s

$G_{a2}$ is the generation rate of CO₂ a in classroom 2, /s

$G_{b1}$ is the generation rate of CO₂ b in classroom 1, g/s
$C_{a2}$ concentration of CO$_2$ a in classroom 2, g/m$^3$

$C_{b1}$ concentration of CO$_2$ b in classroom 1, g/m$^3$

$C_{a1}$ concentration of CO$_2$ a in classroom 1, g/m$^3$

$C_{ao}$ outside concentration of CO$_2$ a (usually 400 ppm), g/m$^3$

$C_{bo}$ outside concentration of CO$_2$ b (usually 400 ppm), g/m$^3$

$\beta_2$ is the ventilation rate of classroom 2,

i.e. $\beta_2 = \frac{X_{o2}}{V_2 \times 3600} \text{ach}$

$\beta_1$ is the ventilation rate of classroom 1,

i.e. $\beta_1 = \frac{X_{o1}}{V_1 \times 3600} \text{ach}$

At equilibrium, gas concentrations are considered to be constant. If the mass balance of tracer gases in the individual sections are considered, then

Flow of tracer gas in (g/s) = Flow of tracer gas out (g/s)

Relations for classroom 2 with tracer gas a

$G_{a2} = (C_{a2} - C_{ao})X_{o2}$

Implies

$C_{a2} = C_{ao} + \frac{G_{a2}}{X_{o2}}$

(5)

Relations for classroom 1 with tracer gas b

$G_{b1} = (C_{b1} - C_{bo})X_{o1}$

Implies

$C_{b1} = C_{bo} + \frac{G_{b1}}{X_{o1}}$

(6)

Relations for classroom 1 with tracer gas a
\[ X_{21}(C_{a2} - C_{a1}) = (C_{a1} - C_{ao})X_{o1} \]

Hence

\[ C_{a1} = \frac{(X_{21}C_{a2}) + (X_{o2}C_{ao})}{X_{21} + X_{o1}} \]  

(7)

Therefore:

\[ X_{21} = \frac{X_{o1}(C_{a2} - C_{ao})}{(C_{a2} - C_{a1})} \]  

(8)

To ensure the effectiveness of the algorithm, the tracer gas (CO\(_2\)) would be injected into the classroom separately to verify their respective ventilation rates (i.e. \(\beta_1\) and \(\beta_2\)).

The derivation of these set of equations in this section is essential because it draws on day to day flow regimes which are caused by ventilation and infiltration but otherwise ignored in most studies. There is no doubt of its effectiveness because of verifications from dwellings to a roof (Essah, 2009) and from a warm space to a cold space (Essah and Sanders, 2009).

Other parameters that will be monitored alongside the gases and the flow rates are the RH and temperature, in both classrooms.

**Learning and performance test**

Generally, in schools the supply of adequate fresh air, and hence perceived acceptable air quality, should be high on the list of priorities to help ensure healthy working conditions for learning (Clements-Croome et al, 2008). Using standardised, computerised tests of cognitive function, Coley and Greeves (2004) has demonstrated that the attentional process of 18 primary school children aged 10/11 were significantly slower when the level of CO\(_2\) in classrooms was high (in excess of 4000 ppm and ventilation rates of less than 0.5 l/s per person - Coley and Beisteiner, 2002). They declare that the effects are best characterised by the Power of Attention factor (PAF) which represents the intensity of concentration at a particular moment, with faster responses reflecting higher levels of focused attention. They concluded that increased levels of CO\(_2\) led to a decrement in PAF by approximately 5%. Thus, in a classroom where CO\(_2\) levels are high, students are likely to be less attentive and concentrate less well on what the teacher is saying, which over time may possibly lead to detrimental effects on learning and educational attainment.

Since there have been few methodologically strong studies of the effects of IAQ on children’s performance in schools (Clements-Croome et al, 2008), piloting of performance measures is essential. For the purpose of this study, while reaction time is important, measures of other facets of cognitive activity (such as speed of processing), will be used in this research. Two different performance tests will be administered to the
pupils in each school. Traditional tests will be executed on paper, which include simple math-based (addition, subtraction and multiplication of numbers) and language based tests (reading comprehension, word substitution, logical reasoning) similar to that performed in a normal school day. Furthermore, a software (Ventilation in Schools and Cognitive Performance) would be used to study changes (improvement and impairment) of pupils’ cognitive performance under different air quality conditions in classrooms (i.e. due to CO$_2$ build up). These tests will be executed on laptops/ desktops installed in the classroom. Both the traditional tests and the computer tests will be given to pupils during their lessons preferably before the lunch break when the CO$_2$ concentrations reach the maximum level of the morning’s teaching session. Details of this approach will be discussed as the research progress into the next phase.

**Summary**

The theory and principles governing two distinct methods have been discussed. These methods as part of the proposed research will be implemented to assess the effectiveness of naturally ventilated classrooms in Gauteng, South Africa. As stated in Section 1, this paper sets the scene for how the classroom environment can be assessed. The tests to assess the performance and learning of pupils have also been briefly presented with the view of an in-depth presentation as the research progresses.

**CONCLUSION**

There is a tendency to reduce ventilation rates and natural or hybrid ventilation systems to ensure the conservation of energy in buildings; in this instance schools. However, the evidence reviewed shows that this can be detrimental to health and wellbeing in schools because of the learner density with a small area, eventually indicating that CO$_2$ levels can rise to very high levels (about 4000 ppm) in classroom occupancy periods. Further, these levels may be detrimental to concentration hence adversely affect learning. In this paper a theoretical concept with embedded practical methods have been proposed for the research programme to investigate the relationship between ventilation rates and learning in schools in Gauteng, a province in South Africa. It must be noted that this paper sets the scene for an on-going research investigating the effects of ventilation rates in classrooms.

The algorithm developed is to study the effect of airflows in naturally ventilated classrooms. It also demonstrates the design and purpose for developing an alternative to the conventional tracer gas techniques. Although work done over the years has involved sampling within only one zone, the theoretical concepts demonstrated above show that sampling can also be used to monitor ventilation rates within two zones simultaneously and the air flow between the zones. This has not been attempted until now.
Based on the outcomes and observations that will be made during the investigations in the SA schools, the outcome of the proposed study will be presented to school managers, designers and related personnel involved in school design and maintenance to ensure adequate measures are put in place for effective learning of pupils.

Finally, it goes without saying that the physical environment of schools affects pupil’s well-being in terms of mind and body. This work would demonstrate that elevated level of indoor air pollutants including CO\textsubscript{2} due to inadequate ventilation encountered in classrooms can affect learning. We know that the air we breathe can affect the brain via the blood oxygenation in about 4s. CO\textsubscript{2} is seen as a harmless gas and so is often accorded little significance, other than as an indicator of ventilation, nevertheless if it contributes directly to increased tiredness and a loss of concentration (Kajtar \textit{et al.}, 2006; Bako’-Biro, 2012) then it should be regarded as a very significant air pollutant and not just a mere defining indicator. Air quality is just as important as temperature hence the need to monitor its flow rates so as to guide educators and learners when to open windows (under naturally ventilated conditions) or switch on fans (OSHA, 1999; Bako’-Biro, 2012).

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REFERENCES


MOTIVATIONAL FACTORS OF EMPLOYEE-CONSULTANT IN NIGERIAN CONSTRUCTION INDUSTRY

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This research seeks to assess Motivational factors of Employee-consultant in Nigerian Construction Industry with a view to enhance best practices of motivation, towards the growth and sustenance of the construction industry. The research work focused on employee-consultants as the key players in the construction industry. It therefore reviewed literatures on motivational theories and factors, providing a platform for the design of questionnaires, and a sample size of 108 construction/consultancy firms, and 150 employee-consultants were randomly selected to answer the two set of questionnaires within Kaduna and Abuja metropolis which are areas of dense construction activities in the country. The results were analysed using statistical tools including the relative important index (RII). From the research findings, the ranking of motivational factors reveals the first six factors as outlined in order of their significance from the research: Job security (0.9), salary (0.89), working condition (0.87), reward (0.84), Training and development (0.83) and Leadership respectively (0.82). The generality of the research findings was affected by at least two factors. First, the research involved only consultancy and construction firms based in Kaduna and Abuja; therefore not all the country was covered. Secondly, the response rate is relatively low, even though it is adequate for analysis. The implementation of the key motivational factors identified in the research will greatly improve the efficiency of the industry.

Keywords: Employee-consultant, motivational factors, Nigerian, construction industry, and management.

INTRODUCTION

What defined construction work in the past are not the same today as work has become more dynamic, the employer-employee relationship is less hierarchical and more transactional. The employee-consultants which

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include the Architects, Quantity surveyors, and Engineers (Mechanical, Electrical and Structural) are identified to be key players in the construction Industry (Kado 2011). While classifying means that motivate employee-consultants, researcher parted them into two groups; external and internal factors (Jones et al., 2005). Bryan et al., (2006); Bymes (2006); Kiger (2006); Kehr (2004) also identified that motivation can be either internal or external, it can be viewed as push or pull determinants. Therefore Managers in the construction industry have a responsibility of utilizing this attributes to accomplish tasks through other people, (Robbins, 2005).

According to Lin, (2007) "Motivation is the force that makes people chooses a particular job, stay with that job and work hard in that job". Work motivation has also been defined as “a set of energetic forces that originates both within as well as beyond an individual’s being, to initiate work-related behavior, and to determine its form, direction, intensity and duration” (Meyer et al, 2004). Ward and Werner (2004) suggest understanding “the construct of reward systems, its impact upon the organizations structure, system, strategies, and employee-consultants has been an area of continued intrigue”, for which this paper stems out, to address the Motivational factors of Employee-consultant in the Nigerian Construction Industry with a view to enhance best practices of motivation, towards the growth and sustenance of the construction industry. The paper reviewed theories of motivation and the key factors of motivations were identified and ranked them on a scale of importance. Its major source of data was the questionnaire which served as a quantitative means of data acquisition. Data was analysed using the relative importance index.

**LITERATURE REVIEW**

The relation between performance and motivation is better understood when the team performance measures are discussed. Thamhain (1998) cites that it is important that the project has the ability to contribute to the overall learning of the organization. To achieve this, it is important to impart the relevant training to the team members. It should be recalled here that training is one of the aspects which make the work motivating to the employees (Hackman and Oldham, 1976). Apart from training, it is also important that the project team has easy access to documented information pertaining to the projects and also communicates effectively, thus supplementing the formal learning interventions. Free exchange of information and communication (Kaliprasad, 2006) and having access to project related information make the team members aware of the overall project organization, responsibilities, procedures, and reporting relationships (Kerzner, 1989) which is motivating and also enhances performance (Kerkfoot and Knight, 1992).

Decision making can be regarded as the cognitive process resulting in the selection of a course of action among several alternative scenarios. Every decision making process produces a final choice (James, 1990). The output
can be an action or an opinion of choice. Human performance in decision terms has been the subject of active research from several perspectives.

Table 1 summarizes the important studies on the application of motivational theories to the construction domain.

**Table 1: Summary of the important studies on the application of motivational theories to the construction domain.**

<table>
<thead>
<tr>
<th>S/ No</th>
<th>First Author (Year of Publication)</th>
<th>Title</th>
<th>Motivation Theories Considered</th>
<th>Study Group</th>
<th>Suggestions for Enhancement of Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Schrader, C.R (1972)</td>
<td>Motivating construction craftsmen</td>
<td>Maslow’s need theory</td>
<td>Workers</td>
<td>Involvement, Information, improved methods, praise and motivational programs to fit the idiosyncrasies of their situation</td>
</tr>
<tr>
<td>2</td>
<td>Hazeltine, C.S (1976)</td>
<td>Motivation of construction workers</td>
<td>Vroom’s expectancy theory</td>
<td>Workers</td>
<td>Active and continuous role played by managers in managing workers motivation, identifying the outcomes valued by employees, developing performance measurement techniques and set reachable goals.</td>
</tr>
<tr>
<td>3</td>
<td>Borcherding, J.D (1977)</td>
<td>Motivating the lower level supervisory staff and workforce on super project</td>
<td>Herzberg’s two-factor theory</td>
<td>Workers and Supervisor</td>
<td>Achievement, growth, challenge suggested as motivators. Avoiding delays and changes by preplanning and methods improvement, Craftsmen and foremen participation in job policy making - techniques to reduce de-motivation.</td>
</tr>
<tr>
<td>4</td>
<td>Laufer, A. (1983)</td>
<td>Motivating construction workers</td>
<td>Vroom’s expectancy theory</td>
<td>Workers</td>
<td>Active and continuous role played by managers in managing workers motivation, identifying the outcomes valued by employees, developing performance measurement techniques and set reachable goals.</td>
</tr>
<tr>
<td>5</td>
<td>Maloney, W. F (1986)</td>
<td>Motivation in unionised construction workers</td>
<td>Vroom’s expectancy theory</td>
<td>Workers</td>
<td>Suggested for performance definition, facilitation for achieving goals and measurement of performance along with continuous encouragement as motivators.</td>
</tr>
<tr>
<td>6</td>
<td>Moilwa, T (1990)</td>
<td>The motivation of construction supervisors in Botswana</td>
<td>Herzberg’s two-factor theory</td>
<td>Supervisor</td>
<td>Motivation is subjected to culture and will influence methods and techniques used to motivate their subordinates.</td>
</tr>
</tbody>
</table>
### Prevalent Motivational factors

From research it is clear that the impact of motivation on the overall performance of employees is very important for many different reasons and organisations can ill afford to ignore employee motivation, an important aspect that has a tremendous impact on the intellectual capital and the overall wellbeing of the organisation (Wyk 2011).

<table>
<thead>
<tr>
<th>Source: Venkatesan et.al (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prevalent Motivational factors</strong></td>
</tr>
<tr>
<td>From research it is clear that the impact of motivation on the overall performance of employees is very important for many different reasons and organisations can ill afford to ignore employee motivation, an important aspect that has a tremendous impact on the intellectual capital and the overall wellbeing of the organisation (Wyk 2011).</td>
</tr>
</tbody>
</table>
One of objectives of the research is to conduct a literature study in order to identify factors that are important to consider when evaluating the motivational levels of employees.

During the analysis of the various theories of motivation, Wyk (2011), Kaming, (1998) Ruthankoon, (2003), Venkatesan et.al. (2009) and Uwakweh, (2006) identified the following thirteen factors which were selected from those identified during the research as having an impact on employee motivation. These factors are:

1. **Rewards** - that are linked to performance and valued by the employee
2. **Goal-setting** - goals that are challenging but achievable
3. **Feedback** - that informs employees of their level of performance and progress towards achieving their goals
4. **Job characteristics** - a job that is interesting and challenging
5. **Salary** - as motivator
6. Advancement and growth opportunities - within the organisation
7. **Working conditions** - quality of equipment, friendly working environment etc.
8. **Recognition and appreciation** - for employee performance and achievements
9. **Training and development** - to enhance skills and ability to improve performance
10. **Job responsibility** - responsible for own work
11. **Job security** - sense of security about future within the organisation
12. **Performance Appraisals** – that is non-subjective and accurately measures an employee’s level of performance
13. **Leadership** - a trustworthy and respectful leader who leads by example

**RESEARCH METHODOLOGY**

According to Saunders *et al*, (2003), the choice of research method influences the way in which the researcher collects data. Given the scale and complexity of the study, a number of methods are considered in order to capture the diversity of information and data across a number of sources and ‘to gather the richest picture of the prevailing condition’ (Saunders *et al*, 2003).

The study was carried out in Northern Nigeria, and random sampling technique was used for selecting construction and consultancy firms for
this study. Descriptive and narrative survey methods were used. The secondary data for this research was obtained through extensive literature search from published and unpublished articles, to articulate and evaluate the motivational factors of employee consultants in the construction industry. The target population for the study was the management of construction and consultancy firms. According to Kado (2011) a list of registered consultancy firms with the Corporate Affairs Commission shows that there are 6,990 registered consultancy and construction firms across the Nigeria, 39% (2726) of which are located in northern part of the country. Focusing on Abuja and Kaduna, where most of the firms are either located or have an office, the research therefore adopted his sample size of 108 firms which was used for the distribution of the research questionnaires. The present study used a random sampling, which consisted of 150 employee consultants. The sampling size for the employee-consultants was determined based on the formula below considering the targeted population to be unknown.

\[
n = \frac{(z^2pq)}{d^2} \]  
\[ \text{Where; } \]
\[ n = \text{the desired sample size} \]
\[ z = \text{the ordinate on the normal curve corresponding to } \alpha \text{ or the standard normal deviate. For the purpose of this study, a confidence level of } 90\% \text{ will be adopted.} \]

Usually a 90% level of confidence has \( \alpha = 0.10 \) and critical value of \( z_{\alpha/2} = 1.64 \).

\[ p = \text{the proportion in the target population estimated to have a particular characteristics (normal between the range of 0.1-0.5)} \]
\[ q = 1.0 - p \]
\[ d = \text{degree of accuracy corresponding to the confidence level and } Z \text{ selected.} \]

The sample size is determined using the following parameters,
\[ z = 1.64, \quad d = 0.0653, \quad p = 0.5, \quad q = 0.5 \]
Sample size \( n = \frac{(1.64)^2 \times 0.5 \times 0.5}{(0.0653)^2} = 150 \)

The research showed that the sample size can be calculated by using the following equation for 94% confidence level (Glenn 2003; Kish 1965)

\[
n = \frac{n^4}{1 + \left(\frac{n^2}{N}\right)} \]  
\[ \text{Where; } \]
\[ n = \text{sample size from finite population} \]
\[ n^1 = \text{sample size from infinite population} = \frac{S^2}{V^2} \quad \text{-----------------------------3.3} \]

Where \( S^2 \) is the variance of the population elements and \( V^2 \) is a standard error of sampling population, \( S = 0.1 \) to \( 0.5 \) and \( V = 0.047 \)

\( N = \text{total number of population}, S = 0.5 \) was chosen

\[ n^1 = \frac{S^2}{V^2} = 69.44, \ N = 2726 \]

\[ n = \frac{69.44}{\left[1 + \left(\frac{0.047^2}{2726}\right)\right]} = 108 \]

Thus the study would administer 108 questionnaires.

The formulae below were adopted to statistically define the quantity and quality of the responses.

\[ \% = \frac{n}{N} \times 100 \quad \text{-----------------------------3.4} \]

\( n = \) Number of responses

\( N = \) Total number of respondents

Weighted Mean

\[ f_1 x_1 + f_2 x_2 + f_3 x_3 + f_4 x_4 + f_5 x_5 \]

\[ x = \frac{\sum f x}{x_t} \]

Where: \( f \) – weight given to each response

\( x = \) Number of responses

\( x_t = \) total number of responses

Relative Importance Index (RII)

Relative importance index was used in the study to rank the factors that affect motivation among both the consultants and the management.

\[ \text{Relative Importance Index (RII)} = \frac{\sum fx}{\sum f} \times \frac{1}{k} \quad \text{-----------------------------3.6} \]

Where,

\( \sum fx = \) is the total weight given to each attributes by the respondents.

\( \sum f = \) is the total number or respondents in the sample.

\( K = \) is the highest weight on the likert scale.

Ranking of the items under consideration was based on their RII values. The item with the highest RII value is ranked first (1) the next (2) and so on.
The rating of all the factors for degree of significance was based on the value of their respective relative importance index (RII). The guide for the rating is given in Table 2 below:

<table>
<thead>
<tr>
<th>Source: Vanduhe (2012)</th>
<th>Degree of significance</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very significant</td>
<td>0.76 above</td>
<td></td>
</tr>
<tr>
<td>Significant</td>
<td>0.67-0.75</td>
<td></td>
</tr>
<tr>
<td>Fairly significant</td>
<td>0.45-0.66</td>
<td></td>
</tr>
<tr>
<td>Not significant</td>
<td>0.44 below</td>
<td></td>
</tr>
</tbody>
</table>

relative importance index (RII) and percentages were used as a means of data analysis.

**FINDINGS AND DISCUSSION**

From the research work, the following findings were discovered, and presented in figures and tables for easy articulation and interpretation.

From Table 3 based on the assertion of Moser and Kalton (1971), the result of a survey could be considered significant if the response rate not lower than 30-40%. Therefore, the percentage of the returned questionnaires is adequate for analysis.

| Table 3: Breakdown of Administered Questionnaires |
|---------------------------------|---------------|---------------|
| Employee-consultants | Management | |
| No. distributed | 150 | 108 |
| No. properly filled and returned | 111 | 63 |
| Percentage response | 74% | 58.3% |
| Source: Field survey 2014 |}

**Professionals**

From Figure 1 architects has the highest percentage of 35.14 (%), while the quantity surveyors and the engineers have equal percentage of 32.43 (%).
From Figure 2, employee consultants worked majorly for 1-3 years with a percentage of 36.04 (%), those within 3-6 years has a percentage of 29.73(%), 6-9 years has a percentage of 19.82(%) and above 9 years had the lowest percentage of 14.41(%).

**Number of Years with current Organization**

**Hours worked per week**
From Figure 3 shows, majority of the employee-consultants work 41-59 hours per week, with the percentage of 63.06(%), those that work above 60 hours per week have a percentage of 18.92(%) and those that work between 30-40 hours per week have a percentage of 18.02(%).

Table 4 Factors influencing the motivation of employee-consultants

<table>
<thead>
<tr>
<th>S/N</th>
<th>Factors</th>
<th>Frequency of Response</th>
<th>∑f</th>
<th>∑fx</th>
<th>Mean</th>
<th>RII</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rewards - that are linked to performance and valued by the employee</td>
<td>7</td>
<td>38</td>
<td>66</td>
<td>111</td>
<td>2.53</td>
<td>0.84</td>
</tr>
<tr>
<td>2</td>
<td>Goal-setting - goals that are challenging but achievable</td>
<td>10</td>
<td>58</td>
<td>43</td>
<td>111</td>
<td>2.30</td>
<td>0.77</td>
</tr>
<tr>
<td>3</td>
<td>Feedback - that informs employees of their level of performance and progress towards achieving their goals</td>
<td>42</td>
<td>58</td>
<td>111</td>
<td>2.42</td>
<td>0.81</td>
<td>7th</td>
</tr>
<tr>
<td>4</td>
<td>Job characteristics - creating jobs that are interesting and challenging</td>
<td>60</td>
<td>44</td>
<td>111</td>
<td>2.33</td>
<td>0.78</td>
<td>9th</td>
</tr>
<tr>
<td>5</td>
<td>Salary - what the firm pay monthly</td>
<td>2</td>
<td>32</td>
<td>77</td>
<td>111</td>
<td>2.68</td>
<td>0.89</td>
</tr>
<tr>
<td>6</td>
<td>Advancement and growth - opportunities within the organization</td>
<td>6</td>
<td>56</td>
<td>49</td>
<td>111</td>
<td>2.39</td>
<td>0.80</td>
</tr>
<tr>
<td>7</td>
<td>Working conditions - quality of equipment, office environment etc.</td>
<td>-</td>
<td>44</td>
<td>67</td>
<td>111</td>
<td>2.60</td>
<td>0.87</td>
</tr>
<tr>
<td>8</td>
<td>Recognition and appreciation - of employee achievements and performance</td>
<td>17</td>
<td>51</td>
<td>43</td>
<td>111</td>
<td>2.23</td>
<td>0.74</td>
</tr>
<tr>
<td>9</td>
<td>Training and development - to enhance skills and ability to improve performance</td>
<td>56</td>
<td>55</td>
<td>111</td>
<td>2.50</td>
<td>0.83</td>
<td>5th</td>
</tr>
<tr>
<td>10</td>
<td>Job responsibility – Allowing employees to be responsible for their own work</td>
<td>15</td>
<td>51</td>
<td>45</td>
<td>111</td>
<td>2.27</td>
<td>0.76</td>
</tr>
<tr>
<td>11</td>
<td>Job security – providing employee consultants, confidence about their future within the organization</td>
<td>-</td>
<td>34</td>
<td>77</td>
<td>111</td>
<td>2.69</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Performance Appraisals - that is non-subjective and accurately measures an employee’s performance levels</td>
<td>12</td>
<td>57</td>
<td>42</td>
<td>111</td>
<td>2.27</td>
<td>0.76</td>
</tr>
<tr>
<td>13</td>
<td>Leadership - a trustworthy and respectful leader who leads by example</td>
<td>3</td>
<td>53</td>
<td>55</td>
<td>111</td>
<td>2.47</td>
<td>0.82</td>
</tr>
</tbody>
</table>

(1=not Important, 2=Important, 3=very Important)
Source: Field Survey, (2014)

Table 4 shows the factors influencing the motivation of employee-consultants. Job security ranked the first among the factors that influence the motivation of employee-consultants. It is a very significant factor.
because it ranked 0.76 and above on the relative importance index (RII). Salary, working conditions, rewards, Training and development, leadership, feedback, Advancement and growth, Job characteristics and Goal-setting ranked second, third, fourth, fifth, sixth, seventh, eighth, ninth and tenth respectively and are all very significant factors. Job responsibility and Performance Appraisals both ranked eleventh on the relative importance index (RII) and are all very significant factors. Recognition and appreciation ranked thirteenth on the relative importance index (RII) and is a significant factor because it relative importance index is ranked between 0.67-0.75.

With the results obtained above, it can be inferred that for effective and efficient motivation of employee-consultants, priority should be given to job security followed by the other motivational factors identified in the table above in the order of their respective significance. Since individual employee-consultants have varying requirements, it will be necessary for the management of the construction and consultancy firms to apply a high level of managerial skills so as to balance the requirements of their employee-consultants.

From Figure 4 shows, majority of the firms have been in existence for 5-10 years, with a percentage of 41.27 (%), while 0-5 years had a percentage of 28.57 (%), 10-15 years have a percentage of 23.81 (%) and above 15 years has the lowest percentage of 6.35 (%).
From Figure 5 above, majority of the firms employed consultants between a percentage of 6-10 consultants with a percentage of 44.44(%), above 10 consultants have a percentage of 30.16(%), while 1-5 consultants have the least percentage of 25.40(%).

Table 5 shows the factors influencing the motivation of employee-consultants from the management perspectives. Training and development ranked the first among the factors that influences the motivation of employee-consultants with a RII of 0.97. It is a very significant factor because it ranked 0.76 and above on the relative importance index (RII).

### Motivational factors of employee-consultant: Management perspective

#### Table 5 The Motivational factors of employee-consultant

<table>
<thead>
<tr>
<th>S/N</th>
<th>Factors</th>
<th>Frequency of Response</th>
<th>Σf</th>
<th>Σfx</th>
<th>Mean</th>
<th>RII</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rewards - that are linked to performance and valued by the employee</td>
<td>2</td>
<td>23</td>
<td>38</td>
<td>63</td>
<td>162</td>
<td>2.57</td>
</tr>
<tr>
<td>2.</td>
<td>Goal-setting - goals that are challenging but achievable</td>
<td>11</td>
<td>29</td>
<td>23</td>
<td>63</td>
<td>138</td>
<td>2.19</td>
</tr>
<tr>
<td>3.</td>
<td>Feedback - that informs employees of their level of performance and progress towards achieving their goals</td>
<td>9</td>
<td>29</td>
<td>25</td>
<td>63</td>
<td>142</td>
<td>2.25</td>
</tr>
<tr>
<td>4.</td>
<td>Job characteristics - creating jobs that are interesting and challenging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Salary - what the firm pay monthly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Advancement and growth - opportunities within the organization</td>
<td>2</td>
<td>31</td>
<td>30</td>
<td>63</td>
<td>154</td>
<td>2.44</td>
</tr>
<tr>
<td>7.</td>
<td>Working conditions – quality of equipment, office environment etc.</td>
<td>30</td>
<td>33</td>
<td>63</td>
<td>159</td>
<td>2.52</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Salary ranked second with a RII of 0.89 and is considered a very significant factor. Rewards and Job security ranked third with an RII of 0.86 and is considered a very significant factor. Leadership ranked fifth with an RII of 0.85, and is considered a very significant factor. Job responsibility and Working conditions ranked sixth with an RII of 0.84, and is considered a very significant factor. Advancement and growth, Job characteristics ranked eighth with an RII of 0.80, and are considered a very significant factor. Recognition and appreciation ranked tenth with an RII of 0.79, and is considered a very significant factor. Feedback ranked eleventh with an RII of 0.75, and is considered a significant factor because it lies between 0.67-0.75. Goal-setting and Performance Appraisals ranked twelfth with an RII of 0.73, and therefore is considered a significant factor.

With the results obtained above, it can be inferred that for effective and efficient motivation of employee-consultants, priority should be given to job security followed by the other motivational factors identified in the table above in the order of their respective significance. Since individual employee-consultants have varying requirements, it will be necessary for the management of the construction and consultancy firms to apply a high level of managerial skills so as to balance the requirements of their employee-consultants.
Table 6: Contrast between the factors that motivate employee-consultants and the management perception

<table>
<thead>
<tr>
<th>S/N</th>
<th>Factors</th>
<th>Employee-consultants</th>
<th>Management’s perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rewards - that are linked to performance and valued by the employee</td>
<td>0.84</td>
<td>0.86</td>
</tr>
<tr>
<td>2.</td>
<td>Goal-setting - goals that are challenging but achievable</td>
<td>0.77</td>
<td>0.73</td>
</tr>
<tr>
<td>3.</td>
<td>Feedback - that informs employees of their level of performance and progress towards achieving their goals</td>
<td>0.81</td>
<td>0.75</td>
</tr>
<tr>
<td>4.</td>
<td>Job characteristics - creating jobs that are interesting and challenging</td>
<td>0.78</td>
<td>0.80</td>
</tr>
<tr>
<td>5.</td>
<td>Salary - what the firm pay monthly</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>6.</td>
<td>Advancement and growth - opportunities within the organization</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>7.</td>
<td>Working conditions - quality of equipment, office environment etc.</td>
<td>0.87</td>
<td>0.84</td>
</tr>
<tr>
<td>8.</td>
<td>Recognition and appreciation - of employee achievement and performance</td>
<td>0.74</td>
<td>0.79</td>
</tr>
<tr>
<td>9.</td>
<td>Training and development - to enhance skills and ability to improve performance</td>
<td>0.83</td>
<td>0.97</td>
</tr>
<tr>
<td>10.</td>
<td>Job responsibility – Allowing employees to be responsible for their own work</td>
<td>0.76</td>
<td>0.84</td>
</tr>
<tr>
<td>11.</td>
<td>Job security – providing employee consultants, confidence about their future within the organization</td>
<td>0.90</td>
<td>0.86</td>
</tr>
<tr>
<td>12.</td>
<td>Performance Appraisals - that is non-subjective and accurately measures an employee’s performance levels</td>
<td>0.76</td>
<td>0.73</td>
</tr>
<tr>
<td>13.</td>
<td>Leadership - a trustworthy and respectful leader who leads by example</td>
<td>0.82</td>
<td>0.85</td>
</tr>
</tbody>
</table>

From Table 6 above shows that Job security ranked the first among the factors that influence the motivation of employee-consultants with a very significant relative important index (RII) of 0.90, however the perception of the construction manager rated it third with a RII of 0.86, which is still within a considerable range. Salary ranked second by both the employee-consultants and the perception of management on the factors of motivation with an RII of 0.89 for both. Working condition ranked third among the factors that influence the motivation of employee-consultants with a very significant relative important index (RII) of 0.87 however the perception of the construction manager rated it sixth with a RII of 0.84. Reward ranked forth with RII of 0.84 by the employee-consultants and third from the perception of the management with RII of 0.86. Training and development ranked fifth with RII of 0.83 by the employee-consultants and first from the perception of the management with RII of 0.97. Leadership ranked sixth with RII of 0.82 by the employee-consultants and fifth from the perception of the management with RII of 0.85.
Therefore from the research it is identified that all the factors of motivation are significantly important, however their degree of significance varies. The first six factors are outlined in order of their significance as identified from the research: Job security, salary, working condition, reward, Training and development and Leadership.

CONCLUSION AND FURTHER RESEARCH

The survey revealed that the factors of motivation as it relates to growth strategy is very important, since most construction and consultancy firms rely majorly on the consultants to carry out construction work. From the research findings, job security ranked first on the factors of motivation by the employee consultants, but from the management perspective, it ranked third. However Training and development ranked the first from the management point of view and fifth from the employee-consultants view. This reveals the varying perceptions of both the employee-consultants and the management of construction firms, and could serve as an indicator to the problem of low level of motivation as identified in previous research. Therefore from the research it is identified that all the factors of motivation are significantly important, however their degree of significance varies. The first six factors are outlined in order of their significance as identified from the research: Job security, salary, working condition, reward, Training and development and Leadership.

The study has established relevant factors of motivation peculiar to the Nigerian setting. It therefore recommends that further research should focus on the implementation strategy of motivational factors.

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PARETO ANALYSIS ON THE TOTAL QUALITY MANAGEMENT STATUS OF NIGERIAN DESIGN FIRMS

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Total Quality System (TQS) is an agreed companywide operating work structure, documented in effective technical and managerial procedures, for guiding coordinated actions of workforce, machine and information of a company in the best and most practical ways to ensure customer satisfaction and economical cost of quality. Total Quality Management (TQM), a subsidiary of TQS is based on the philosophy of continuously improving goods and services. In 1993, European construction Institute (ECI) developed a measurement matrix based on 12 quality factors used to measure the degree at which a company is operating under TQM. This study was aimed at identifying the vital factors that have greater effects on the ECI status of Nigerian Design Firms based on principles of Pareto Analysis. The results of the analysis identified 20% of the quality factors responsible for the status recorded by the Nigerian Design Firms with their average scores as; ‘Training, awareness, education and skill (3.3)’; ‘Natural use of TQ tools and techniques (3.4)’; and Objective measurement and feedback (3.4). For the Nigerian Design Firms to make progress towards attaining the requirements of TQM, it is recommended that proper attention need to be paid on these three factors as outlined in the ECI matrix.

Keywords: design firm, measurement matrix, pareto analysis, quality factors, total quality management

INTRODUCTION

Yasamis et al (2002) defined total quality system as “the agreed companywide and plant wide operating work structure, documented in effective, integrated technical and managerial procedures, for guiding the coordinated actions of the workforce, the machines, and the information of the company and plant in the best and most practical ways to ensure customer satisfaction and economical cost of quality”.

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Duncan et al. (1990), Stebbing, (1990) and Yasamis et al. (2002, 2005) outlined some of the recognised standards containing framework for Quality Management System (QMS) to include the International Standard Organisation (ISO) series, the Malcolm Baldridge (MB) standard and BS 5750 of the British Standard Institute (BSI). The requirements of the QMS covered by the ISO embrace issues relating to Quality Control (QC), Quality Assurance (QA) and Total Quality Management (TQM). TQM was identified not only as an aspect but an apex of modern QMS (Harris and McCaffer 2005). TQM evolved from Quality Assurance (QA) as a result of the change in the concept of QMS (Chen, 2008). ‘Do it right the first time’ is the underlying focus of QA. However, TQM intends to improve both process and its product. Mack and Jokhsten (2004) revealed that the concept of TQM is based on the relationship between improved quality and improved productivity. Aggarwal and Rezaee (1996) revealed that many of the most successful organisations that have become global, more cost effective and efficient, and, more focused on customer satisfaction have implemented the TQM concept.

According to Nee (1996), ISO was founded in 1946. Its function then was to establish worldwide common standards for manufacturing, communication and trade. The best known series and recognised quality standards is the ISO 9000 series or families of standards, (Pyzdek, 2003 and Harris and McCaffer, 2005).

Development of the ISO series started with the formation of a Technical Committee 176 (TC176) in 1979. The ISO series was first issued in 1987. The ISO standard embodies comprehensive quality management concepts and provides guidance for implementing its principles. The concept which underlies the ISO 9000 standards is that consistently high quality is best achieved by combination of technical product specification and management systems standards. The standard allows more flexible framework to be achieved which allows organisations to develop their own policies and procedures.

It is imperative to mention some of the requirements of ISO series. For instance, ISO 9001 (2008) required that quality organisation “shall continually improve effectiveness of the quality of management system through the use of the quality policy, quality objectives, and audits results, analysis of data, corrective actions and management review”. Similarly, ISO 9000 (2005) highlighted that the aim of continual improvement of QMS is to increase the probability of enhancing the satisfaction of customers and other interested parties.

In Nigeria, Standard Organisation of Nigeria (SON) is an organisation charged with the responsibility of formulating national standard for QMS system (Kolawole, 1998). The organisation was established by Enabling Act No. 56 of 1971 which has three amendments - Act No. 20 of 1976, Act No. 32 of 1984 and Act No. 18 of 1990. The activities of SON are similar to those of BSI and ISO. In fact, SON has officially adopted ISO 9000 series for quality management in Nigeria (Bamisile, 2004). Principal among
their sections is design. This portrays the relevance of design and design organisations, particularly in achieving quality in construction. Harris and McCaffer (2005) stated that the ISO 9000 family standards operate on the assumption that certain factors have influence on the quality of a product or service provided by an organisation. Top on their list among these factors is design. Similarly, Bubshait et al (1999) stated that design organisations are the media that transfer the requirements of the client to the contractor and ensure that they are met. Hence the organisations need to provide a high quality of service to ensure that their client’s project achieves the best possible standards of cost, time and quality.

Kolawole (1998) identified three categories of factors militating against the achievement of quality in construction; these are ‘cheapest cost first’ attitude, design and construction. With respect to design Griffith (1990), mentioned that the problems attributed to design are detailing, legislation, co-ordination, communication, supervision and buildability”. However, this is in no way exhaustive because the ISO 9000 and the Malcolm Baldridge Standards have been identified to have 13 and 14 major quality sections relevant to design, respectively, (Bubshait et al 1999).

Various tools and techniques exist for the implementation of TQM principles. One of such is Total Quality Management Matrix produced by European Construction Institute (ECI) in 1993. The matrix uses 12 quality factors to measure the degree to which a company was operating under TQM.

Concern over the global decline in the construction quality made Kubal (1994) to cite a report of the USACE Blue Ribbon (1993) that “explicit solicitude has been reported about the decline in construction quality in the past decade in addition to concerns regarding the decrease in customer satisfaction in the construction industry, despite the programmes developed to improve the process and the products of construction”. However, such concern in Nigeria goes beyond customer satisfaction. In the Nigerian context, the issue of quality and standard has been the subject of concern in the country’s construction industry in recent times following the incessant collapse of building structures around the nation (Abiodun and Afangadem, 2007). This is despite adaptation of ISO provisions by the SON. A report of the Lagos State Physical and Development Authority (2006) indicated that out of 61 reported cases of building collapse, 13% were directly attributed to faulty designs, while 53% of the recorded deaths therein were attributed to faulty designs.

This paper, therefore intends to identify the vital factors responsible for the poor performance of the Nigerian Design Firms that will require to be improved upon based on ECI matrix and Pareto Principle in order to improve on their general performance.
TOTAL QUALITY MANAGEMENT, TOOLS AND TECHNIQUES

Total Quality Management (TQM)
According to Yasamis et al. (2002), QMS is the collection of all processes, tools, techniques and subsystems that run simultaneously with production system (service or manufacturing), and the control of the production system’s effectiveness, efficiency and productivity. QMS is therefore responsible for ensuring that production conforms to customer requirements, minimizing cost of quality and production of a product to standards. Generally, QMS consists of a framework for guiding quality related actions and all employees and a means of assessing how well these actions are carried out.

TQM is identified as the ultimate among the components of QMS. Watson and Howarth (2011) revealed that “a key feature of the western quality revolution of later part of the twentieth century was the development of a strategic approach to quality management.” The approach was labelled ‘Total Quality Management’. Its philosophy revolves around continuous improvement.

TQM Tools and Techniques
Kume (1988) noted that the cornerstone of continuous improvement programme is the ability of management and employees to control their work processes, to recognise problems, trace their root causes and implement effective remedies. He added that, “attempts to achieve better quality without improving design and process will result in increased cost”.

Development of quality management in a company should be based on a recognised quality culture and its development process. To aid development of total quality, certain models exist and a company should select the right model which captures the essence of what it is trying to achieve. Deming’s 14 points is among the prominent ones. In 1988 Deming developed a list of fourteen points that can be used to aid in the development of quality (Macks and Joshnsten 2004; Watson and Howarth 2011). According to Aggarwal and Rezaee (1996), TQM uses effective management techniques and therefore delivers product on time and within budgetary constraints.

Additional tools and techniques of TQM as outlined by Harris and McCafferr (2005) include; Brainstorming, Matrix Analysis, Paired Group Comparison, Ranking and Rating, Pareto Analysis, Causes and Effects Diagrams, Failure Prevention Analysis, Force Field Analysis and Process Flow Chart. Moreover, thequalityweb.com (2015) has on its list, seven basic quality tools. These included, Pareto Diagram, Histogram, Cause-and-Effect, Scatter Graph, Control Charts and Np control Charts.

Furthermore, another relevant tool for TQM is the matrix produced by ECI to measure the degree to which a company was operating under TQM. The 12 quality factors with their corresponding ultimate requirements are:
1) **Commitment and leadership by top management at location.**
The ultimate aspiration is for an organisation to be fully committed and actively leading the process of total quality.

2) **Organised process and structure for total quality.**
An organisation should be fully integrated with normal management system.

3) **Necessary business performance.**
A company should be of a high performance; one meeting or exceeding targets.

4) **Supplier relationship (internal and external).**
Active partnering should be taking place with joint improvement team working.

5) **Training, awareness, education and skills.**
All that are involved are provided with essential training.

6) **Relationship with internal and external customer.**
Active partnering is taking place with joint improvement team working.

7) **Understanding and satisfaction of employees.**
The organisational culture should show total commitment and enthusiasm for total quality through employees’ commitment as a result of job satisfaction and motivation.

8) **Communications.**
There should be an established communication system fully implemented with feedback.

9) **Teamwork for improvement.**
Action should noticeably be taken on the teams’ recommendations and results monitored.

10) **Independent certification of quality management system.**
Quality management system should be fully documented, implemented and certified.

11) **Objective measurement and feedback.**
There should be performance indicators that will serve as standard measurement tool.

12) **Natural use of total quality tools and techniques.**
The use of the total quality management should come naturally to all within the organisation.

To successfully promote business efficiency and effectiveness and also to realise the benefits of TQM; it must be companywide. Its principle is based
on the state of mind of every individual in an organisation based on his pride in the job (Harris and McCaffer, 2005). For TQM to succeed, certain level of commitment is required from each class of members of an organisation.

RESEARCH METHOD

Sample frame and Sample Sizing
The target population of the research work was Nigerian building design firms. Since not all the design firms could be included in the study, a sample of the population of the design firms was targeted. Population size of the design firms across the country was obtained from Headquarters of the Corporate Affairs Commission (CAC), Abuja. The Commission is the only Government Agency of Nigeria charged with the responsibility of registration of Companies, Business Names and Incorporated Trustees (CAC, 2010). The list indicated that there were a total of 6,990 registered Architectural and Engineering Consultancy firms across the nation. Sample size of 237 was calculated at 95% confidence level using the approaches outlined by Krejcie and Morgan, (1970), Cochran (1977), Bartlett et al (2001), United Nation Development Programme (UNDP) (2004) and Olanruwaju (2010).

DATA COLLECTION
Matrix produced by the European Construction Institution (ECI) in 1993 was adopted for data collection. ECI was founded in 1990 to build and champion a culture motivated to raising the performance standards of the construction industry across Europe. The matrix is used to measure the degree to which a company is operating under TQM (Harris and McCaffer, 2005). The matrix is accompanied by guide for improvement. The guide also gives an indication of the status of performance of an organisation based on individual quality factor.

The matrix contains 12 total quality factors and it uses a measurement scale of zero (0) to five (5) based on which response is made by an organisations being assessed. If an organisation scored a maximum of 5 points on all the 12 factors it would achieve a maximum of 60 points. By calculating the overall score ECI’s companies can measure the progress they are making towards TQM and can establish the ECI status of their companies. Targeted respondents were the executive or senior management staff of the design firms. This was necessary because they were in the right position to have adequate awareness and ability to disseminate data pertaining to their organisations’ quality management systems and status. Self-administered survey principle was adopted in accordance with the suggestion of Keller and Warrack (2003).
DATA ANALYSIS TECHNIQUES
ECI Status and TQM Factors

Analysis of the data using the ECI matrix was conducted by calculating the scores of the ECI total quality factors for each responding organisation and an average score was calculated for each group. Overall average for all the groups was calculated. ECI classification shown below is used to draw inference, and to establish status of the organisations.

<table>
<thead>
<tr>
<th>Score</th>
<th>Quality Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-60</td>
<td>A recognised TQ Company</td>
</tr>
<tr>
<td>45-54</td>
<td>A world class operation</td>
</tr>
<tr>
<td>33-44</td>
<td>Realisation of improvement needed</td>
</tr>
<tr>
<td>25-32</td>
<td>The start of improvement</td>
</tr>
<tr>
<td>12-24</td>
<td>Need commitment to overcome resistance</td>
</tr>
<tr>
<td>0-11</td>
<td>No appreciation of quality.</td>
</tr>
</tbody>
</table>

Due to the fact that the Standard Organisation of Nigeria (SON) had not started certification of design organisations in the country as asserted by Bamisile (2004), 11 quality sections were treated in the study. Quality Section 10 (Independent certification of quality management system) was not involved in the study.

To identify the relevance each quality factors on the performance of the design firms, overall average scores of each factor scored by the organisations were calculated. This also facilitates the conduct of the Pareto Analysis.

**Pareto Analysis**

According to Harris and McCaffer (2005) Pareto Analysis is a simple technique that helps separates the major causes of problems from the minor ones. It is identified as an effective means of visually representing major causes of a problem. It is useful in helping focusing attention on the really important issues. The history of Pareto Analysis was traced back to early 1900s. Reh (2014) mentioned that “in 1906, Italian economist Vilfredo Pareto created a mathematical formula to describe the unequal distribution of wealth in his country.” This was as a result of his observation that 20% of his people owned 80% of country’s wealth. In the late 1940s, Dr. Joseph M. Juran (1940) named the 80/20 Rule as Pareto’s Principle.

Faucheux (2013) identified Pareto Principle as one of the “top Total Quality Management (TQM) tools available. The principle states that majority of errors come from only handful of causes. In ratio terms 80% of the problems are linked to 20% of the causes. Haughey (2014) outlined eight steps in identifying principal causes (20%) that should be focused in
such events that can be governed by Pareto Principle. The steps are as follow:

1. Create a vertical bar chart with causes on the x-axis and count (number of occurrence) on the y-axis.
2. Arrange the bars in descending order of cause importance, that is, the cause with highest count comes first.
3. Calculate the cumulative count for each cause in descending order.
4. Calculate the cumulative count percentage for each cause in descending order.
5. Create a second y-axis with percentages descending in increments of 10 from 100% to 0%.
6. Plot the cumulative count percentage of each cause on the x-axis.
7. Join the points to form a curve.
8. Draw a line at 80% on the y-axis running parallel to the x-axis. Then drop the line at the point of intersection with the curve on the x-axis. This point on the x-axis separates the important causes on the left (vital few) from the less important causes on the right (trivial many).

RESULTS

Response Rate
Out of the 237 administered copies of matrix, 106 were returned. This indicates a return rate of 44.7%. However, 96 (40.5%) were identified to be usable for analysis.

Figure 1: Average scores for groups of firms
Results on ECI Status and TQM Factors

Figure 1 represents a chart showing the average scores calculated for the four groups of designed firms studied across the country. Note that the fourth group emanated due to the fact some firms are engaged in multiple design activities. Thus the name; ‘Multi-disciplinary’ firms.

From figure 1, the Architectural, Structural and the Multi-disciplinary groups of design firms have recorded average scores which fall within the category with score between 25-32 points. This happened to be the fourth category of the ECI classification; ‘The Start of Improvement’. This means that the groups’ average scores indicated that the groups of firms have only shown an indication of commencement of effort towards TQM.

As can be depicted from the figure, the M and E group had an average score of 24.3. This value indicated that the group, based on ECI classification, falls within 12-24, that is the class tagged ‘Need Commitment to Overcome Resistance’. This suggests that more is required from the group in order to start showing sign of commitment toward TQM.

The overall average of the firms is calculated to be 27.4. Therefore, the overall efforts of the Nigerian design firms generally and according to the ECI classification belong to the class recognized as ‘The Start of Improvement’. The overall average scores for individual factors are presented in table 1.

Table 1: Average ECI Quality Factors Scores for Groups of Design Firms

<table>
<thead>
<tr>
<th>Firms/Code</th>
<th>Architectural Average Scores</th>
<th>Structural Average Scores</th>
<th>M and E Average Scores</th>
<th>Multi-disciplinary Average Scores</th>
<th>Overall Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECI F1</td>
<td>4.3</td>
<td>4.6</td>
<td>2.0</td>
<td>4.1</td>
<td>3.8</td>
</tr>
<tr>
<td>ECI F2</td>
<td>3.4</td>
<td>3.8</td>
<td>3.1</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td>ECI F3</td>
<td>3.7</td>
<td>3.8</td>
<td>3.1</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>ECI F4</td>
<td>3.9</td>
<td>4.1</td>
<td>3.5</td>
<td>3.9</td>
<td>3.9</td>
</tr>
<tr>
<td>ECI F5</td>
<td>3.4</td>
<td>2.8</td>
<td>3.6</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>ECI F6</td>
<td>3.0</td>
<td>3.4</td>
<td>3.1</td>
<td>4.0</td>
<td>3.5</td>
</tr>
<tr>
<td>ECI F7</td>
<td>4.1</td>
<td>4.0</td>
<td>3.5</td>
<td>3.7</td>
<td>3.8</td>
</tr>
<tr>
<td>ECI F8</td>
<td>3.7</td>
<td>4.0</td>
<td>3.7</td>
<td>4.1</td>
<td>3.9</td>
</tr>
<tr>
<td>ECI F9</td>
<td>3.7</td>
<td>3.9</td>
<td>3.7</td>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>ECI F10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ECI F11</td>
<td>3.2</td>
<td>3.3</td>
<td>3.5</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>ECI F12</td>
<td>3.1</td>
<td>3.8</td>
<td>3.2</td>
<td>3.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Average</td>
<td>3.6</td>
<td>3.8</td>
<td>3.5</td>
<td>3.8</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Result of Pareto Analysis

For the purpose of Pareto Analysis, the overall average of firms score in the last column of table 1 will be used. As earlier described, each factor has a maximum of 5 points. Thus, it implied that factors with lowest average points could be the major causes of the result recorded. In order to carry out the Pareto Analysis it is necessary to identify the shortfall from the overall score of each factor (from the maximum of 5 points). The factors with higher shortfall will therefore be expected to be among the ‘vital few’ (causes). Table 2 presents the required adjustment and some of the steps outlined in the procedure.
Table 2: Average ECI Quality factors’ scores and shortfalls

<table>
<thead>
<tr>
<th>Factors/ scores</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
<th>F10</th>
<th>F11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Average</td>
<td>3.5</td>
<td>3.5</td>
<td>3.6</td>
<td>3.9</td>
<td>3.5</td>
<td>3.5</td>
<td>3.8</td>
<td>3.9</td>
<td>3.8</td>
<td>-</td>
<td>3.4</td>
</tr>
<tr>
<td>Shortfall</td>
<td>1.2</td>
<td>1.5</td>
<td>1.4</td>
<td>1.1</td>
<td>1.7</td>
<td>1.5</td>
<td>1.2</td>
<td>1.1</td>
<td>1.2</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>(5: Overall Average)</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
</tr>
</tbody>
</table>

To address the requirements of steps 3-5 of the procedure, table 3 is constructed with factors rearranged in descending order (step 3). Note that F5 appeared first since it was having the highest shortfall.

Table 3: Calculation of Cumulative Count Percentages

<table>
<thead>
<tr>
<th>Factors</th>
<th>Short fall scores (descending order)</th>
<th>Cumulative count (descending order)</th>
<th>Percentage count (descending order)</th>
<th>Cumulative percentage count (descending order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5</td>
<td>1.7</td>
<td>15.1</td>
<td>11.1</td>
<td>100.0</td>
</tr>
<tr>
<td>F12</td>
<td>1.6</td>
<td>13.4</td>
<td>10.6</td>
<td>93.9</td>
</tr>
<tr>
<td>F11</td>
<td>1.6</td>
<td>11.8</td>
<td>9.5</td>
<td>87.3</td>
</tr>
<tr>
<td>F6</td>
<td>1.5</td>
<td>10.2</td>
<td>8.4</td>
<td>79.3</td>
</tr>
<tr>
<td>F2</td>
<td>1.5</td>
<td>8.7</td>
<td>6.9</td>
<td>72.8</td>
</tr>
<tr>
<td>F3</td>
<td>1.4</td>
<td>7.3</td>
<td>5.4</td>
<td>65.6</td>
</tr>
<tr>
<td>F9</td>
<td>1.2</td>
<td>5.8</td>
<td>4.0</td>
<td>58.6</td>
</tr>
<tr>
<td>F7</td>
<td>1.2</td>
<td>4.6</td>
<td>3.0</td>
<td>50.6</td>
</tr>
<tr>
<td>F1</td>
<td>1.2</td>
<td>3.4</td>
<td>2.5</td>
<td>43.6</td>
</tr>
<tr>
<td>F8</td>
<td>1.1</td>
<td>2.2</td>
<td>1.7</td>
<td>40.6</td>
</tr>
<tr>
<td>F4</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>40.0</td>
</tr>
</tbody>
</table>

To obtain the main result of the analysis, stages 1, 2 and 5-8 will be completed based on the information on tables 2 and 3. Fig 2 shows the bar charts with factors (causes) in descending order of importance. It can easily be depicted that factor F5 has the highest cause among others. The factors were followed by F12 and F11 with similar shortfalls. F8 and F4 have the lowest shortfall (thus placed to the far right).

Figure 2, Bar chart of quality factors in relation to shortfall
Step 5 is illustrated in figure 3. The figure shows a curve plotted using the cumulative count percentage. The broken line separates the vital causes (factors) – top 20% (left side) from the trivial many – lower 80% (right side).

![Figure 3, Curve for cumulative count percentages of factors (causes)](image)

To clearly identify the factors, figures 2 and 3 are superimposed into figure 4 as suggested in steps 5-8. From the figure, it can be understood that three factors were affected by the broken line drawn at 80% cumulative count percentage. These factors are F5, F12 and F11.

![Figure 3, Separation of vital from trivial factors (causes)](image)
CONCLUSION

According to the analysis conducted using the principles of the Pareto Analysis ‘Training, awareness, Education and Skill’ (F5), ‘Natural Use of TQ Tools and Techniques’ (F12) and ‘Objective Measurement and Feedback’ (F11) are the most relevant quality factors that contributed largely in bringing down the status of the Nigerian design firms based on the ECI matrix. In order to make meaningful improvement in their status the following measures need to be taken by the Nigerian Building Design Firms (as outlined in the guide accompanying the matrix).

- Firms’ programme relating to total quality should be improved beyond partial implementation. Firms should aspire to progressively achieve full development and rise to the position of providing external training to others.
- In order to achieve requirements relating to use of tools and techniques, firms should create environment such that the use of tools and techniques in their undertaking becomes natural (not when reminded) or partial usage among staff.
- Firms should aspire to improve the aspect of objective measurement and feedback beyond having coordinated measurement and analysis of results, but to the level of establishing performance indicators as standards measurement tools.

REFERENCES


PERCEPTION OF EMPLOYERS ON THE PERFORMANCE OF CONSTRUCTION CRAFTSMEN TRAINED IN NIGERIA

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Studies on construction craft skills have identified a number of problems including ineffective training as responsible for shortages of craftsmen in construction industry. This study assessed the performance of construction craftsmen trained in Nigeria. Qualitative approach was used in conducting the research. Detail literature review on training of craftsmen led to the development of a semi-structure interview guide which was used in conducting interviews with management staff in construction organisations. Nine (9) large construction firms were selected using purposive sampling and interviews were done with a management staff in each firm. Data obtained from the interviews were subjected to conceptual content analysis. The results showed that organisations are generally not satisfied with the performance of craftsmen trained in Nigeria. Craftsmen are found relatively satisfactory in general education but lack trade focused theory as such, organisations had to train them on-the-job to acquire basic operation skills. The poor performance of the craftsmen was generally attributed to generic training adopted by the institutions against industry focused training. The study also found that training is institution-based with very weak arrangement for industrial training which lack direct collaboration with the construction industry. It is therefore concluded that the performance of craftsmen trained in Nigeria is unsatisfactory in terms of practical (hands-on) skills. It is recommended that training should be done on industry basis and collaboratively with emphasis on acquisition of hands-on skills.

Keywords: construction, craft skills, craftsmen, Nigeria, training, performance

INTRODUCTION

The Construction Industry relies on human and material resources to provide its numerous services and products. In terms of importance, Khalil

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and Lees (2006) ranked human resources higher than natural (material) and capital resources in both production and services process of an organisation. Similarly, Muya et al. (2006) argued that the quality of services offered by construction firms depend largely on the quality of their workforce. For this reason, construction organisations attached importance to the performance of their employees. Amongst the employees, the professionals and the technicians are basically the skilled workers of which the craft skills constitute the majority in the technical category and executes most of the jobs because the industry is still manual labour intensive (Fellows et al., 2002). Construction craft skills are therefore in high demand both in quantity and quality but regrettably several studies revealed that they are scarce in most part of the world (Agapiou et al., 1995; Agapiou, 1998; Gann and Senker, 1998; Mckenzie, et al., 2000, Forde and MacKenzie, 2004; Datoegoem, 2006; Issam, 2006; McGuinness and Bannett, 2006; Muya et al., 2006; Chan and Dainty, 2007; Smith, 2009; Abdullahi, 2010; Kikwasi, 2011; Medugu et al., 2011).

Based on this scarcity, the construction industry was expected to emphasise training and retraining to boost the supply of craft skills, but studies suggest that firms prefer importing or poaching craft skills to improve performance and out-play competitors than train (Agapiou et al., 1995; Muya et al., 2006). Ironically, poaching is reported to increase cost of construction projects through direct cost of labour charged by poached workers which may lead to companies losing jobs as a result of high tender figures (Agapiou et al. 1995; Muya et al., 2006; Construction Industry Institute [CII] 2007; Clarke and Herrmann, 2007; Wachira et al., 2008; Hansen, 2011). For these reasons, various efforts are made in solving craft skills shortages in different parts of the world (Clarke and Wall 2000; Clarke and Herrmann, 2007; Arkani, et al., 2003; Castaneda et al., 2005).

While in most developed countries the effort is largely on improvement of training systems, certification and attraction of youths to the industry (Clarke and Wall, 1998; CBC, 2002; Ellison, 2003; deGraft-Johnson et al., 2003), in developing countries it is either lack of formal training or the training system is largely ineffective (Kumaraswamy, 1997; Gann and Senker, 1998; Makenzie et al., 2000; Ziderman, 2001; Dainty et al., 2004; Muya et al., 2006).

In Nigeria, efforts at improving the availability of formal craft skills training led to the establishment of training institutions with the aim of developing indigenous crafts skills. It is estimated that there are 110 state and 19 federal owned craft skills training institutions in Nigeria, but despite these, there are indications of employers still preferring foreign craftsmen or poaching than employing locally trained ones. This has raised questions on the quality of training in these institutions (Bamisile, 2004; Datoegoem, 2006; Abdullahi, 2010; Simire, 2010; Odusami and Ene, 2011; Okoye and Chijioke, 2013). Some researchers observed that the training institutions are largely characterised by lack of uniform basis for supervision, assessment and methodology for training (Datoegoem, 2006; Abdullahi 2010; Okoye and Chijioke, 2013). These studies further suggests
that the training systems are also inefficient, ineffective and lacks unified framework for training. Effective and efficient training systems are expected to successfully produce craftsmen with desired competencies. However, the Nigeria training systems are criticised not to have succeeded in this regards (Odusami and Ene, 2011; Okoye and Chijioke, 2013). Okoye and Chijioke (2013) further observed that there is mismatch between skills requirements of the construction industry and craft skills training in Nigeria. This study therefore assessed the performance of craftsmen trained in Nigeria by obtaining the opinions of employers in order to identify the weaknesses of training systems in Nigeria with the view of improving training.

CONSTRUCTION INDUSTRY TECHNICAL TRAINING IN DEVELOPING ECONOMIES

Research evidence indicates that training in developing countries has been neglected and the content of the training is disconnected with industry requirement (Johanson and Adams, 2004; Okoye and Chijioke, 2013). Generally craft skills are train either through informal or formal training systems. Previous studies also showed that informal training is the predominant training system in developing countries, accounting for 80 percent of training in Iran, Sri-lanka and China (Zakeri et al., 1996; Jayawardane and Gunawardena, 1998; Sha and Jiang, 2003). In sub-Saharan Africa, the case is similar to other developing countries (Wachira et al., 2008).

Although formal skills training only accounts for small portion of training in developing countries, studies show that available ones are ill-prepared both in manpower and facilities to equip trainees with the skills needed to operate in the construction industry (Zakeri et al., 1996; Jayawardane, and Gunawardena, 1998; Sha and Jiang, 2003; Datoegoem, 2006; Abdullahi, 2010). While findings from Muya et al., (2006) established the problem of poor funding of skills training centres, Datoegoem, (2006) and Abdullahi, (2010) found a training condition that is generally characterised with lack of standards and unified framework in Nigeria. Okoye and Chijioke (2013) also found that facilities in most training institutions are generally inadequate, obsolete and sometimes in poor condition. Ironically, the National Centre for Construction Education and Research [NCCER] (2013) observed that quality comprehensive craft skills training is fundamental to the development of a skilled workforce and a skilled workforce is essential to safe, productive and sustainable construction and maintenance activities, which in turn, is critical to the nation’s economic future.

Technical training in Nigeria

Available literature suggest the absence of a common training system in training (Datoegoem, 2006; Abdullahi, 2010; Chindo, 2015). The different routes of training craft skills in Nigeria are the Federal Science and Technical Colleges (FSTCs); the State Technical (Vocational) Colleges (STCs); the Industrial Training Fund (ITF); the National Directorate of
Employment (NDE) and a few Privately own technical training institutions. Chindo (2015) found that the training approach in these institutions largely covers four major components described below:

i. **Theory aspect (General education)** - this is delivered in the classroom for the Trainees to acquire general knowledge on the trade they are learning,

ii. **Workshop practice (Training)**: here the instructors demonstrate and allow students to replicate,

iii. **Projects and assignments (Practice)**: trainees are given projects to do in their respective trades in order to ingrain the skills in them and,

iv. **Industrial training (Experience)** - trainees are sent to industry to acquire experience while on training.

These conform to those components identified in Hughes (1980); Luissier and Shandrick (2006). In Hughes (1980), *training, experience, self-development and education* were identified as the four broad components for skills development. Similarly, Luissier and Shandrick (2006) listed *education, training, practice and experience* as components of training that are required in developing skills. Although Hughes (1980) use the term self-development for the third component while Luissier and Shandrick (2006) use practice, it is logical that practice is targeted at self-development. Therefore, education, training, practice and experience are adopted as the four components of training programme in this study.

Additionally, Chindo (2015) found that in most training institutions, the programme is for a period of two (2) or three (3) years depending on the institution, covering theory and practice. The theory takes nine (9) terms of three (3) months each in the institution while three (3) months is for Industrial Training [IT]. IT is a programme that allows trainees to acquire skills and basic experience in the industry before finishing training. The IT is usually during the second year vacation period. It is the design of the programme that ratio of classroom to workshop practice is 30% to 70% (NBTE, 2012), this is rarely so as most institutions aim to measure up with conventional institutions rather than develop craft skills (Oranu, 2003).

**Training systems**

In reviewing training systems adopted by several countries, Sharpe and Gibson (2005) observed that there is no “one-size-fit-all” system of technical and vocational training. Likewise, Gann (1989) suggests that training arrangements and the acquisition of skills vary considerably across the construction industry. The approach varies from one country to another but generally there are common features in all the frameworks. The challenges of the right type (multi-skilling or single skilling) and the right composition of skills for training has been highlighted (Clarke and Wall, 2000). Clarke and Wall (2000) further observed that the different training systems in UK, Germany and the Netherlands for example have
affected the results obtained in each country. For instance, In the UK, a trade based approach is adopted, while in Germany, a holistic approach that is industry-based is adopted.

In the Dutch system, training is first given on industry wide basis before streamlining to specific trade. The system gives emphasis on practical training accompanied by theoretical knowledge with a wider curriculum covering the construction industry in general. The Dutch system also emphasized the understanding of the construction process holistically against specific trades (Clarke and Wall, 2000).

Interestingly, the training systems in the three countries have all emphasised theory and practice (Oulton and Steedman, 1994; Sharpe and Gibson, 2005; Hippach-Schneider, et al., 2007) where combination of college-based (school-based) training and a structured learning on-the-job with actual work experience in an approved company is encouraged. Generally, these training systems are either dual or college-based training system.

**Dual Training System (DTS)**

The dual training system aims to combine general transferable skills acquired during college-based training with structured learning on-the-job and actual work experience within a training company. The training system is described as “dual” because training is carried out in two places of learning: companies and vocational schools (Oulton and Steedman, 1994; Hippach-Schneider, et al., 2007; TSSR, 2011). It was argued that theoretical learning at school facilitates a well-grounded approach to practical problems, while workplace experience provides real world examples and applications (ITSJ, 2014). In some literature, the minimum requirement for entry into the training institution is completion of secondary education with relevant credits and attainment of 18 years (Boehm, 1996; Hippach-Schneider, et al., 2007; Syben, 2008; Apprenticeship in Canada, 2014; ACC, 2014). In studying the German dual training system, Gough and Macintosh (2007) elaborated that the two schools (college and institution as platforms for learning) have generally provided a rigorous introduction to areas of academic knowledge relevant to the *Berufe* (these are clusters of skills, knowledge and practical capacities that are seen as separate occupations by agreement between the social partners in German training system). The formal training complements the second element of the German system, the company-based workplace training overseen by apprentice supervisors or *Meister* (Foreman that studied the skills to train apprentice in their occupation).

To achieve the desire of the dual training system, the training is fashioned in a way that the trainee alternates between the institution and the organisation. There are different patterns of alternating the training, the choice of any depends on the industry and the training institution. It is generally difficult to state any particular pattern of alternating because it varies between country to country and industry to industry. The entire
arrangement of the pattern depends on the nature of the industry (Sockice, 1994; Oulton and Steedman, 1994; Boehm, 1996; ITSJ, 2014).

In the dual training system, the capability of organisation to provide industry training is usually assessed before trainees are sent to the organisation. It is also the responsibility of the training institution to secure placement or at least provide a platform for trainees to meet organisations that are capable and willing to provide industry training. It is claimed that the system provides solution to educational mismatch inherent in a purely school-based training system (ITSJ, 2014).

**College-based training system**

There are different approaches to college-based training system, also refers to as School-based apprenticeships and traineeships (SATs). Generally, the system provide opportunity for young people (usually 11 and 12 years) to participate in training and work as paid employees while completing senior schooling (Australian School-Based Apprenticeship [ASBA], 2014). The system combines paid employment as an apprentice or trainee, off-the-job vocational training and senior secondary school studies. The unique feature of the system is the combination of the secondary education with vocational education that centres on acquisition of hands-on-industry experience.

ASBA (2014) explained that the training by a registered training organisation may be undertaken for a couple of hours every week or for a longer block of time, less frequently. The pattern will depend on the requirement of the registered training organisation and the vocational training course. The apprentice schedule will depend on the agreement but the following are various options available (Canada Apprenticeship Careers in Construction [CACC], 2014):

i. Working as an apprentice for one semester, and going to school the next semester
ii. Working half a day and going to school the other half
iii. Working during the summer, and on holidays and weekends, and attending school during the regular term
iv. Working one or two days a week and going to school the other days.

**RESEARCH METHODS**

To achieve the objectives of this research, related literature were reviewed which led to the development of a semi-structured interview guide in conducting interview with respondents. The choice of semi-structured interview is to allow some degree of flexibility in the interview while providing some lead questions to stir the interview. Following the development of the interview guide, interviews were scheduled and conducted in nine construction organisations from the months of March,
2013 and February, 2014. An interview session took average of 60 minutes. The organisations were selected based on purposive sampling where management staff were interviewed in order to assess the performance of the craftsmen. The data obtained were transcribed to aid clarity and consistency for eventual analysis. The transcribed data were coded to ensure the results were easy to use and understand. In analysing the data, conceptual content analysis was adopted and takes into account the appearance of a concept or the numbers of times (frequency) a particular concept appears in a text.

RESULTS AND DISCUSSION

The results of the analysis of data obtained from the interview with management staff of the construction organisations are presented and discussed in this section. The assessments are generally based on four components of training identified in Hughes (1980); Luissier and Shandrick (2006).

Characteristics of the construction organisations and the interviewees

A total of nine (9) top rated construction organisations in Nigeria were visited and interviews conducted with management staff of the organisations. Amongst the interviewees are a Director of Administration, two (2) Project Coordinators, five (5) Project Managers and a Construction/Project Manager. Although all the organisations are in the private sector of the economy, two (2) are Public Liability Companies (PLC) while seven (7) are Limited Liability Companies (LLC). One of the organisations was established in 1937 in Lagos and arguably the oldest in Nigeria which has now become a PLC. Most of the organisations have worked in Nigeria for over 30 years; Table 1 shows the distribution of the age of the organisations. Similarly, the interviewees have averagely worked in the construction industry in Nigeria for 20 years. Table 2 summaries the years of experience of the interviewees. The years of experience of both the organisations and the respondents has undoubtedly suggested that the respondents have acquired relevant experience to contribute meaningfully in the research. On the specific area of business, four (4) organisations indicated that they execute both civil and building construction projects while four (4) indicated general civil engineering construction projects. Only one organisation limited her business to building construction projects. The area of business of an organisation determines the mixture of skills workers in the organisations, this therefore suggests that the organisations have good mixture of skills workers and are knowledgeable in the study area.

The interviews were all conducted as individual sessions and each lasted an average of 60 minutes. Notes were taken on a predesigned interviewee list of questions to serve as guide in steering the interview and also to capture relevant information from the interviews.
<table>
<thead>
<tr>
<th>Number of Years</th>
<th>Nr</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20 years</td>
<td>2</td>
</tr>
<tr>
<td>21-30 years</td>
<td>1</td>
</tr>
<tr>
<td>31-40 years</td>
<td>4</td>
</tr>
<tr>
<td>41-50 years</td>
<td>1</td>
</tr>
<tr>
<td>Over 50 Years</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2 Interviewees years of Work Experience**

<table>
<thead>
<tr>
<th>Working Experience</th>
<th>Nr</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20 years</td>
<td>4</td>
</tr>
<tr>
<td>21-30 years</td>
<td>4</td>
</tr>
<tr>
<td>31-40 years</td>
<td>1</td>
</tr>
</tbody>
</table>

**Education**

Respondents’ opinions were sought on the performance of craftsmen trained in Nigeria relative to their education. On this, most organisations found the craftsmen relatively satisfactory except that the education content is too generic. It was observed that combining secondary education and craft skills training may have created difficulty in balancing between conventional education and industry/trade focused education. Learning from developed countries, it is common practice for craft skills training to start after completion of secondary education (Boehm, 1996; Hippach-Schneider, *et al.* 2007; Syben, 2008; ACC, 2014). This approach has ensured that trainees acquired sufficient general education before making informed decision on career path and serving as foundation for industry/trade focused theory. In Nigeria, it is shown that craft skills training institutions mostly combine conventional education with craft skills training (Bokinni, 2005; Datoegoem, 2006; Abdullahi, 2010; Chindo, 2015). This suggests a need to separate craft skills training from conventional education and focused the education of craft skills on specific industry/trade issues only.

**Training and practice**

Being two of the four important components of effective training programme, training and practice are usually carried out in college workshops and sometimes on-the-job. It is expected therefore that adequate and current training facilities are provided in training institutions. Based on this, organisations were asked to assess the ability of craftsmen trained in Nigeria in using basic facilities. On this, most organisations showed overwhelming dissatisfaction with the performance of craftsmen trained in Nigeria. Many of them observed the inability of Nigerian trained craftsmen to carry out simple site operations. This agrees with previous studies (Datoegoem, 2006; Abdullahi, 2010; Okoye and Chijioke, 2013) that facilities in most training institutions are generally
inadequate, obsolete and sometimes in poor condition. This may explain the poor performance of graduates from those institutions.

It was also observed that because of the generic nature of training in Nigeria, it was difficult for craftsmen trained in Nigeria to apply acquired skills to construction industry since their training did not take into account specific industry issues and peculiarities. This finding confirms the studies of Johanson and Adams, 2004; Okoye and Chijioke, 2013). The employers therefore suggested a collaborative training believing that it will bridge the gap with industry requirement and training. Training Skills Survey Report [TSSR] (2011) asserts that delivering training in partnership amongst stakeholders in an industry ensures that training covers the whole issues on training in that industry. Employers are also concerned that the institution based approach to training in Nigeria is not allowing trainees to take advantage of the two platforms (institution and industry) to learn. This contrast with other systems of training where learning in the industry is incorporated as an essential component of technical training (Boehm, 1996; Sharpe and Gibson, 2005; Hippach-Schneider et al 2007; Syben 2008; Apprenticeship in Canada, 2014; ACC, 2014). This is achieved through alternating a well structured and controlled training in the industry and in vocational and technical institution at predetermined intervals as in the case of dual system of training.

In butressing the need for collaborative training, employers found Nigerian trained craft skills that did IT with them transiting from training institution to the industry easily because they already acquired basic skills in the aspects of using facilities and site operations. Given the performance of those that did IT, it suggests that with direct collaborative training amongst industry’s stakeholders, technical training will improve. Also, to ensure that training covers relevant areas of industry needs, an integrative training approach is encouraged where the institutions and the industry collaboratively participate in determining what should be learnt, where and how, through the development of training guidelines particularly to be used when receiving training in the industry by trainees. Previous studies showed that alternating training between the industry and training institutions where pre-planned training guidelines developed through the combine effort of the institution and the industry helps in delivering effective craft skills training (Oulton and Steedman, 1994; Clark and Wall, 2000; CBC, 2002; Hippach-Schneider, et. al, 2007). This approach ensured that training is provided in areas relevant and useful to the industry, while industry’s facilities are used to augment the facilities that are not sufficient or readily available in the institutions.

**Experience**

On the aspect of basic experience expected of graduates of craft skills training institutions, employers found Nigerian trained craftsmen generally not satisfactory. They opined that trainees were either not given opportunity to practice or the institutions lack facilities for training. As a result, graduates of those institutions spend longer time on probation
before getting employed. Some of the respondents expressed concern on the currency of the trainers’ skills, explaining that without regular update of their skills, it will be difficult for the institutions to measure up with the industry. These findings may explain the preference of poaching and importation of craft skills by organisations instead of employing local ones. Other probable reason for lack of basic experience may be the absence of, or poor integration of institution and industry training as earlier explained. It is important therefore to adopt collaborative training where stakeholders will determine what should be learn, where and how, through the development of training guideline particularly for use during IT by trainees (ITSJ, 2014).

Another concern of employers is the lack of commitment of training institutions to IT. They observed that most times trainees were left at the mercies of the organisations to obtain placement for IT, learn without predetermined guidance on what to learn while on IT and the duration (mostly three months) is inadequate. They attest that obtaining placement for IT especially in large construction organisations was very difficult and such act prevents majority of trainees from acquiring some industry experience while on training. This therefore calls for concern because of the need to integrate training as established in previous studies (TSSR, 2011; ITSJ, 2014). As a way of improving training, the interviewees suggested pre-assessment of organisations before IT, pre-agreement in terms of number of trainees to be send, timing and direct placement of trainees in organisations for IT, increase of the duration for IT to nine months and an entire restructuring of the IT programme. This conforms with current thinking that for effective training, stakeholders should be involved at the onset of training (Sockice, 1994; Oulton and Steedman, 1994; Boehm, 1996; ITSJ, 2014). It is also evident in the dual training system that a collective agreement on training must be reach before training can commence in an organisation (Oulton and Steedman, 1994; Boehm, 1996; ITSJ, 2014). In a similar vein, Sharpe and Gibson (2005) elaborated that to ease the difficulty of finding an employer willing to provide training, a list of potential offers for training should be published for interested participants to apply. In summary, considering the benefits of collaborative training as discussed and established in previous studies (Boehm, 1996; Sharpe and Gibson, 2005; Hippach-Schneider et. al. 2007; Syben 2008; Apprenticeship in Canada, 2014; Apprenticeship-Career in Construction, 2014) it will be gainful to considered implementing it to improve training in Nigeria.

Buttressing the need for experience while on training, some of the interviewees compared training in Nigeria and other countries. Their opinions were that, craftsmen trained in other countries were better on average in terms of experience. Some of the respondents argued that, training in developed countries is with better facilities and in systems that integrate school and industry learning. This assertion has since been established in literature (Oulton and Steedman, 1994; Sharpe and Gibson, 2005; Hippach-Schneider, et. al., 2007; ITSJ, 2014).
Additionally, the opinions of the employers were sought on the acceptability of the National Technical Certificate [NTC] (this is the certificate issued to technical college graduate in Nigeria). It is revealed that most of the holders of NTC were given further training on-the-job before they were fully employed. Employers find this below acceptable standard. This is a confirmation of earlier study by Okoye and Chijioke (2013) which found that most holders of Nigerian technical skills certificate appear naive at practical expressions. As a result of this deficiency, employers prefer conducting practical assessment than using NTC as criteria for assessing competency of craft skills. To some extent, organisations would rather employ craft skills with relevant skills but no certificate than those with certificate but without relevant skills. However, the City and Guilds certificates which the NTC replaced is still a preferred technical certificate amongst the organisations examined. The general preference of City and Guilds of London Certificate is hinged on the ability of the holders of such certificate to demonstrate the skills the certificate indicates they have. Although this is a confirmation of earlier findings and suggestions on the need to reinforce the training, practice and experience aspects of training in Nigeria, it has however showed the need to improve on the assessment and certification process of the programme to meet acceptable standard expected by the industry.

CONCLUSION

The study assessed the performance of craftsmen in the construction industry and found that craftsmen are largely lacking in practical skills but generally adequate in general education. Employers of craft skills suggested that emphasis should be on acquisition of hands-on skills and trade focused theory instead of general education. This can be achieved by providing training collaboratively between institutions and industry, increasing the IT from three months to nine months as well as restructuring the IT to provide direct placement of trainees in organisations, assessment of the potential organisations for the IT in terms of capability to deliver training. It is also suggested that training facilities should be improved both in terms of number and currency. There should also be provision for retraining the trainers to ensure they are abreast with current practice in the industry. Technical training should also be separated from conventional education which should be industry tailored with the educational content emphasising trade theory. Finally in providing training in a collaborative manner, the strengths of one party should be utilised to complement the weaknesses of the other. This will address the mismatch that existed between industry need and institution’s training.
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PERCEPTION OF ESTATE SURVEYORS AND VALUERS ON USERS’ PREFERENCE FOR GREEN BUILDING IN LAGOS, NIGERIA

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The purpose of this paper is to investigate users’ preference for green building features as perceived by real estate practitioners managing office properties in Lagos. This is with a view to determining the willingness of users to demand for property with green features and maturity of the property market for sustainable green building. Questionnaire were administered on 88 estate surveyors and valuers managing office properties selected through a purposive sampling technique. Data were analysed with the use of frequency distribution, percentage and relative preference index (RPI). The results showed that users preferred most of green building features above conventional building features. The index of preference on all features is above average (2.50). It was also discovered that features relating to direct occupant use and comfort were most preferred. The paper concludes that with high level of preference for green features in the study area, conscious efforts should be made by relevant agencies to encourage green building practice.

Keywords: energy efficiency, green building, Nigeria, office property, sustainability

INTRODUCTION

In times, there has been an increasing change in the environment globally and intense alteration to its quality. This is evident in the various environmental hazards such as flooding, erosion, drought, desertification, pollution, climate change, etc. and is traceable to various human activities such as deforestation, fuel burning, and gas flaring among others. These have immense impact on man and his quiet enjoyment of the environment and its endowments (ICSU, 2005; Adeleke, 2010).

Of more interest is the fact that many of these activities stem from the built environment. For instance, it is estimated that the built environment contributes up to 40% of all energy consumption and one third of the world CO₂ emission (Adeleke, 2010). High energy sap by buildings result into

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continuous burning of fossil fuel to produce more energy in order to meet demands. Other environmental hazards that emanate from buildings include resource depletion, production of waste (especially non-recyclable) and emission of hazardous substances (Volatile Organic Compounds - VOCs) into the atmosphere (Brown and Bardi, 2001) among others. These cause environmental imbalances. Given the contribution of the built environment to environmental threat, green or sustainable property development becomes imperative. In order to mitigate the impact of the activities of humans on the environment, there is need to approach sustainability from a change in practise in the built environment; this is the essence of green building. In addition to this, green building takes cognisance social and economic issues in construction (Connelly, 2006) and seeks a balance between economic prosperity, social wellbeing and environmental protection.

Several countries, especially in the developed world have tapped into green property development and are fast pulling efforts to maximise the benefits accruable in sustainable building practises through policy instruments (Nduka and Ogunsanmi, 2015). Many of African countries are however lagging behind even though they are more vulnerable to environmental threat due to low level of development and technological know-how to tackle the consequences of environmental hazards (Boko, Niang, Nyong, Vogel, Githeko, Medany, Osman-Elasha, Tabo and Yanda, 2007).

Nigeria is Africa’s most populous country with a rapid rate of urbanisation and resultant high level of environment-related activities (NESP, 2014). Despite this profile, Nigeria is one African county that has made little or no effort in adopting green building. Policy efforts towards environmental conservation has focused less on the built environment (Nduka and Ogunsanmi, 2015).

To enhance sustainable culture in the Nigerian built environment and promote the adoption of green building, there is need to examine the preference of users for green features as it has been established in literature that the most important factor as a benchmark of a building success in meeting the design objectives is the level of users’ satisfaction (Peretti, Schiavon, Goins, Arens and De Carli, 2010). Users are important stakeholders pertinent to successful green building implementation and data on their opinion and preference will provide information on their willingness to adopt green building, which is useful in approaching green building policy in Nigeria in a manner that will foster success. This information is better sought from property-managing surveyors who in the process of carrying out property management services are conversant with users’ opinion and interest. From their experience with several property users and being familiar with their demands and choices, it is deemed that they will be able to provide information on users’ take around the concept of green building. Also, the Estate surveyors, given the extent of their training and experience on building design and construction are expected to have a better grasp of the green building design terms related in this study, thereby being able to provide more informed responses.
This study therefore aims at examining the preference of users for green features as perceived by the property managing surveyors. The study adopts empirical survey method using self-administered questionnaire.

Furthermore, in building design and construction practices, perception of green building has received little attention in the literature; instead, numerous studies discuss the users’ satisfaction and comfort in green buildings through post occupancy evaluations (Hitchings, 2009; Huang et al., 2012; Lee and Guerin, 2009; Altomonte and Schiavon, 2013; Baird and Field, 2013; Liang et al., 2014). Also, recent research activities on green building in Nigeria, among other emerging economies have focused more on implementation difficulties (Oladokun, Ogunba and Gbadegesin, 2010 and Ikediashi, Ogunlana, Oladokun and Adewuyi, 2013), level of awareness (Oladokun, Ogunba and Gbadegesin, 2010 and Abolore, 2012) and extent of involvement of stakeholders in sustainable property investment (Nwokoro and Onukwube, 2011 and Oyewole, Araloyin and Sani, 2012). Explicit evaluation of users’ interest in green building features is sparse in literature, yet it is fundamental to green building success, hence this study.

CONCEPT OF GREEN BUILDING

The term green building has been described as energy-efficient building, environmental building, eco-building, sustainable building and high-performance building (Lucuik, Trusty, Larsson and Charettre, 2005). The terms are still vague and lead to much ambiguity in their implementation (Zachariah, Kennedy and Pressnail, 2002). Although sustainability as a concept includes both economic prosperity and social justice, much of the literature and indeed government and intra-governmental responses (Shahmanesh-Banks, 2008; Abolore, 2012; NESP, 2014) have focused on environmental protection and in particular issues surrounding energy and more recently, carbon. This is also reflected in the various definitions of green building that have emerged over time. For example, the US Green Building Council (2003) defined Green building as the practice of increasing the efficiency of new buildings, and reducing their impact on human health and the environment through better site location, design, construction, operation, maintenance, and removal. According to the same source, Green buildings are designed, constructed, and operated to boost environmental, economic, health and productivity performance over that of conventional building. Chatterjee (2009) defined green building practice as a process to create buildings and infrastructure in such a way that minimize the use of resources, reduce harmful effects on the ecology, and create better environments for occupants. Kamana and Escultura (2011) defined green building as an outcome of a design which focuses on increasing the efficiency of resource use while reducing impacts on human health and the environment during the building’s lifecycle, through better location, design, construction, operation, maintenance, and removal.
Despite the relevance of economic and social sustainability as part of the three bottom-line issues in sustainability, and the assertion of the US green building council that green buildings are designed, constructed, and operated to boost environmental, economic, health and productivity performance over that of conventional building (US Green building council, 2003) the definition of green building according to the council and series of other definitions that have emerged over time still do not reflect the social and economic benefits accruable.

Moves towards a universal definition are beginning to be manifested. This is articulated more clearly in the current UK Green Building Council definition (UKGBC, 2009): ‘A sustainable building should be one which meets peoples’ needs – as a home, or a workplace for example – in ways which enhance its positive impacts and minimize its negative impacts, environmentally and socially, both locally and globally over time.’. In other words green building is a building which is environmentally friendly, socially and economically viable from design to the end of its useful life. Sayce, Sundberg and Clement (2010) corroborated that most business and government interpretations currently recognize that sustainability is not just a matter of environmental protectionism; it requires a balance between the need to conserve the natural environment with the requirements for a just society and economic survival, if not growth. Premised on the foregoing arguments, green building will be defined for the purpose of this study as “a building that is so designed and built to conserve resources and contribute less to environmental threat, at the same time, improving habitability with minimal economic liability, throughout its useful life”.

Green building has proven to be successful in contributing toward sustainability of the environment, economy and society (Anuar, Nor Kalsum, Zulkiflee and MohdYazid, 2012) and nowadays, the importance of the non-technical issues such as economic and social aspects has been incorporated in most of definitions of green building (Anuar et al, 2012). Adoption of green principle in line with the three bottom line concepts of sustainability confers a number of benefits which justify its wide spread campaign. Some of these include ability to attract higher profile tenants (Wasiluk, 2007), lower operating cost, higher operating income, capital value and productivity (Roper and Breard, 2006), optimization of building layouts, simple and efficient planning of buildings (Shiers, 2000). According to Shiers (2000), green building provides healthier working environment and reduction in building related health risk. Turban and Greening (1996) also pointed out improved corporate image through better corporate social performance. Optimization of energy use, lower resource use and lower release of environmentally toxic substances helps to minimize the environmental footprint of the real estate industry. Thus, green building confers advantages on three areas of sustainability, i.e. economic, social and environmental sustainability.

With regard to users’ expectations on the advantages of green building and their resultant preferences for green features, studies like Yang and Zoo
(2013) found that construction cost and government incentive were considered as major influence factors on achieving energy efficient residential building development, and the lower bills from reduced energy and water consumption were considered as the most important benefits from the Australian households’ perspectives. Ling, Gunawansa and Tong (2010) discovered that the most important green feature that young Singaporean adults required in their new homes were: public transport accessibility, good indoor environment and energy efficiency; Kong, Harun, Sulong and Lily (2014) demonstrated that within Malaysian consumers’ perception; green corporate perception, eco-label, and green product value had positive significant influences on green purchase intention with eco-label and green product value making the largest contribution in influencing green purchase intention among consumers. This study extends the existing research to Nigeria property market context and attempts to uncover issues surrounding users’ preference for green property features.

FEATURES OF GREEN BUILDING

To attain a sustainable property development, several criteria are established in literature. In most cases, such criteria cover the economic, environmental and social aspects of sustainability. For instance, Cole and Larsson (1999) emphasized reduction in resource consumption (energy, land, water, and materials), environmental loadings (airborne emissions, solid waste, liquid waste) and improvement in indoor environmental quality (air, thermal, visual and acoustic quality). Zigenfus (2008) presented guiding principles that are to be taken into consideration when building a green home as proposed by the National Association of Home Builders. They include Lot design, Preparation, and Development, Resource Efficiency, Energy efficiency, Water efficiency, Indoor environmental quality, Operation, Maintenance and Homeowner Education, Global impact, Site planning and Land development. According to Aye and Hes (2012), a model green building should use less materials, consider modular design for deconstruction, use recoverable materials and take cognizance of durability. Most of the studies mentioned above and other existing ones (Kilbert, 2007; Akadiri, Chinyio and Olomolaiye, 2012; Vatalis, Manoliadis, Charalampides, Platias, and Savvidis, 2013 and Houghton, 2014) cover seven distinctive areas including material use and conservation, building ecology, waste and recycling, energy, indoor air climate, site selection site design and landscape ecology, water conservation and owner and occupant education. This study adopts these seven areas in its survey. A brief elaboration of the seven green building principles highlighted is presented in the section below.

Energy Conservation

These are features concerned with maximising utility with as minimal energy use as possible. Elements severally considered in the literature include use of solar cells, winds or photovoltaic means for power supply,
availability of contingency plans for both short-term and long-term power failures, design for low energy intensive in-house and public transportation such as situation of buildings close to complimentary land uses and avoidance of high energy consuming transportation facilities such as lifts; installation of low-energy basic lighting such as use of power saving bulbs and design for natural daylight penetration; use of natural cooling systems, energy recovery ventilation systems, design for energy efficient deconstruction and recycling, maximizing the contribution of passive solar energy without reducing the comfort in periods with high solar exposure and use of energy optimized windows. (All Party Urban Development Group, 2008; Aste, Adhikari, and Buzzetti, 2010 and Akadiri, Chinyio and Olomolaiye, 2012).

**Indoor Air Climate**

Indoor air climate is commonly regarded as an important element of green building as it has direct impact on occupant health and comfort (Peretti, Schiavon, Goins, Arens and De Carli, 2010). The following green features in building as identified in the literature are tailored towards obtaining a sustainable indoor environment: use of in-door materials that are less air-toxic, such include concrete made of fly ash, gypsum board made from recycled materials etc.; these materials emit less VOCs (Zigenfus, 2008); others include location of air intakes far from sources of pollution such as parking areas, bus stops, cooling towers or stagnant water, building design to utilize natural and cross ventilation, mechanical ventilation of enclosed parking areas, building effective local exhaust into heavy equipment rooms, and building design which avoids the need for air condition.

**Material Use and Conservation**

Several sustainability issues in buildings can be traced to decisions on material choice. To improve on sustainability in material use, the following are features relevant for consideration: Use of durable materials, use of materials that protect against the local weather conditions, availability of equipment on-site to deal with environmental emergencies, avoidance of foam materials using Chlorofluorocarbons (CFSs) and Hydro chlorofluorocarbons (HCFCs) which are strong greenhouse gases having the potency of causing global warming like CO$_2$ (Wallington, Srinivasan, Nielsen and Highwood, 2004). Others include water installations, cable works and related installations without Polyvinyl chloride (PVC) which escapes into the air and reacts with other chemical substances to form compounds which are harmful to human health and the environment (Wallington et. al. 2004). Other elements of sustainable material use include use of recyclable/recycled materials in construction and use of natural and local materials in construction (USGBC, 2003; NAHB, 2006; Qaem and Herav, 2012).

**Water, Rainwater and Sewage**

Water and water management systems is an area where much resources can be conserved and pressure on the environment can be lessened. To achieve this it is important to consider the use of water efficient plumbing features, collection of rain water for utilization to lessen pressure on
portable water, water saving toilet and baths facilities, design for dual plumbing which supplies both potable and reclaimed water to a home or business using two completely separate piping systems. Waste water discharge can be reduced through this means and much water resources be conserved. Other features are waste water reutilization and availability of pressure reducing mechanisms on the plumbing features (USGBC, 2009; IISBE, 2012 and BRE, 2013).

Building Ecology, Waste and Recycling
Building ecology encompasses management of waste and consideration of environmental impact of buildings. To achieve this as a green building objective, it is important important to ensure right channelization of floor drains, freedom of building area from contamination, availability of storm water management measures, keeping noise from installations moderate and under control, right channelization of roof drains, availability of means of waste diversion from living areas where it could be toxic, control of site pollution, treatment of waste water from sinks and showers, availability of collection points for sorting wastes into paper, glass, metal and plastic for treatment, availability of suitable measures to ensure that food or food waste is well contained and that there are no unprotected openings, to minimize access by rodents, availability of facilities for storing and handling recyclable materials and availability of construction, renovation and demolition waste management policy (Polese and Stren, 2000; Graham, 2003 and Brent and Labuschagne, 2004).

Site Selection, Site Design and Landscape Ecology
Sustainability in building is better achieved when green issues are taken into consideration from the initial stage of building i.e. selection of site and building design. Relevant issues to be considered in design include access to public transport within reasonable time, building plan that allow considerable area of the building to have access to daylight penetration, thereby reducing energy burn through artificial lighting means; planning of building design to allow for easy access to technical installations, sustainable transportation, work space sufficiency, good lighting controls, smart transportation options, including access to public transit, along with bicycle racks, signage and storage facilities; ease, in open office areas, to engage in a conversation using a normal voice, understand a phone conversation, and have a private conversation using lowered voices; sufficient acoustic privacy, building design that allows for non-destructive inspection, availability of controllable internal or external blinds and light fixtures that prevent glare at visual display terminals, shading of glazing (windows) is achieved when necessary, sustainable landscaping, flexibility of design to allow for easy conversion, inclusion of green common area in each main plot of land and landscaping minimizing the need for irrigation (DOS, 2007; Schumann, 2010; Zainul Abidin, 2010; and GRI, 2011;).

Owner and Occupant Education
Sustainable building practises is likely unachievable without communicating sustainable culture to the occupant; realisation of sustainable practices in buildings depend largely on the actions or
inactions of the occupants. Important elements of owner and occupant education common in the literature include availability of regular procedure for checking and fixing leaks, availability of emergency response manuals, availability of regular maintenance schedule, availability of tenants' sub-metering (on energy, water, etc.), availability of checklist of items connected to indoor air quality that must be discussed with architects, engineers, contractors, and other professionals prior to renovations and repairs, availability of communications to tenants on the environmental measures that they can implement in the building, availability of carbon dioxide monitoring or sensors to maintain pre-set levels of carbon dioxide, regular check of outdoor air intakes to ensure that the openings are protected and free from obstruction, availability of waste reduction work plan, availability of documented measures to control pollutants at source in areas such as washrooms, kitchens, printing areas, chemical storage and general storage areas; availability of readily available operating manual covering standard control settings and operating instructions for all services equipment that may affect the energy consumption and availability of "use and maintenance" manual (Edward, 1998; Polese and Stren, 2000; Haris and Goodwin, 2001 and Brent and Labuschagne, 2004).

RESEARCH METHOD

The target population for the study is the registered estate surveying and valuation firms in Lagos, the commercial and economic core centre of Nigeria, where property market is most active. The total number of firms based on the current directory of Nigerian Institution of Estate Surveyors and Valuers, Lagos State Branch (2013) are 440. Estate surveyors and valuers are considered because they are the intermediaries between landlords and tenants and are therefore in the position to air tenants' impression of buildings. Eighty eight (88) firms were purposively sampled based on extent of involvement in office property management. Using self-administered questionnaire, one real estate practitioner each was served in the estate firms selected. Information contained in the questionnaire detailed the individual characteristics of the respondent and respondents' perceptions on the extent to which users will prefer green features in office properties in the study area.

Sixty nine green building indices (features) which in line with commonalities observed in existing literature, fall into seven aspects that are required of a model green building, were compiled. The seven areas include material use and conservation, building ecology, waste and recycling, energy, indoor air climate, site selection site design and landscape ecology, water conservation and owner and occupant education. The Estate Surveyors were asked to rate the features (based on their experience in practise) on a five point likert scale (i.e. 1 to 5) ranging from “not at all preferred” which represents the lowest hierarchy in ranking (1), to “very much preferred”, the highest hierarchy in ranking (5). Multi-
attribute analytical technique was essentially used to analyse the ratings of the respondents with a view to establishing a representative or mean rating point for each group of respondents. The analysis drew from the multi-attribute utility approach of Chang and Eve (2002), and involved computations of the Mean Rating (MR) and the Relative Preference Index (RPI) for each attribute under a subset. The MR indicates the mean or average rating point of the respondents for the level of importance of an attribute within a subset of attributes. In each computation, the total number of respondents (TR) rating each attribute was used to calculate the percentages of the number of respondents associating a particular rating point to each attribute as shown in Equation 1.

\[ MR_j = \sum_{k=1}^{5} (R_{pj,k} \times R_{jk}) \]  

Where \( MR_j \) = Mean Rating for attribute \( j \),
\( R_{pj,k} \) = Rating point \( k \) (ranging from 1 to 5),
\( R_{jk} \) = percentage response to rating point \( k \), for attribute \( j \).

Relative preference index was used to compare MR values of the variables in a given subset. It was computed as a unit of the sum of MRs in a subset of variables:

\[ RPI_i = \frac{M_i}{\sum_{i=1}^{n} M_i} \]

This method ensures that evaluation categories can easily be compared and response categories can be collapsed into positive and negative response groups with an intervening neutral category between the two poles.

**RESULT**

Out of the 88 estate surveyors that were served with questionnaire, 83 responded, thus the response rate amounts to 94.3%. Majority of the respondents were male graduates, with ages ranging from 31-40 years. Most of them were at least managers of the firms and have spent minimum of five years practising. This indicates that the respondents are in a good position to supply the information needed. Table 1 to Table 8 present the result on their views on users’ interest in green building.

As can be seen in Table 1, on green features relating to indoor air climate, “In-door materials that are less air-toxic” (mean value: 4.506) and “A building design which avoids the need for air condition” (3.148) have the
highest (ranking first) and lowest (ranking least) mean values respectively. It is also apparent that the mean value of the least preferred feature in this category is higher than 2.5 (mid-way through the highest possible mean value) and most mean value were above 3.9. This result indicates that perceived preference on most of the features falling under indoor air climate were high. From the relative preference indices, it is also noticeable that the features that were ranked higher in the category, especially the first two features relate to freeing the air from toxic substances. Other features that were similarly ranked high were features whose direct health and comfort related benefits can easily be traced. The surveyors’ judgement in this respect is likely traceable to the fact that safety of the immediate atmospheric environment and occupant health and comfort are major factors severally considered by users in housing choices based on the practitioners’ experience. This notion is corroborated by Osterhus (1997) who asserts that worries about decrease in comfort is the most important determinant of environmental conscious behaviour. This further explains the reason why despite the higher perceived preference on utilization of natural and cross ventilation (ranking third) the users were perceived as not willing to do away with the use of air conditioning systems (see the least ranked feature). Purity of the indoor and outdoor air and occupant health and comfort are therefore primary issues when considering green housing supply that will command users’ interest.

**Table 1: Indoor Air Climate**

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-door materials that are less air-toxic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>11.1</td>
<td>22</td>
</tr>
<tr>
<td>Location of air intakes far from sources of pollution such as parking areas, bus stops, cooling towers or stagnant water?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td>Building design to utilize natural and cross ventilation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>30.9</td>
<td>28</td>
</tr>
<tr>
<td>Mechanical ventilation of enclosed parking areas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>32.1</td>
<td>37</td>
</tr>
<tr>
<td>Building effective local exhaust into heavy equipment rooms</td>
<td>0</td>
<td>11</td>
<td>13.6</td>
<td>11</td>
<td>13.6</td>
<td>54</td>
</tr>
<tr>
<td>A building design which avoids the need for air condition/cooling systems</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>23.5</td>
<td>33.3</td>
<td>2</td>
</tr>
</tbody>
</table>

Preference Ratings: 1: (NAP) = Not at all preferred; 2: (NP) = Not Preferred; 3: (SP) = Somewhat Preferred; 4: (P) = Preferred; 5: (VMA) = Very Much Preferred; F = Frequency; RPI = Relative Preference Index; ROA = Rank Overall; RWG = Rank within group.
Table 2: Site selection, site design and landscape ecology

Preference Ratings: 1: (NAP) = Not at all preferred; 2: (NP) = Not Preferred; 3: (SP) = Somewhat Preferred; 4: (P) = Preferred; 5: (VMA) = Very Much Preferred; F = Frequency; RPI = Relative Preference Index; ROA = Rank Overall; RWG = Rank within group.

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<th>Building Features</th>
<th>NAP</th>
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<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
<th>F</th>
<th>RPI</th>
<th>RWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site selection, site design and landscape ecology</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>3.6312365 27.71271854.4218814.213163.7920.758² 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to public transport within reasonable time</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>13.3</td>
<td>43</td>
<td>51.8</td>
<td>29</td>
<td>34.9</td>
</tr>
<tr>
<td>Building plan that allow considerable area of the building to have access to daylight penetration?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>66</td>
<td>79.5</td>
<td>12</td>
<td>14.5</td>
</tr>
<tr>
<td>The design is planned for an easy access to technical installations</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>15.7</td>
<td>53</td>
<td>63.9</td>
<td>17</td>
<td>20.5</td>
</tr>
<tr>
<td>Sustainable transportation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>24.1</td>
<td>44</td>
<td>53</td>
<td>19</td>
<td>22.9</td>
</tr>
<tr>
<td>Work space sufficiency</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>21.7</td>
<td>50</td>
<td>60.2</td>
<td>15</td>
<td>18.1</td>
</tr>
<tr>
<td>Good lighting controls</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>23</td>
<td>27.7</td>
<td>45</td>
<td>54.2</td>
<td>15</td>
<td>18.1</td>
</tr>
<tr>
<td>Smart transportation options, including access to public transit, along with bicycle racks, signage and storage facilities?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>31.3</td>
<td>40</td>
<td>48.2</td>
<td>17</td>
<td>20.5</td>
</tr>
<tr>
<td>Ease, in open office areas, to engage in a conversation using a normal voice, understand a phone conversation, and have a private conversation using lowered voices</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>16</td>
<td>19.3</td>
<td>48</td>
<td>57.8</td>
<td>14</td>
</tr>
<tr>
<td>Sufficient acoustic privacy?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>20.5</td>
<td>62</td>
<td>74.7</td>
<td>4</td>
<td>4.8</td>
</tr>
<tr>
<td>Building design allows for non-destructive inspection</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>31.2</td>
<td>44</td>
<td>57.1</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td>Availability of controllable internal or external blinds and light fixtures that prevent glare at Visual Display Terminals?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>32.5</td>
<td>50</td>
<td>60.2</td>
<td>6</td>
<td>7.2</td>
</tr>
<tr>
<td>Shading of glazing (windows) achieved when necessary</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>31</td>
<td>38.3</td>
<td>46</td>
<td>56.8</td>
<td>4</td>
<td>4.9</td>
</tr>
<tr>
<td>Sustainable landscaping</td>
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<td>0</td>
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<td>8.4</td>
<td>30</td>
<td>36.1</td>
<td>35</td>
<td>42.2</td>
<td>11</td>
</tr>
<tr>
<td>Design is flexible enough to allow for easy conversion</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>41</td>
<td>49.4</td>
<td>37</td>
<td>44.6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>A green common area is included in each main plot of land</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>12</td>
<td>38</td>
<td>45.8</td>
<td>28</td>
<td>33.7</td>
<td>7</td>
</tr>
<tr>
<td>Landscaping minimizing the need for irrigation?</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>31.7</td>
<td>25</td>
<td>30.5</td>
<td>27</td>
<td>32.9</td>
<td>4</td>
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</table>
Table 3: Building Ecology, waste and recycling

Preference Ratings: 1: (NAP) = Not at all preferred; 2: (NP) = Not Preferred; 3: (SP) = Somewhat Preferred; 4: (P) = Preferred; 5: (VMA) = Very Much Preferred; F = Frequency; RPI = Relative Preference Index; ROA = Rank Overall; RWG = Rank within group.

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Right channelization of floor drains</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>21</td>
<td>40</td>
</tr>
<tr>
<td>Freedom of building area from contamination</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>21</td>
<td>47</td>
</tr>
<tr>
<td>Availability of storm water management measures</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>22.2</td>
<td>46</td>
</tr>
<tr>
<td>Noise from installations is kept moderate and under control</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>6.2</td>
<td>7</td>
<td>8.6</td>
</tr>
<tr>
<td>Right channelization of roof drains</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>29</td>
<td>35.8</td>
<td>31</td>
</tr>
<tr>
<td>Availability of means of waste diversion from living areas where it could be toxic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>19.8</td>
<td>58</td>
</tr>
<tr>
<td>Control of Site Pollution</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>33.3</td>
<td>36</td>
</tr>
<tr>
<td>Waste water is treated from sinks and showers</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2.6</td>
<td>31</td>
<td>40.8</td>
</tr>
<tr>
<td>Availability of collection points for sorting wastes into paper, glass, metal and plastic for treatment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>38</td>
<td>46.9</td>
<td>41</td>
</tr>
<tr>
<td>Availability of suitable measures to ensure that food or food waste is well contained, and that there are no unprotected openings, to minimize access by rodents?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>41</td>
<td>50.6</td>
<td>36</td>
</tr>
<tr>
<td>Facilities for Storing and Handling Recyclable Materials</td>
<td>0</td>
<td>11</td>
<td>13.6</td>
<td>45</td>
<td>55.6</td>
<td>20</td>
</tr>
<tr>
<td>Availability of construction, renovation and demolition waste management policy?</td>
<td>0</td>
<td>19</td>
<td>23.5</td>
<td>33</td>
<td>40.7</td>
<td>24</td>
</tr>
</tbody>
</table>

The result on users’ perceived preference on features relating to building ecology, waste and recycling is as presented in Table 3. It can be observed from the table that “Right channelization of floor drains” was ranked highest (mean value: 4.086) followed by freedom of living area from contamination (mean value: 4.000). Most other features in this category were also ranked high as their mean values are higher than 3.5 in most cases. “Facilities for storing and handling recyclable materials” and “Availability of construction, renovation and demolition waste management policy” attracted mean values of 3.235 and 3.185 respectively and these features were ranked least in this category. It is also revealed in the table that the features that were rank high in this category were
features that will enhance peaceful and quiet enjoyment of the properties by the users. Other features like those relating to sorting and recycling and particularly features whose environmental benefits are more prominent (relative to economic or social benefits) were ranked lower relative to the other features. The lower perceived preference on features relating to recycling and construction/demolition waste management is can be linked to higher perceived inconvenience attached to these features. This is in agreement with studies like McCarty and Shrum (1997) which discovered that perceived inconvenience is the only significant (negative) determinant of recycling behaviour. Kollmuss and Agyeman (2002) also discovered that comfort is a primary determinant of ecologically conscious behaviour. Difficulty in tracing social gain in terms of comfort (by the users) can thus be responsible for the lower preference.

The result on energy conservation is as presented in Table 4. “Use of solar cells, winds or photovoltaic means for power supply” was ranked highest (mean value: 4.06) in this category and “Availability of contingency plans for both short-term and long-term power failures” follows immediately (mean value: 3.935). The high rating on the use of solar cells, winds or photovoltaic means of energy supply is attributable to inadequate public power supply to meet up with the increasing population in Nigeria. Most commercial property users depend on private power supply which is usually expensive and environmentally unfriendly. The surveyors are familiar with the users’ predicament in sourcing for electricity supply and the responses based on their experience indicates a high tendency of most users to prefer more sustainable substitutes to the existing means of power supply. Other features relating to energy, especially those relating to use of energy efficient appliances were also ranked high as the mean values on most of the features were higher than 3.5. High ratings on most of these other green features can be credited to the tendencies of energy cost reduction in use which further provides solution to cost challenges on existing energy sources. “Maximizing the contribution of passive solar energy without reducing the comfort in periods with high solar exposure” (mean value: 3.47) was ranked least in the group.

Table 4: Energy conservation
The result on the perceived preference for green features relating to owner and occupant education is as presented in Table 5. From the table, it is revealed that “availability of regular procedures for checking and fixing leaks” was ranked first in this category (mean value: 3.964). This is immediately followed by “availability of emergency response manuals” and “availability of “regular maintenance schedule” (with mean values of 3.94 and 3.92 respectively). These features and most other features that were ranked high in this category link more directly to better building maintenance and occupant health safety. This response by the practitioners indicate that these issues are more paramount to the users they offer their services to. From the rankings, it is also observed that features that require manual and conscious operational efforts by the
users were rated lower. This implies that the users were perceived to prefer use of automated devices in carrying out sustainable practices. On the whole, most mean values on the features falling into this category are also higher than 3.5 and this implies a high perceived preference for this category of green features as well. “Availability of use and maintenance manual” was ranked least in this category and this feature attracts a mean value of 3.301.

**Table 4: Result on energy conservation**

Preference Ratings: 1: (NAP) = Not at all preferred; 2: (NP) = Not Preferred; 3: (SP) = Somewhat Preferred; 4: (P) = Preferred; 5: (VMA) = Very Much Preferred; F = Frequency; RPI = Relative Preference Index; ROA = Rank Overall; RWG = Rank within group.

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of solar cells, winds or photovoltaic means for power supply</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>64</td>
<td>83</td>
</tr>
<tr>
<td>Availability of contingency plans for both short-term and long-term power failures</td>
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<td>0</td>
<td>0</td>
<td>24</td>
<td>31.2</td>
<td>44.2</td>
</tr>
<tr>
<td>Design for low energy intensive in-house and public transportation</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3.6</td>
<td>19</td>
<td>22.9</td>
</tr>
<tr>
<td>Installation of low-energy basic lighting.</td>
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<td>0</td>
<td>0</td>
<td>22</td>
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<td>52</td>
</tr>
<tr>
<td>Use of natural cooling systems</td>
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<td>0</td>
<td>0</td>
<td>33</td>
<td>40.7</td>
<td>38</td>
</tr>
<tr>
<td>Use of natural lighting systems</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>32.5</td>
<td>56</td>
</tr>
<tr>
<td>Energy recovery ventilation systems</td>
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<td>0</td>
<td>0</td>
<td>38</td>
<td>45.8</td>
<td>39</td>
</tr>
<tr>
<td>Design for energy efficient deconstruction and recycling</td>
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<td>0</td>
<td>1</td>
<td>1.2</td>
<td>35</td>
<td>43.2</td>
</tr>
<tr>
<td>Energy optimized windows</td>
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<td>0</td>
<td>0</td>
<td>45</td>
<td>54.2</td>
<td>36</td>
</tr>
<tr>
<td>Maximizing the contribution of passive solar energy without reducing the comfort in periods with high solar exposure</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>47</td>
<td>56.6</td>
<td>33</td>
</tr>
</tbody>
</table>
### Table 5: Owner and occupant education

Preference Ratings: 1: (NAP) = Not at all preferred; 2: (NP) = Not Preferred; 3: (SP) = Somewhat Preferred; 4: (P) = Preferred; 5: (VMA) = Very Much Preferred; F = Frequency; RPI = Relative Preference Index; ROA = Rank Overall; RWG = Rank within group.

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
<th>F</th>
<th>%</th>
<th>F</th>
<th>%</th>
<th>F</th>
<th>%</th>
<th>F</th>
<th>%</th>
<th>F</th>
<th>%</th>
<th>MeanRPI</th>
<th>RWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of regular procedure for checking and fixing leaks</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td></td>
<td></td>
<td>0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.1</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of Emergency response Manuals</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
<td>26</td>
<td></td>
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<td></td>
<td>25.3</td>
<td>83</td>
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<td></td>
</tr>
<tr>
<td>Availability of regular maintenance schedule</td>
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<td>17</td>
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<td></td>
<td>0</td>
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<td></td>
<td></td>
<td></td>
<td>13.9</td>
<td>79</td>
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</tr>
<tr>
<td>Availability of tenants' sub-metering (On energy, water, etc.)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td></td>
<td></td>
<td>0</td>
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<td></td>
<td></td>
<td></td>
<td>8.4</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of checklist of items connected to Indoor Air Quality that must be discussed with architects, engineers, contractors, and other professionals prior to renovations and repairs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td></td>
<td></td>
<td>0</td>
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<td></td>
<td></td>
<td>21.7</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of communications to tenants on the environmental measures that they can implement in the building</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td></td>
<td></td>
<td>0</td>
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<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.5</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of carbon dioxide monitoring or sensors to maintain pre-set levels of carbon dioxide.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
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<td></td>
<td></td>
<td>18</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular check of outdoor air intakes to ensure that the openings are protected and free from obstruction.</td>
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<td>0</td>
<td>10</td>
<td>13</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
<td>13</td>
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<td></td>
<td></td>
<td></td>
<td>15.7</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of Waste Reduction Work plan</td>
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<td>5</td>
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<td></td>
<td>0</td>
<td></td>
<td>31</td>
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<td></td>
<td></td>
<td></td>
<td>9</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of documented measures to control pollutants at source in areas such as washrooms, kitchens, printing areas, chemical storage and general storage areas</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>24</td>
<td></td>
<td></td>
<td>0</td>
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<td>28.9</td>
<td>83</td>
<td></td>
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<tr>
<td>Availability of readily available operating manual covering standard control settings and operating instructions for all services equipment that may affect the energy consumption</td>
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<tr>
<td>Availability of &quot;Use and Maintenance&quot; manual</td>
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<td></td>
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<td></td>
<td>28.9</td>
<td>83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

877
As revealed in Table 2, on green features falling under “Site selection, site design and landscape ecology”, access to public transportation within reasonable time was rated highest by the surveyors (mean value: 4.217). This is followed by features relating to “design for access to daylight consideration and easy access to technical installation (mean values of 4.084 and 4.048 respectively). The mean values on most other features falling into this category were higher than 3.5 and this indicates that users were also perceived to exhibit high preference for most features relating to site selection, site design and landscape ecology. At the bottom of the list are features like flexibility of design to allow for easy conversion and availability of green common areas. “Landscaping minimizing the need for irrigation” was ranked least (mean value: 3.11). The relatively high rating attached to transportation consideration among other features is traceable to the transportation challenges in Lagos due to its high population density. The responses of the practitioners are likely informed by their conversance with users’ transportation experience and their opinion as to the importance attached to transportation in housing consideration given the challenges attached to public road transportation. This result is also supported by previous studies like that of Ling, Gunawansa and Tong (2010) who discovered that access to public transport, good indoor environment and energy efficiency (in rank order) were the three most prioritised considerations by users in housing choices. The features that were rated low by the surveyors were features that confer more of long run advantages. This implies that the practitioners’ experience with users point to the fact that they attach less importance to these features.

Table 6 contains the result on the perceived preference of users for green features relating to water, rainwater and sewage. As revealed in the table, water efficient plumbing features was ranked first (mean value: 3.974), followed by collection of rain water to lessen pressure on portable water (mean value: 3.842). Availability of pressure reducing mechanisms on plumbing fixtures, attracting a mean value of 3.329 was ranked least. From this result, it is evident that the surveyors, based on their experience with users, are of the opinion that they are likely to attach high preference to water efficient plumbing features. However, features like design for dual plumbing, waste water reutilisation, and availability of pressure reducing mechanisms on plumbing features which also promote water efficiency were rated low. This is likely due to practitioners’ view of users’ perceived inconvenience on adopting these sustainable features. This view is also supported by studies like McCarty and Shrum, 1997 and Kollmuss and Agyeman, 2002. Nonetheless, as observed on other categories of features, most features in this category attracted mean values that are higher than 3.5 and this suggests a high need for these features as perceived by the practitioners.
Table 6: Water, rainwater and sewage

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
<th>F %</th>
<th>RPI</th>
<th>ROA</th>
<th>RWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water efficient plumbing features</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>18</td>
<td>23.7</td>
<td>39</td>
<td>51.3</td>
<td>18</td>
<td>23.7</td>
<td>76</td>
</tr>
<tr>
<td>Collection of rain water for Utilization to lessen pressure on portable water</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>34.2</td>
<td>36</td>
<td>47.4</td>
<td>14</td>
<td>18.4</td>
<td>76</td>
</tr>
<tr>
<td>Water saving toilet and baths facilities</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>7.9</td>
<td>21</td>
<td>27.6</td>
<td>34</td>
<td>44.7</td>
<td>15</td>
<td>19.7</td>
</tr>
<tr>
<td>Design for dual plumbing</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>6.2</td>
<td>32</td>
<td>39.5</td>
<td>36</td>
<td>44.4</td>
<td>8</td>
<td>9.9</td>
</tr>
<tr>
<td>Waste water reutilization</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2.9</td>
<td>28</td>
<td>40</td>
<td>38</td>
<td>54.3</td>
<td>2</td>
<td>2.9</td>
</tr>
<tr>
<td>Availability of pressure reducing mechanisms on the plumbing features</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>13.2</td>
<td>36</td>
<td>47.4</td>
<td>25</td>
<td>32.9</td>
<td>5</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Table 7: Material use and conservation

<table>
<thead>
<tr>
<th>Building Features</th>
<th>NAP</th>
<th>NP</th>
<th>SP</th>
<th>P</th>
<th>VP</th>
<th>Total</th>
<th>F %</th>
<th>RPI</th>
<th>ROA</th>
<th>RWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of durable materials</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>12.3</td>
<td>49</td>
<td>60.5</td>
<td>22</td>
<td>27.2</td>
<td>81</td>
</tr>
<tr>
<td>Use of materials that protect against the local weather conditions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>16</td>
<td>63</td>
<td>77.8</td>
<td>5</td>
<td>6.2</td>
<td>81</td>
</tr>
<tr>
<td>Availability of equipment on site to deal with environmental emergencies</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>26.7</td>
<td>45</td>
<td>60</td>
<td>10</td>
<td>13.3</td>
<td>75</td>
</tr>
<tr>
<td>Avoidance of Foam materials using CFC and HCFC</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>7.4</td>
<td>21</td>
<td>25.9</td>
<td>44</td>
<td>54.3</td>
<td>10</td>
<td>12.3</td>
</tr>
<tr>
<td>Water installations, cable works and related installations without toxic PVC</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>13.6</td>
<td>28</td>
<td>34.6</td>
<td>20</td>
<td>24.7</td>
<td>22</td>
<td>27.2</td>
</tr>
<tr>
<td>Use of recyclable/recycled materials in construction</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>12.3</td>
<td>44</td>
<td>54.3</td>
<td>24</td>
<td>29.6</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>Use of natural and local materials in construction</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>16</td>
<td>43</td>
<td>53.1</td>
<td>23</td>
<td>28.4</td>
<td>2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Table 7 shows the result on the perceived preference of users on green features relating to material use and conservation. From the table it can be observed that use of durable materials, attracting a mean value of 4.148 was ranked first; this is followed by use of materials that protect against local weather condition (mean value: 3.901). The use of natural and local
materials in construction attracted a mean value of 3.173 and was ranked least in this category. It is observed from this result that features like use of CFC-free, recyclable and natural/local materials that were ranked low by the surveyors are features whose immediate benefits (cost saving, health benefits, etc.) are not easily traceable by the users as they are less familiar with some of the features. This implies that the practitioners, based on users’ observation over time, are of the opinion that users’ housing choices are better influenced by their perceptions on the short term benefits derivable from building use and operation. Also, to engender widespread embrace of these features, efforts should be directed towards awareness creation on their benefits, especially the need to value the long run advantages.

Table 8: Examination of perceived preference for green features across the categories

| Building Features                                      | NAP | NP | SP  | P   | VP | Total | F               | %    | F         | %    | F         | %    | F         | %    | F         | %    | F         | MeanRPI | R       |
|--------------------------------------------------------|-----|----|-----|-----|----|-------|-----------------|------|-----------|------|-----------|------|-----------|------|-----------|--------|---------|
| Indoor air climate                                      | 0   | 0  | 30  | 174 | 117| 486   | 0               | 0    | 6.183     | 117  | 24.07     | 199  | 40.97     | 140  | 28.82     | 3.924  | 0.7847  |
| Site selection, site design and landscape ecology       | 0   | 0  | 48  | 3.6125365  | 27.712571854.426518814.2313193.7920.7582  | 2    | 3.63125365  | 27.712571854.426518814.2313193.7920.7582  | 2    | 3.792     | 0.7498 |
| Energy conservation                                     | 0   | 0  | 4   | 0.48 | 29736.2| 44253.84 | 77 9.48 820 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 | 3.7230.7464 |

In Table 8, the response of the Estate surveyors is examined across the categories of green features and compared relative to each other. From the table, it is observed that indoor air climate attracts a mean value of 3.924 and is the perceived to be the most preferred features by the users. The higher rating on this feature is traceable to the Estate Surveyors’ observations on the priority being given to indoor air condition by users. This is perhaps due to the continuous connection of building occupants to the atmosphere; thus, any alteration to its quality is likely to have quick and direct impact on the occupant (their health, comfort, productivity, etc.). The next ranked feature is site selection, site design and landscape ecology (3.792) followed by “building ecology, waste and recycling” (3.749), energy conservation (3.723), owner and occupant education (3.722), water, rainwater and sewage (3.677) and material use and conservation (3.672). As can be observed from this result, most mean values (apart from the mean value on the feature that was ranked first) were very close and none of the features attracted mean values that is less than 3.6; this implies
that the Estate Surveyors, based on their experience with users, are of the opinion that all aspects of green features indicated are likely to be embraced by the users.

CONCLUSION

Based on the observations of the Estate surveyors in practise, users’ need for green building features is apparent; it is however revealed also that occupant comfort in use is a primary consideration by users in the choice of green building features. This implies that users are likely to be hesitant in the choice of green features if a higher extent of inconvenience/difficulty in use (relative to what is obtainable in the conventional substitute) is perceived. Adequate attention should therefore be given to users’ comfort in green building design in Nigeria if widespread users’ embrace is to be achieved. In addition, the result shows that users were perceived to attach less preference to features whose immediate benefits are not readily noticeable; particularly, features that confer more of environmental benefits. Hence, there is need for increasing sensitisation on the practical implications of conscious environmental considerations in the choice of building features and particularly, the need to value the long-term benefits accruable from green practises. Also, as it is difficult, getting users to adopt green practises when they are not familiar with the benefits accruable, efforts should be tailored towards intimating users with green building features and the benefits accruable in the use of green features in homes. This will help improve on users’ orientation and enhance the spread of sustainable practises in Nigeria.

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PERFORMANCE LEVEL OF ACCURACY MEASURING METHODS IN CLASSIFIED REMOTE SENSING IMAGES AS APPLIED TO THE BUILT ENVIRONMENT

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Assessing the accuracy of a classified image is an essential task that gives the user apriori information of the overall reliability of subsequent analysis performed with such classification methods. This research seeks to carry out an assessment of the accuracy measure for evaluating the integrity of the result of image classification using the overall accuracy and the Confusion Matrix. The effect of the size of the defined training site on the accuracy of the resulting classified image has also been examined. LandSAT image of part of South Western Nigeria was used in this study with three different classification methods (Maximum Likelihood, Mahalanobis distance and minimum distance Classifiers). The results obtained shows that the use of the confusion matrix gives a better analysis of the level of reliability of the classification than the use of chance adjusted indices or overall accuracy.

Keywords: accuracy measure, confusion matrix, image classification, spectral class, training site

INTRODUCTION

Generally, Image classification involves computer based techniques for separating multiple features within an image into distinct classes each with homogeneous characteristics. It group pixels into different land spectral classes to represent different land cover features. It is primarily aimed at enhancing the ability to discriminate multiple objects from each other within an image, based on earlier assigned similarity levels to features with homogeneous characteristics. Image classification is

classified into Supervised Image Classification, Unsupervised Image Classification and Object-based image analysis.

Image classification is used by professionals within the built environment as a fundamental operation prior to such applications which range from Urban Sprawl investigation, Modeling land use dynamics, investigating crop health/yield in largely forested areas (Francesco et al, 2014, Jones et al, 2008), change detection etc.

Considering therefore the enormous areas of application to which image classification serves as basis (Campbell, 2002) and the many classification techniques available for such operations (Liu et al 2002, Ozesmi and Bauer 2002, Dean and Smith 2003, Pal and Mather 2003); the need for assessment of the accuracy of the entire classification process cannot be over emphasized Lu and Weng (2007) Jipsa and Karunakaran (2012) and Pooja et al, (2013) gave a survey of existing image classification approaches and techniques while Nur et al (2015) compared image classification techniques using CalTech 101 Dataset.

Conventionally, Pixel based image classification accuracy assessment is done using either chance adjusted indices (such as the kappa co-efficient, tau co-efficient etc.), the overall accuracy measure or the confusion matrix (user and producer accuracies). In recent times however, despite its universal patronage, the use of chance-adjusted indices as accuracy measure in image classification has been greatly criticized as the degree of chance agreement may be over-estimated (Shiguo and Desheng 2011).

The overall accuracy on the other hand also suffers defect in the event when multiple classes are being classified as the accuracy in classification of various classes differ one from another. This has therefore raised much research interest in the need for more reliable indicators of accuracy estimate of which the confusion matrix appears to be a preferred option. Another research concern in recent times is determining the effect of choice of classifier technique (Akgun et al, 2004) and size of defined training site on the result of image classification.

In this paper, three different image classification techniques (Maximum likelihood, Mahalanobis distance and Minimum distance) were used to classify a Landsat Image covering part of South West Nigeria. The level of accuracy of the classification results was then assessed using three methods (Kappa co-efficient, the overall accuracy, the confusion matrix). Also, an attempt has been made to investigate the effect of the size of defined training sites on the resultant accuracy of the image classification.

BACKGROUND OF THE STUDY

A brief and concise description of the underlying mathematical algorithms or models behind the image classification techniques and accuracy assessments used in this research are herein presented. Though not mathematically exhaustive, the basic formulae are stated and further references given:
**Maximum likelihood classifier**
The maximum likelihood classifier is a supervised classifier that assumes that the distribution of data within a given class “i” obeys a multivariate Gaussian distribution. Derived from the Bayes theorem which states that the a posteriori distribution (\(P(i|\omega)\)) i.e the probability that a pixel with feature vector \(\omega\) belongs to class i is given by (Asmala and Shaun 2012) in (1):

\[
P(i|\omega) = \frac{P(\omega|i)P(i)}{P(\omega)}
\] (1)

**Mahalanobis distance classifier**
The Mahalanobis distance classifier is best used in cases where there is no correlation between the axes in feature space. The mahalanobis distance with variance-covariance matrix is given as (2):

\[
d_k = (X - \mu_k)^T \Sigma_k^{-1} (X - \mu_k)
\] (2)

*where:*
- \(X = \text{Vector of image data (n bands)}\)
- \(\mu_k = \text{mean of kth class}\)
- \(\Sigma_k = \text{Variance – covariance matrix}\)

\[
\Sigma_k = \begin{bmatrix}
\sigma_{11} & \sigma_{12} & \cdots & \sigma_{1n} \\
\sigma_{21} & \sigma_{22} & \cdots & \sigma_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{n1} & \sigma_{n2} & \cdots & \sigma_{nn}
\end{bmatrix}
\]

**Minimum distance classifier**
Generally, minimum distance classifiers are used to classify unknown image data to classes which minimize the distance between the image data and the class in the multi feature space. The mahalanobis distance classifier is a variant form of the minimum distance.

\[
d_k = (X - \mu_k)^T (X - \mu_k)
\] (3)

**Accuracy assessment algorithms**
The accuracy of a classification is usually assessed by comparing the classification with some reference data that is believed to accurately reflect the true land-cover. Sources of reference data include among other things ground truth, higher resolution satellite images, and maps derived from aerial photo interpretation (http://www.yale.edu). Once an error matrix is generated, the elements of the matrix could be used for computation of accuracy assessment parameters as given by (Asmala and Shaun 2012) in (4), (5) and (6).
Kappa Co-efficient \( (k) = \frac{\sum_{i=1}^{Q} c_{ii} - \frac{\sum_{i=1}^{Q} c_{ii}}{Q} \sum_{j=1}^{Q} c_{ij} c_{jj}}{1 - \sum_{j=1}^{Q} \frac{c_{ij} c_{jj}}{Q^2}} \)  

Where:  
\( c_{aa} = \text{element at position ath row and ath column} \)  
\( c_{ia} = \text{Column Sum} \)  
\( c_{ia} = \text{Row Sum} \)

Overall Accuracy = \( \frac{\sum_{i=1}^{Q} c_{ii}}{Q} \)  
User Accuracy = \( \frac{c_{ii}}{c_{i*}} \times 100\% \)

Producer Accuracy = \( \frac{c_{ii}}{c_{ii}} \times 100\% \)

STUDY AREA

The study area is part of south western Nigeria comprising of Lagos State, Ogun State and Part of Oyo State. The area studied covers an area of about 34,000 Sq.Km extending across various natural and artificial features such as to allow for analysis of the behavior of different classifiers for different earth surface feature class.

RESEARCH METHOD

Landsat image of the study area was obtained and classified using three different image classification techniques (maximum likelihood classifier, mahalanobis distance classifier and the minimum distance classifier). After the acquisition of the Landsat imageries and prior to the image classification, a true colour composite was first generated from the image bands 1, 2 and 3 to aid easy identification of the feature classes. This true colour composite map was then used in defining the training sites that was used for the image classification.

Five feature classes were identified and created namely:

Vegetation (2) Water Body (3) Bare Ground (4) Built Up and (5) Mangroove.

In order to assess the effect of the size of training site, two classifications were done with each of the earlier stated classifiers herein grouped as classification 1 and classification 2.

The training site region specified for classification 1 being smaller than that specified for classification 2. After the image classifications have been done, the ground truth regions were then identified on the true composite and saved as a separate region of interest ensuring that the ground truth sites were completely independent of the training site used for either classification 1 or 2 respectively.

The results obtained from the classifications were then compared with ground truth region of interest in a post classification process via the
generation of a confusion matrix (error matrix) from where all the accuracy measure used in this research was extracted.

The ENVI 4.7 Image processing software was used for the image classification and analysis and the results obtained are as presented in section 6.0 and further discussed in section 7.0.

A sequence of the steps followed are as listed:

(a) Acquire LandSat Image bands 1, 2 and 3
(b) With the image bands, develop a True Colour composite
(c) Define training sites for each feature class
(d) Perform image classification using the three (3) different image classifiers
(e) Perform a post classification analysis and generate the confusion matrix.

RESULTS

Shown in Figure 2(a – d) is the true composite map of the study area and the results obtained from the three different classification approaches using a small – sized training site hereafter called classification 1. Figure 3(a – d) however presents same results but with a larger sized training site hereafter called classification 2. Tables 1(a and b) presents a summarized analysis of the accuracy level of the three (3) classifiers using the two specified training site sizes (Classification 1 and 2). The full confusion matrixes for each of the classifier technique used in the two (2) classifications are presented in the appendix.
Table 1(a): Summary of accuracy Level obtained From the Three (3) Classifiers when a small Training Site region was used (CLASSIFICATION 1) showing the Kappa co-efficient, Overall Accuracy and User accuracy (Per class).

### Minimal Training Site Specified (CLASSIFICATION 1)

<table>
<thead>
<tr>
<th>CLASSIFICATION TYPE / Accuracy Parameters</th>
<th>Kappa Co-efficient</th>
<th>Overall Accuracy</th>
<th>Vegetation</th>
<th>Bare Ground</th>
<th>Mangrove</th>
<th>Built Up</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Likelihood</td>
<td>0.57%</td>
<td>69.97%</td>
<td>1.03%</td>
<td>14.38%</td>
<td>2.18%</td>
<td>92.51%</td>
<td>92.30%</td>
</tr>
<tr>
<td>Mahalanobis</td>
<td>0.17%</td>
<td>45.15%</td>
<td>15.74%</td>
<td>21.36%</td>
<td>2.72%</td>
<td>58.54%</td>
<td>41.72%</td>
</tr>
<tr>
<td>Minimum Distance</td>
<td>0.81%</td>
<td>87.29%</td>
<td>97.57%</td>
<td>61.59%</td>
<td>26.89%</td>
<td>87.21%</td>
<td>99.06%</td>
</tr>
</tbody>
</table>

Table 1(b): Summary of accuracy Level obtained From the Three (3) Classifiers when a large Training Site region was used
Increased Training Site Specified (CLASSIFICATION 2)

<table>
<thead>
<tr>
<th>CLASSIFICATION TYPE / Accuracy Parameters</th>
<th>Kappa Co-efficient</th>
<th>Overall Accuracy</th>
<th>Vegetation</th>
<th>Bare Ground</th>
<th>Mangrove</th>
<th>Built Up</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Likelihood</td>
<td>0.81%</td>
<td>87.34%</td>
<td>95.73%</td>
<td>51.05%</td>
<td>25.29%</td>
<td>88.20%</td>
<td>99.60%</td>
</tr>
<tr>
<td>Mahalanobis</td>
<td>0.79%</td>
<td>85.98%</td>
<td>97.58%</td>
<td>58.88%</td>
<td>21.12%</td>
<td>87.85%</td>
<td>98.07%</td>
</tr>
<tr>
<td>Minimum Distance</td>
<td>0.88%</td>
<td>91.86%</td>
<td>98.08%</td>
<td>75.42%</td>
<td>63.81%</td>
<td>88.50%</td>
<td>98.65%</td>
</tr>
</tbody>
</table>

DISCUSSION OF RESULTS

Visual examination of Figures 1(b – d) in comparison to Figure 1(a) reveals that the minimum distance classifier gave the closest result to the true ground situation when a small size training site is used for the classification. The next in accuracy being the maximum likelihood while the mahalanobis distance classifier gave the least visually appealing output. Similarly, visual examination of the results of classification 2 also follow similar trend. These visually ascertainable results are further supported by the values obtained from the accuracy assessment results excerpts presented in tables 1 (a and b).

However, Tables 1 (a and b) justified the advantage of the use of the error matrix derived User accuracies over the conventional Kappa co-efficient and overall accuracy as the user is able to ascertain to a reasonable extent the confidence interval of the accuracy of a particular feature over other classes before using the image for further analysis.

For instance, in classification 1 and 2, although the overall accuracy and kappa co-efficient of maximum likelihood is more than that of mahalanobis distance classifier, the accuracy of the latter in classifying vegetation and bare ground exceeds that of the former. Therefore though the overall accuracy is lower, a user of such a classified image who is interested in vegetation or bare ground class would prefer to use the mahalanobis classifier rather than the maximum likelihood.

As it is seen from the user accuracy assessment that the accuracy of mahalanobis in classifying Vegetation and Bare Ground feature classes is consistently higher than that of the maximum likelihood in both classifications, it may be possible to further infer that the Mahalanobis distance is a better classifier for these classes than the Maximum likelihood. Further research is however recommended to validate this finding.

Finally, the summarized results presented above also shows that the accuracy of any classification technique is improved by large sized training
sites therefore the “Larger the size of the training site, the better the classification Results”

CONCLUSION

From the discoveries made in this research, it can be affirmed that using kappa-coefficient and its overall accuracy alone as a means of evaluating accuracy measure of remote sensing image classification may not be absolutely reliable. Also, it has been identified that the larger the size of the training site, the better the resulting classified image obtained and that the mahalanobis classifier is better suited for vegetation and bare ground classes than the maximum likelihood classifier.

It is therefore recommended that image classification result assessment should be based on the use of confusion matrix results (Producer and User accuracy) rather than solely depending on the overall accuracy or the kappa co-efficient.

REFERENCES

AKGÜN A, Eronat A. H and Turk N (2004); Comparing different satellite image classification methods: An application in Ayvalik District, Western Turkey.


Campbell, J. B (2002); Introduction to remote Sensing, Taylors and Francis, London.


APPENDIX (ERROR MATRIX)
(Classification 1)

(a) MAXIMUM LIKELIHOOD CLASSIFIER:

Overall Accuracy = (83870/119973) 69.9074%
Kappa Coefficient = 0.5670

Ground Truth (Percent) (Confusion Matrix)

<table>
<thead>
<tr>
<th>Class</th>
<th>Vegetation</th>
<th>Mangroove</th>
<th>Built Up</th>
<th>Water</th>
<th>Bare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Unclassified</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Vegetation [G]</td>
<td>0.09</td>
<td>40.94</td>
<td>0.00</td>
<td>1.21</td>
<td>0.57</td>
</tr>
<tr>
<td>Mangroove [Ye]</td>
<td>99.91</td>
<td>14.13</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
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<tr>
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<td>0.00</td>
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PERCENTAGE ERROR

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<tr>
<th>Class</th>
<th>Commission (Percent)</th>
<th>Omission (Percent)</th>
<th>Commission (Pixels)</th>
<th>Omission (Pixels)</th>
</tr>
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<tbody>
<tr>
<td>Vegetation [G]</td>
<td>98.97</td>
<td>99.91</td>
<td>1924/1944</td>
<td>22231/22251</td>
</tr>
<tr>
<td>Mangroove [Ye]</td>
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<td>85.87</td>
<td>22231/22726</td>
<td>3008/3503</td>
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<tr>
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<td>7.49</td>
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<td>4123/55042</td>
<td>1816/52735</td>
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<td>1047/1919</td>
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ACCURACY ASSESSMENT

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</thead>
<tbody>
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<td>20/1944</td>
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<td>495/3503</td>
<td>495/22726</td>
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<td>Built Up [Red]</td>
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<td>92.51</td>
<td>50919/55042</td>
<td>50919/52735</td>
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<td>Water [Blue]</td>
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<td>92.30</td>
<td>31564/34198</td>
<td>31564/39565</td>
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(b) MAHALANOBIS CLASSIFIER:

Overall Accuracy = (54163/119973) 45.1460%
Suleyman et al.

Kappa Coefficient = 0.1681

### Ground Truth (Percent) (Confusion Matrix)

<table>
<thead>
<tr>
<th>Class</th>
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<th>Mangrove</th>
<th>Built Up</th>
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<td>0.00</td>
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</tr>
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<td>0.00</td>
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<tr>
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</tr>
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### PERCENTAGE ERROR

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<th>Commission</th>
<th>Omission</th>
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<td>Mangrove [Ye]</td>
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<td>21457/22058</td>
<td>2902/3503</td>
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### ACCURACY ASSESSMENT

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<tbody>
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<td>50721/86639</td>
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<tr>
<td>Vegetation [G]</td>
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<td>15.74</td>
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<td>795/5051</td>
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(c) MINIMUM DISTANCE CLASSIFIER

Overall Accuracy = (104726/119973) 87.2913%
Kappa Coefficient = 0.8097
### Ground Truth (Percent) (Confusion Matrix)

<table>
<thead>
<tr>
<th>Class</th>
<th>Vegetation</th>
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<th>Mangroove</th>
<th>Built Up</th>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>Water [Blue]</td>
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<tr>
<td>Bare Ground [Ma]</td>
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<td>19.70</td>
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<td>15.09</td>
<td>0.94</td>
<td>62.89</td>
<td>0.00</td>
</tr>
<tr>
<td>Built Up [Red]</td>
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### PERCENTAGE ERROR

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<th>Omission (Pixels)</th>
<th>Commission (Pixels)</th>
<th>Omission (Percent)</th>
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<tbody>
<tr>
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<td>22247/22251</td>
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<tr>
<td>Water [Blue]</td>
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<td>250/26689</td>
<td>13126/39565</td>
<td>33.18</td>
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<tr>
<td>Bare Ground [Ma]</td>
<td>38.41</td>
<td>726/1890</td>
<td>755/1919</td>
<td>60.66</td>
</tr>
<tr>
<td>Mangroove [Ye]</td>
<td>73.11</td>
<td>5989/8192</td>
<td>300/3503</td>
<td>1.60</td>
</tr>
<tr>
<td>Built Up [Red]</td>
<td>12.79</td>
<td>7728/60401</td>
<td>62/52735</td>
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### ACCURACY ACCESSMENT

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<thead>
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<tbody>
<tr>
<td>Vegetation [G]</td>
<td>99.98</td>
<td>97.57</td>
<td>22247/22251</td>
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</tr>
<tr>
<td>Water [Blue]</td>
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<td>26439/39565</td>
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<tr>
<td>Bare Ground [Ma]</td>
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<td>1164/1919</td>
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<tr>
<td>Mangroove [Ye]</td>
<td>62.89</td>
<td>26.89</td>
<td>2203/3503</td>
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</tr>
<tr>
<td>Built Up [Red]</td>
<td>99.88</td>
<td>87.21</td>
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### (CLASSIFICATION 2)

(a) MAXIMUM LIKELIHOOD CLASSIFIER:

Overall Accuracy = (104786/119973) 87.3413%
Kappa Coefficient = 0.8113

### Ground Truth (Percent) (Confusion Matrix)

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<tr>
<th>Class</th>
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<th>Mangroove</th>
<th>Water</th>
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<td>0.00</td>
<td>0.21</td>
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### PERCENTAGE ERROR

<table>
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<tr>
<th>Class</th>
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<th>Commission</th>
<th>Omission</th>
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<tr>
<td>Vegetation [G]</td>
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<td>4/22251</td>
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<tr>
<td>Water [Blue]</td>
<td>0.94</td>
<td>250/26689</td>
<td>13126/39565</td>
<td>33.18</td>
</tr>
<tr>
<td>Bare Ground [Ma]</td>
<td>38.41</td>
<td>726/1890</td>
<td>755/1919</td>
<td>60.66</td>
</tr>
<tr>
<td>Mangroove [Ye]</td>
<td>73.11</td>
<td>5989/8192</td>
<td>300/3503</td>
<td>1.60</td>
</tr>
<tr>
<td>Built Up [Red]</td>
<td>12.79</td>
<td>7728/60401</td>
<td>62/52735</td>
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</table>
Suleyman et al.

<table>
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</thead>
<tbody>
<tr>
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<td>52295/59291</td>
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(b) MAHALANOBS CLASSIFIER:
Overall Accuracy = (103158/119973) 85.9843%
Kappa Coefficient = 0.7919

Ground Truth (Percent) (Confusion Matrix)

<table>
<thead>
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<th>Mangrove</th>
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PERCENTAGE ERROR

<table>
<thead>
<tr>
<th>Class</th>
<th>Commission (Percent)</th>
<th>Omission (Percent)</th>
<th>Commission (Pixels)</th>
<th>Omission (Pixels)</th>
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<td>7319/9279</td>
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ACCURACY ACCESSMENT

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<tr>
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<tr>
<td>Vegetation [G]</td>
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<td></td>
</tr>
<tr>
<td>Bare Ground [Ma]</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Mangrove [Ye]</td>
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<tr>
<td>Water [Blue]</td>
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</table>
(c) MINIMUM DISTANCE CLASSIFIER
Overall Accuracy = (110210/119973) 91.8623%
Kappa Coefficient = 0.8767

<table>
<thead>
<tr>
<th>Class</th>
<th>Ground Truth (Percent)</th>
<th>Confusion Matrix</th>
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<tbody>
<tr>
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<td>Water [Blue]</td>
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PERCENTAGE ERROR

<table>
<thead>
<tr>
<th>Class</th>
<th>Commission (Percent)</th>
<th>Omission (Percent)</th>
<th>Commission (Pixels)</th>
<th>Omission (Pixels)</th>
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<tbody>
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<td>589/2386</td>
<td>112/1919</td>
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<tr>
<td>Mangrove</td>
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<td>1522/4206</td>
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</tr>
<tr>
<td>Built Up</td>
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<td>0.91</td>
<td>6790/59046</td>
<td></td>
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<tr>
<td>Water</td>
<td>1.35</td>
<td>20.55</td>
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</table>

ACCURACY ASSESSMENT

<table>
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<tr>
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<td>88.50</td>
<td>52256/52735</td>
<td>52256/59046</td>
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<tr>
<td>Water</td>
<td>79.45</td>
<td>98.65</td>
<td>31436/39565</td>
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</tbody>
</table>
PERFORMANCE OF PRIVATE SECTOR PARTICIPATION IN SOLID WASTE COLLECTION: A POLYCENTRIC PLANNING PERSPECTIVE

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The inability of public authorities in charge of waste management to effectively perform their responsibility in waste collection has led to the adoption of Private Sector Participation (PSP) initiatives. A study was conducted to ascertain the performance of PSP in waste collection taking into cognizance the aspirations, expectations and perspectives of the citizens and the role of the government. Data were collected from 159 households sampled across three areas in Osogbo – core, intermediate and newly developing areas. Results show that the majority of the respondents (80.5%) subscribed to the private waste collectors, while others still employ crude and environmentally degrading methods such as: dumping on roadsides and water channels (3.2%) and burning (13.1%). Most of the respondents (47.4%) rated the PSP efficient, while another 20.1% rated it very efficient. Further findings show that 79.2% of the respondents confirmed the consistency and reliability of the PSP in waste collection. In spite of the laudable achievement of the PSP, political factor discouraged private collectors that had been in the business for about 8 years before governmental intervention. They were economically disempowered and government action is viewed to be paradoxical to its objective of using PSP to create jobs for citizens. The study suggests policy template that can enable government to facilitate rather than strangulate the private sector initiatives in waste collection in the city and the entire Osun State. Using African Polycentric Information Networking (APIN) and African Polycentric Public-Private Solid Waste Management Model (APPPSWM), this paper designs institutional mechanisms for involving the stakeholders/grassroots in waste collection through public enlightenment, necessary to bring the people to the level of public officials so that a common-thought between the three groups can be established.

Keywords: Nigeria, performance, polycentric planning, private sector, waste collection

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INTRODUCTION

The Institutional Analysis and Development (IAD) framework was used to appraise the performance of Private Sector Participation (PSP) initiatives in solid waste collection in Osogbo, the state capital of Osun State, Nigeria. The rapid growing urban population that culminates into a high rate of solid waste generation, over the years, has greatly out-grown the rate of collection and disposal in cities of developing world, Nigeria inclusive, while public authorities that were charged with the responsibility of waste management have not produced expected results for healthy and livable environment. That is why Akinbamijo (2006:72) points out that waste management is one of the most visible management crises in Nigerian cities today. He attributes the culture of indiscriminate dumping of waste to the inadequate public awareness and the lack of better option for waste management (Akinbamijo, 2006:73). Out of necessity, the private sector has been responding to the challenge posed by waste management in Nigeria and in recent times has attained some level of competence.

Realizing the obvious inadequacy and inefficiency of waste management agencies in Nigerian cities and, in quest of a lasting solution to the menace of solid waste, the Private Sector Participation (PSP) initiatives in waste management was initiated in 2000 in Lagos State. According to Ramamurti (1993), developing countries are finding new ways of harnessing the participation of private sector in achieving specific objectives of realizing the original promise of state-owned enterprises. Similarly, Akinola and Salawu (2002:82) while making references to countries like Germany, Switzerland, Japan, Great Britain, United States and Canada brought to light the idea that the privatization of government enterprises especially in waste management is a progressive concept. In the same vein, Egunjobi (1986) and Mandel (2009:113) confirm that the private sector is a very important player in goods and service provision and economist gives it priority than governments. It is believed that the government plays a more befitting role when they assume the duty of protecting the interest of the public by regulating the activities of the private sector through enforcement of laws and regulations (Mandel, 2009:113). The above discussion explains the adoption of privatisation as an approach for the collection of solid waste in Osogbo, the state capital of Osun State, Nigeria. In 2013, the Osun State Government established Osun State Waste Management Agency (OWMA) under Private Sector Participation (PSP) programme.

Using the Institutional Analysis and Development (IAD) framework, this study employed empirical data to appraise the performance of private sector participation (PSP) in solid waste collection in Osogbo. This study ascertained the level of satisfaction that residents derive from private sector operators in the waste collection taking into cognizance the aspirations, expectations and perspectives of the citizens and the role of the government. In order to achieve the aim, two objectives are set: (1) To determine the effectiveness and efficiency of private sector waste collectors
using the customer’s perspective; and (2) To examine the role played by the government in monitoring and regulating the activities of the private sector waste collectors in Osogbo.

The IAD framework is rooted in the theories of collective action and suggests 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).

The IAD framework produced polycentric planning, which 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, 2010a:58, 2011a:7).

The point of departure of this paper, therefore, is in problem solving and solution seeking. Using African Polycentric Information Networking (APIN) and African Polycentric Public-Private Solid Waste Management Model (APPSSWM), this paper designs institutional mechanisms for involving the stakeholders/grassroots in waste collection through public enlightenment, necessary to bring the people to the level of public officials and private sector so that a common-thought between the three groups can be established. The paper adopts traducture\(^2\) (wa Goro, 2007) as a new concept in development planning and in executing public enlightenment campaigns on waste collection by exploring several possible means and avenues that the people are familiar with in conveying waste management endogenous knowledge to stakeholders.

**THEORETICAL UNDERPINNING: INSTITUTIONAL ANALYSIS OF WASTE MANAGEMENT**

In order to contextualise the line of analysis in this paper, polycentric planning, an off-shoot of the Institutional Analysis and Development (IAD) framework is adopted. Institutional analysis helps us to better understand how individuals within communities, organizations and societies craft rules and organize the rule-ordered relationships in which they live their lives (Sawyer, 2005:3). Polycentric planning recognizes the fundamental defects in the centralist model of planning and the persistence failure of the state to meet the collective yearnings and aspirations of the citizenry. As a result, polycentric planning has called attention to the self-organising capabilities of the people that are rooted in collective action at community

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\(^2\) Traducture is defined as the explorations of several possible means of conveying knowledge-based development issues to stakeholders instead of relying on translation of words alone (wa Goro, 2007).
level. This line of thought recognizes that human beings can plan, organize and govern themselves based on appropriate institutional arrangements and mutual agreements in a community of understanding. The IAD believes in institutional arrangement designed by people who cooperate based on rules and constitution of their choice, and thereby are able to resolve socio-economic and techno-political problems which other people (external to their conditions) are not capable of doing for them.

The power of collectivity and joint efforts among the people are based on contractual relationships, building of trust and reciprocity in their day-to-day existence. For example, there are indications that all the LGs in Lagos State practised organised public method of waste disposal, however, with serious constraints and setbacks. One of the problems had to do with the distance of the collection points to the houses they supposed to serve. Households at far distances found it difficult or unwilling to go the long distance to dump waste, hence, they often resort to using either private or illegal method (Akinola 2000:35). Similarly, the poverty stricken people in the high density residential areas resorted to indiscriminate dumping of waste in any available vacant plots of land, sidewalks, roadway, streams, rivers, channels and drainages (Omoleke 2004:271).

The different types of waste identified by Agrawal, et. al. (2002:281) have different impact when they are not properly disposed. Such wastes are: (a) Food wastes which include: animal remains and fruit or vegetable residues. (b) Rubbish which include: combustible – paper, cardboard, plastics, textiles, rubber, leather, wood, furniture and garden trimmings and non-combustible – glass, crockery, tin cans, aluminum cans, ferrous and non-ferrous metal, dirt and construction wastes. (c) Ashes and residue which refers to remains from burning of combustible materials. (d) Special wastes which include: street sweeping, roadside litter, catch-basin debris, dead animals and abandoned vehicles. (e) Domestic waste include that from domestic premises, caravan sites, residential homes, etc.

Agrawal, et. al. (2002) observes that since waste cannot be continuously removed, it has to be stored and transported quickly at specific intervals. Attah (2012) describes waste management to simply mean “the collection, keeping, treatment and disposal of waste in such a way to render them harmless to human and animal life, the ecology and environment generally. In case of inadequate cooperation of residents and inefficiency in collection of waste, problem arise due to accumulation of wastes leading to odour, proliferation of flies, mosquitoes, disease pathogens and other vectors leading to transfer of infections – sources of threat to the health of the general public. Similarly, uncollected waste acted as breeding ground for vectors like rats that were noted for different types of diseases, including cholera and typhoid, as well as a number of deaths from leptospirosis, a disease spread through rat urine (Akinola 2000:36; Agrawal, et. al. 2002:295).

Agrawal, et. al. (2002:295) outlined the following basic collection systems: (a) Shared container: - residents and other generators put their waste
inside a container which is emptied or removed. (b) Block collection: collectors sound horn or rings bell and waits at specified locations for residents to bring waste to the collection vehicle. (c) Kerbside collection: waste is left outside the premises in a container and picked up by passing waste collection vehicle or swept up and collected by sweepers. (d) Door to door collection: waste collector knocks on each door and rings doorbell and waits for waste to be brought out by residents. (e) Yard collection: collection laborer enters property to remove waste.

Disposal of waste into water bodies, open dumps, and poorly designed landfills is a principal cause of surface water and groundwater contamination (World Resources, 1997:70). Other effects of solid waste generation include pollution of air and land, unsightly scene, a threat to the public health, epidemics, and blockage of drains and river channels. For example, the presence of waste management problems in Nigeria has been established over the years through empirical studies (Egunjobi 1986; Akinola 2000; Akinola and Salawu 2002). These studies have established that some of the waste management problems experienced in Nigeria stems down from bad governance, failure to develop community-based initiatives and lack of awareness on the part of the public concerning the health implications of improper disposal of waste. Out of necessity, the private sector has been responding to the challenge posed by waste management in Nigeria and in recent times has attained some level of competence.

In spite of appalling performance of Nigerian state, Self-Governing Institutions3 (SGIs) or people-centred community institutions have through shared strategies provided answers to most local development questions which the state has been dodging over the years. For example, the intervention of diverse voluntary groups, from time to time, to hire private contractors in collecting and disposing solid waste as well as through the use of manual labour in declogging blocked drains and gutters helped to stem the tide of waste generated problems in Lagos (Akinola, 2000:37). Rather than waiting for the local government authorities, that are closest to them (and with a lot of money), the local people, through self-organizing and self-governing capabilities, have planned and executed several social services that directly touch the lives of their people across Nigeria and Africa (Wunsch and Olowu, 1995; Sawyer, 2005; Gellar, 2005; Tamuno, 2009; Akinola, 2008b, 2009b, 2010a, 2011a,b,c).

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3 A self-governing institution (SGI) is defined as an institution crafted by the people, without external interference, in an attempt to solve their common problems within their locality or community. It is also called a people-oriented, people-centered, or community-based institution (E. Ostrom 1990, 1999; E. Ostrom, J. Walker, and R. Gardner 1992; Wunsch and Olowu 1995; McGinnis 1999; V. Ostrom 1994, 1997, 2000; Ayo 2002; V. Ostrom and E. Ostrom 2003; Olowu and Wunsch 2004; Akinola 2005d; Sawyer 2005). These institutions, on the basis of their origins, are classified into two broad categories: indigenous and endogenous (see for details, Akinola 2008b:95; 2009b:87).
Indications from Ghana, Kenya, Senegal and South Africa corroborate the findings in Nigeria (Hodgkin, 1957; Wallerstein, 1964; Galvin, 1999, Galvin, 2010: 342-343; Higgs, 2004; Kew, 2004:128; Gellar, 2005:94-98, 100-106; Akinola, 2011a:31-32). According to Osumanu, et. al. (2010:1) People’s Dialogue Ghana (PDG) in Ghana’s urban areas is a community-based NGO that works in partnership with the Ghana Homeless People’s Federation to find permanent solutions to urban poverty through the improvement of human settlements, waste management and shelter conditions. Since its formation in 2003, PDG has been working in slums and informal settlements in Accra, Tema, Kumasi, Takoradi, Afram Plains, etc (Osumanu, et. al., 2010:12-13). These examples provide a basis for better understanding of how to identify and build upon local initiatives that are likely to improve water, sanitation services and waste management. Local people have been able to consider various possible alternatives to many current coping and management strategies, especially revitalizing public dialogue that has been missing for many years.

Following the example of Lagos Waste Management Agency (LAWMA) and in quest of a lasting solution to the menace of solid waste, the Osun State Government adopted PSP programme in 2013. In view of the fact that some local people had commenced private waste collection about ten years ago before the commencement of government initiated PSP, the critical question borders on the type of relationship between government and previous private collectors and the citizens. How are rules governing private waste collection made? Are citizens and PSP involved in rules making?

This study ascertained the performance of PSP by examining the level of satisfaction that residents derive from private sector operators in the waste collection taking into cognizance the aspirations, expectations and perspectives of the citizens and the role of the government. In order to achieve the aim, two objectives are set: (1) To determine the effectiveness and efficiency of private sector waste collectors using the customer’s perspective; and (2) To examine the role played by the government in monitoring and regulating the activities of the private sector waste collectors in Osogbo. The next section discusses the methodology used for the study.

**METHODOLOGY**

The methodology used in this paper is the Institutional Analysis and Development (IAD) framework, which is a very powerful analytical tool for diagnosing problems and challenges in human society and for proffering possible solution (V. Ostrom and E. Ostrom, 2003). The IAD framework has three components - exogenous variables or context, action arena and evaluative criteria. Since society is a system of human cooperation, people in any society should collectively relate to and deal with their exogenous variables. This normally starts when people (participants) within an
Akinola

organization/community (action arena) respond to exogenous variables or context (biophysical/material conditions, cultural and other attributes of a community, and rules-in-use) by engaging in community projects/programmes – water supply, sanitation, electricity, roads, etc. When outcomes of the engagement on projects are positive the participants will increase their commitment to maintain the structure (system of operation) as it is or move to another set of exogenous variables and then on and on like that. However, if outcomes are negative, participants might raise some questions on why the outcomes are negative. They might then move to a different level and change their institutions to produce another set of interactions and consequently, different outcomes. It is important, however, that rules ‘crafters’ (designers) understand the interplay between actions and outcomes as the duo interlinked.

In the context of this paper, the participants/stakeholders are the private collectors of waste, the general public, whose wastes are being collected and the government agency (OWMA) in charge of regulating the activities of the waste collectors. The IAD framework emphasises collective action of stakeholders in deliberating on waste collection as it affects them in their environment. The action situation describes the identification of goals and strategies of how to achieve the set goals. The evaluative criteria describes how the stakeholders can come together to review their achievements.

This study focuses on the perception of the residents concerning their waste collection. This makes the IAD framework relevant to this study as it advocates for deliberation among all stakeholders in a community in achieving a set of goals (E. Ostrom, 1990). This study ascertained the performance of PSP by measuring the level of satisfaction that residents of Osogbo derive from private sector operators in the waste collection through questionnaire and interviews. Data were collected from the Osun State Waste Management Agency (OWMA) and private sector operators (both currently operating and those that are not in operation). A total of 154 questionnaires were administered on sampled households to measure their level of satisfaction. Stratified random sampling technique was employed in order to ensure the representation of different socio-economic groups in Osogbo. For this purpose, three areas/strata were identified in Osogbo and they include: (i) Core area - Oja Oba area. (ii) Intermediate area - Sabo, Gbonmi and Ayetoro. (iii) New area - Agunbelewo.

The respective numbers of identified streets in each area are: In the core area (Oja Oba area): 13 streets were identified and 5 streets were selected randomly. In the intermediate area (Gbonmi area/ Orita Sabo area/ Ayetoro area), it was discovered that Gbonmi area has 10 streets, Orita Sabo area has 8 streets and Ayetoro area has 9 streets. Gbonmi area (from 10 identified streets, 4 were chosen at random. Orita Sabo area (from the 8 identified streets, 4 streets were chosen at random). Ayetoro Area (from the 9 streets identified, 5 streets were randomly selected). In the new area (Agunbelewo), 11 streets were identified while 4 streets were selected randomly. A total of 154 questionnaires were administered. The private sector participants in waste collection in Osogbo was identified through
snowball sampling and then interviewed. Information concerning the regulatory role played by the government was also collected from the State Government’s agency in charge, OWMA. The data were analysed using frequency distribution and percentile method.

**DATA COLLECTION AND RESULTS**

Data analysis shows that the percentage of males (56.5) is more than females (43.5). The age groups 26-35 years and 36-45 years have the highest representation in the sample, 31.2% and 26.6% respectively. Other age groups represented in the sample include 18-25 years (25.3%), 46-55 years (15.6%) and 56-65 years (1.3%). Analysis further shows that literacy level in the sample is high as 45.5% and 44.2% of the respondents indicated that they had secondary and tertiary education respectively. These figures infer that the respondents are capable of making sound assessment of their conditions. Only 3.2% of the respondents had no formal education while 7.1% had primary school education. Analysis of the income of the respondents shows that the highest percentage (33.1%) has an income range of ₦10,100-₦20,000. This is relatively low but shows the economic status of the majority as represented in the sample.

**Table 1: Solid Waste Generation in Osogbo**

<table>
<thead>
<tr>
<th>Components of Waste</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food waste</td>
<td></td>
<td>19</td>
<td>12.3</td>
</tr>
<tr>
<td>Combustible rubbish</td>
<td></td>
<td>47</td>
<td>30.5</td>
</tr>
<tr>
<td>Non-combustible</td>
<td></td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>Ashes and residue</td>
<td></td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Garden trimmings</td>
<td></td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Combination of any of the above</td>
<td></td>
<td>82</td>
<td>53.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials used by the households in waste storage</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sack (e.g rice bag)</td>
<td></td>
<td>108</td>
<td>70.1</td>
</tr>
<tr>
<td>Nylon bags</td>
<td></td>
<td>27</td>
<td>17.5</td>
</tr>
<tr>
<td>Plastic containers and dustbins</td>
<td></td>
<td>19</td>
<td>12.3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source:** Field Survey, 2014

Table 1 displays data on waste generation in Osogbo in terms of components of waste and materials used by the households in waste storage. The major components of solid waste in Osogbo as indicated by the sample are combustible materials (30.5%). However, most of the respondents (53.2%) indicated that their waste comprises of a combination of the listed categories of waste. Nylon bags which have the advantage of its disposability receive little usage (17.5%) as indicated in Table 1. The use of sack in keeping waste is the most popular (70.1%) waste container.
in the city. Plastic containers and dustbins also receive only a 12.3% usage.

According to Table 2, majority of the respondents (80.5%) had subscribed to the PSP while others still employ crude and environmentally degrading methods such as; dumping on roadsides and water channels (3.2%), burning (13.1%) and burying (2.6%). From personal interviews with the respondents that are yet to subscribe to the services, they gave their reasons to include high cost of the service, unavailability of the service in their areas while some regard subscribing to the service as optional. Others claim that the waste collectors should not charge any price for their service as they believe they are government staff. Most of the respondents (52.6%) indicated that their waste gets collected only once in a week, 19.5% had their waste removed twice a week while 13.6% had their waste collected thrice in a week and only 2.6% and 1.3% had their waste removed daily and once in two weeks respectively.

Table 2: Methods of Household Waste Disposal and Frequency Collection

<table>
<thead>
<tr>
<th>Variables</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods of waste disposal</td>
<td>Dumping on roadsides and water channels</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Burning</td>
<td>20</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Burying</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Through the state's waste collectors (O'clean PSP)</td>
<td>124</td>
<td>80.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>153</td>
<td>99.4</td>
</tr>
<tr>
<td>No response</td>
<td></td>
<td>1</td>
<td>.6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of waste collection</td>
<td>Once</td>
<td>81</td>
<td>52.6</td>
</tr>
<tr>
<td></td>
<td>Twice</td>
<td>30</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>Thrice</td>
<td>21</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Once in two weeks</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>16</td>
<td>10.4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014

Further findings show that 48.1% of the respondents indicated that they had missed a collection schedule before while 41.6% claimed they have never missed the schedule. Most of the respondents from interviews indicated that there is a designated location on their premises where they usually leave their waste to be collected on collection days. The population that has missed collection may be attributed to unfair compound arrangement on some streets which may have deprived them of enough space to designate for waste collection. The respondents that acknowledged that they have missed collection day(s) indicated what
happened to the waste that was left behind. Some 56.8% claimed to have kept it for the next collection, 33% said they burned the waste, 4.5% dumped it at illegal dumpsites while 5.7% dumped it in the bush and water bodies.

Analysis also shows the price ranges of the amount the respondents pay for the service of waste removal. Most of the respondents (62.3%) pay within ₦401-₦600 while 11.3% claim to pay nothing to get their waste removed. The respondents that did not pay, from interviews, reveal that they usually carry their waste to the state’s own collection vehicles which is free.

### Table 3: Efficiency of the PSP

<table>
<thead>
<tr>
<th>Variables</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratings of the PSP</td>
<td>Not efficient</td>
<td>6</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Less efficient</td>
<td>7</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Fairly Efficient</td>
<td>21</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Efficient</td>
<td>73</td>
<td>47.4</td>
</tr>
<tr>
<td></td>
<td>Very Efficient</td>
<td>31</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>16</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>154</td>
<td>100.0</td>
</tr>
<tr>
<td>Consistency of the PSP in keeping appointments</td>
<td>No</td>
<td>16</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>122</td>
<td>79.2</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>16</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source: Field Survey, 2014**

Table 3 displays efficiency of the PSP in the study area. Most of the respondents (47.4%) rated the PSP as efficient and another 20.1% rated the PSP as very efficient. Only 13.6 percent rated the PSP fairly efficient while 4.5% and 3.9% rated the PSP less efficient and not efficient respectively. These ratings show that the service offered by the PSP in waste collection is mostly efficient. However from interview with some of the respondents, they claim that some of the staff of the PSP are less helpful as they are not usually willing to help with moving waste from the premises of the houses to their vehicle and complained when the household’s accumulated waste is more than the usual. Similarly, Table 3 shows the level of consistency of the PSP on designated collection days. 79.2% of the respondents indicated that there has never been a time the PSP staff in their area did not come to collect waste while only 10.4% acknowledged that the PSP might have missed one collection day or the other in their area.

According to Table 4, a total of 80.5% of the respondents claimed to have noticed improvement in their area since the PSP programme commenced while only 9.1% of the respondents indicated that they haven’t noticed any
improvement. The majority (36.4%) believe their area to be cleaner (reduced litter on roads); 7.8% observed that there has been reduced water lodging; 7.1% indicated that the occurrence of malaria sickness in their area has reduced; 6.5% observed that there is less odour; 3.2% indicated that there has been reduction in the occurrence of flooding. The summary is that most of the respondents are aware of changes around them and this proves that the removal of waste from households by PSP has yielded positive results.

Table 4: Effectiveness of the PSP

<table>
<thead>
<tr>
<th>Variables</th>
<th>Particulars</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation of improvements in the appearance of the residential environment</td>
<td>Yes</td>
<td>124</td>
<td>80.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>16</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>154</td>
<td>100.0</td>
</tr>
<tr>
<td>Description of the improvement</td>
<td>The area has been cleaner</td>
<td>56</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>Reduced occurrence of flooding</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Reduced cases of malaria sickness</td>
<td>11</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>Less water lodging</td>
<td>12</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>Reduced odour</td>
<td>10</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Combination of any of the above</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Not Applicable</td>
<td>55</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>154</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014

The Role of Osun State Waste Management Agency (OWMA)

The PSP programme which was initiated in 2013 was designed for job creation, empowering the people, maintaining a clean environment and also generating revenue for the government. Interested applicant purchased an application form at the price of ₦50,000. A non-refundable fee of ₦1 million was deposited by the successful PSP applicant after which a waste collection truck was given to the applicant for the operation. The ₦1 million serves as security for the waste collection vehicle. The PSP are still financially obliged to the state government but the actual price and total amount to be paid for the full purchase of the vehicle remains unclear. The State government also made arrangements for maintenance of the vehicles in an automobile workshop designed for repairs of the vehicle with the first vehicle service rendered for free while consequent services attract charges from the PSP. However, from interviews, it was discovered that the workshop is non-functional and the PSP are currently struggling with maintaining the vehicles. There are 15 Private Sector Partners currently operating in Osogbo and each of the partners is given a specific area of coverage to avoid overlapping of service.
The Private Sector Operators in Osogbo

Most of the PSP operators indicated that they had been in the waste collection business since 2008 which means that they had gathered sufficient experience in the work before the government’s policy was operationalized in 2013. The compulsory acquisition of the government’s trucks meant that the previous trucks owned by private operators can no longer be used. All the private sector participants are also required to have an environmental health officer on their payroll, while a sum of ₦50,000 is paid by the PSP per annum as renewal fee to OWMA. The PSP operators collect waste once in a week and increment in waste collection days attracts more charges.

The challenges faced by PSP in waste collection include: (i) The trucks which the State government made compulsory for the PSP are not helpful because the spare parts are not available in the Nigerian market and often they break down. (ii) The price specified by the State government is not feasible when compared with the running/operation cost. (iii) There is no legislation or law on the PSP operational ethics and price, what happens is that the State government forces its will on the operators. (iv) The State Governments approved dumpsite (OnibuEja Dumpsite) is not properly managed as waste usually littered on the drive way and this usually causes damage to the waste collection vehicle tires. (v) Some households refuse to pay because they are of the opinion that the Government owns the vehicle; therefore, they believe the service is free. (vi) There are bigger vehicles owned by the government that are used to collect waste for free along major roads. The government’s waste collection which is free, provides an alternative to the service of the PSP.

The unfavourable impact of government’s policy concerning waste collection shows that two former waste collectors who had been in the waste collection business for 8 and 5 years respectively had been displaced out of the operation as they could not afford the compulsory payment of ₦1 million. They had gone into other businesses that are not as profitable as waste collection business.

DISCUSSION OF RESULTS

The categories of waste identified in Osogbo confirmed the findings of Agrawal, et. al. (2002:281). The waste generated by households in Osogbo are typical metropolitan waste and require proper management. With the high level of combustibility of the type of waste generated, it becomes important that the households are discouraged from engaging in burning of waste which leads to pollution and gradual degradation of the environment as earlier found by World Resources (1997:70).

For the majority of the respondents to have subscribed to the PSP suggests that the PSP is responding to the people’s needs. Those that are yet to subscribe and still employ crude and environmentally degrading methods require enlightenment through collective action as suggested by E. Ostrom (1990), Akinola (2000) and Akinbamijo (2006).
The fact that the waste collection frequency is relatively low suggests that waste would have accumulated before collection. Accumulation of waste within household premises especially in cases where the majority makes use of reusable sacks to keep their waste constitutes a serious health risk as people are exposed to decaying food materials that are potential breeding grounds for pathogens, which become a threat to the health of members of the households in the process of handling the container. The occurrence of pest problems which can be attributed to accumulation of waste is an indication of the inefficiency of keeping waste for up to a week before it gets collected. This is because rodents such as rats which are known for disease vector (laser fever) account for the majority of the known pest problems in the study area. Other usual pest incidences involve dogs, cats, goats, etc. These pests can become potential vectors, carriers of germs, bacterial and disease pathogens as discovered by previous studies by Akinola (2000) and Agrawal, et. al. (2002).

Further, uncollected waste by PSP is an indication of illegal and unsanctioned means of waste disposal, which is consistent with the findings of Agrawal, et. al. (2002). Those that missed collection due to one reason or the other got rid of the waste in four ways: (a) kept it for the next collection, (b) burnt the waste, (c) dumped it at illegal dumpsites, (d) dumped it in the bush and water bodies. The implications are these: keeping household waste for up to two weeks might become very uncomfortable, as foul smell and appearance of decease vectors would occur. Burning of waste generates air pollution with the consequence of health hazard such as cancer, blood contamination, bronchitis (a respiratory ailment), tuberculosis, catarrh, and nasal discharges. Disposal through illegal means at illegal dumpsites and water bodies constitutes environmental hazards as found by World Resources (1997).

Though the charges levied by the PSP are relatively affordable and uniform, lack of adequate sensitization of the public concerning the policy, make some of the residents to have the impression that the service is free and hence refuse to pay. The respondents that did not pay and did not use illegal means of disposal usually carry their waste to the state’s own collection vehicle which is free, while some dump at kerbs on highways overnight for government vehicles to collect the next day. The State’s Government free service is of interest at this point as it logically suggests that most of the potential customers of the PSP that reside near major roads prefer the government’s free service than to subscribe to the PSP’s service. Government’s vehicles move along the major roads and highways at specified time of the days of the week to collect the waste. This corroborates the suggestion of Mandel (2009) that enforcement of laws and regulations by government is critical for successful operation of private sector.

The assessment of the PSP shows that the service offered by the PSP in waste collection is mostly efficient. The claims of some respondents that some of the staff of the PSP do not help in carrying waste from the premises of the houses to their vehicles show that there are some gaps
that need to be addressed. The collection system as explained by Agrawal, et. al. (2002) has not been complied with by the PSP operation, especially on door to door collection – waste collector knocks on each door and rings doorbell and waits for waste to be brought out by residents, and yard collection – collection laborer enters property to remove waste. These two areas still need to be explored by all the stakeholders through enlightenment programme such as traducture. A re-examination of the interaction and agreement between customers and PSP in carrying waste from premises to vehicles will improve the performance of the PSP.

The challenges faced by PSP in waste collection are consistent with previous studies by Olokesusi (1988) and Olowu (1990) especially in the areas of equipment and plant maintenance. The trucks which the State government made compulsory for the PSP are a cog in the wheel of the progress of the programme because of lack of spare parts. At the same time, the workshop that the government proposed for maintenance of these vehicles is non-functional and the operators are currently struggling with maintaining the vehicles. The government’s waste collection which is free, provides an alternative to the service of the PSP. However, Omoleke (2004:271) argues that poverty may not enable some people, especially the poverty ridden people to pay for PSP services, hence the justification for the free collection arrangement made by government to take care of this group. At the same time, it is important to note that politicians want to structure situations so that citizens can like them and vote for them during elections.

There was no indication of representation of the private waste collectors and the citizens in the deliberation on waste collection, rules and regulations guiding the operations, vehicles' maintenance, charges and payments by operators. These findings corroborate the view of E. Ostrom (1990) that deliberation among all stakeholders in any project or programme is imperative in achieving a set goal. In spite of the laudable achievement of the PSP, political factor seems to be discouraging private collectors that had been in the business for about 8 years before government intervention to register private collectors.

POLYCENTRIC PUBLIC-PRIVATE SOLID WASTE MANAGEMENT

Self-Governing Community Assembly (SGCA), Civic Enlightenment and Citizens' Responsibilities/Tasks

Self-Governing Community Assembly (SGCA) should be set up to comprise all interests and groups at the community/local level as well as representatives of governments with their agencies, higher institutions, community institutions, occupational groups, women groups, youth, etc.). SGCA should be saddled with the responsibility of deliberation, education and enlightenment of citizens so that public officials and the people operate within shared communities of understanding. Some of the critical questions that citizens need to address at the SGCA include: (1) What
should governments do in terms of waste management and environmental health? (2) What can people do alone without government involvement in waste management? (3) What can people do in tandem with government in waste management? Both leaders and citizens need new orientations, which require regular dialogues and some training at the level of SGCA. This would provide fertile ground for the adoption of successful practices elsewhere. This is well demonstrated by African Polycentric Information Networking (APIN) (see Akinola 2009b:94). APIN could be applied to strengthen linkages and interactions between individuals, self-governing institutions and between government. This would help in addressing the problem of information asymmetry, which is a major factor that strengthens “prisoner’s dilemma” and “tragedy of the commons (see Akinola 2009b:94).

In the conceptualization, deliberation and implementation of policies by the government, it is important that all the stakeholders is represented in order to ensure that the result reflects the values, wishes and aspiration of the people that will be at the receiving end of the policy. It is important the charged rate to be paid by the citizens is reviewed with considerable representation of the citizens and the PSP(s). For this programme to be sustainable, it might be necessary to adopt traducture for enlightenment among the citizens (wa Goro, 2007).

Conceptual Framework for Operationalizing African Polycentric Public-Private Solid Waste Management Model (APPPSWM) in Osogbo, Osun State

Effective waste management must be seen by the masses as a viable venture and this will help in achieving the MDGs-7 through elimination of burning of solid waste; recycling of solid waste; improving sanitation; reducing slums; preserving water resources; reducing clogging of channels and drainages and mitigating flooding. It is the responsibility of urban managers in Osogbo to devise appropriate methods and techniques of mainstreaming the citizenry into decision making so that the environment can be livable and healthy. The conceptual framework for operationalizing solid waste management pilot scheme in Osogbo, Osun State is based on the Future Plan of Action on Solid Waste Management derived from the World Summit on Sustainable Development held in Johannesburg, South Africa, August/September 2002 that emphasizes, among other things, the need to establish a focal network of stakeholders and professionals in waste management in Nigeria. The conceptual framework, which is diagrammatized in Fig. 1, is anchored on synergistic arrangements between the Osun State Government (OSG), OWMA, the private sector, and SGIs. Shared responsibilities among the four groups will invariably create a network of stakeholders and professionals in waste management.

The four groups would operate using rules that are crafted by stakeholders. Rule crafting takes place at three levels – constitutional, collective choice and operational. The synergy between the four groups would produce Institutional Mechanism with a well-defined measurable goal for waste management. The new institutional mechanism would define roles,
functions, responsibilities of each of the four groups in the areas of finance, urban geography, schedule of work, timing of activities and operations, deadlines, evaluation, monitoring, sanctions on rule infraction on burning waste, dumping in storm water, etc. It is also essential that evaluation of the programme be carried out from time to time.

**Implementation Process for Effective Waste Management**
Applying African Polycentric Information Networking (APIN) and African Polycentric Public-Private Solid Waste Management Model (APPPSWM), it is suggested that traducture (wa Goro, 2007) should be adopted in order to convey these ideas to the people using several avenues that the people are familiar with. Such avenues may include: radio, theatre, drama, artefacts, computer, IT, etc. that people can easily understand. For instance, ijala and ewi could be used in various dialects among the Yoruba to reach the people of Egba, Egun, Ekiti, Ijebu, Ijesa, Igbomina, Ikale, Ile-Ife, Ondo, Offa, Osogbo, Owo, Oyo, etc. The same applies to the Hausa-Fulani, Ijaw, Ibo, Edo languages, etc. Similarly, religious clerics can also be involved in using religious platforms to convey the ideas to the people.

The methodology proposed for the implementation of APIN and APPPSWM embrace direct contact and (working in) collaboration with the people at the local/ward level through the various groups, interests and associations/organizations within local communities in an integrated fashion (Fig. 1). In a polycentric system, PSP are partly responsible to government officials and partly responsible to the stakeholders and the people who pay for services of the PSP. This means that the waste management project is owned by the people from conception to implementation, financed by the people, while government facilitates, monitors and subsidizes as the case may be.

**CONCLUSION**
This paper concludes that the majority of the respondents subscribed to the PSP, while others still employ crude and environmentally degrading methods such as: dumping on roadsides and water channels, burning, and burying. Most of the respondents rated the PSP as efficient. However due to lack of adequate sensitization of the public concerning the policy, some of the residents have the impression that the service is free and hence refuse to pay. Subscribers of PSP service have noticed some improvement in their area such as: reduction in occurrence of flooding, bad odour and incidence of malaria sickness as well as cleaner environment. In spite of the laudable achievement of the PSP, political factor is discouraging private collectors that had been in the business before government intervention. In spite of the fact that the PSP in waste collection is meeting the needs of the respondents, it is important that the government strives to provide a more enabling policy backing to support the activities of the private operators, especially through enlightenment of the public.
and enforcement of the programme. These can be achieved through the setting up of SGCA.

This paper contends that effective solid waste management is an important task that needs to be carried out. It raises some fundamental issues on the roles of stakeholders (scholars, policy makers, public officials, practitioners, professionals and citizens) within the built environment in designing strategies for effective waste management. The paper adopts African Polycentric Information Networking (APIN) and African Polycentric Public-Private Solid Waste Management Model (APPPSWM) for innovating institutional mechanisms that can synergize the efforts of all the stakeholders (including the grassroots) in waste management. The paper adopts traducture as a new concept in development planning in executing public enlightenment campaigns on waste management. This
will bring the people to the level of public officials so that a common-thought between the two groups can be established.

ACKNOWLEDGEMENT

The effort of Fakolujo Femi, a final year student in the Department of Urban and Regional Planning, Osun State University, Osogbo, Osun State, Nigeria is acknowledged for data collection.

REFERENCES


PERSPECTIVES OF CONSTRUCTION BUSINESS MARKETING STRATEGIES: EXPLORING THE INHERENT CHALLENGES OF MARKETING STRATEGIES OF SME CONTRACTING FIRMS IN GHANA

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Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Facing keen competition for survival and sustenance is evident in every sector of the economy; and the construction industry is not an exception. Marketing is acknowledged to influence organizational performance and survival of small medium enterprises (SMEs). However, professional alignment of marketing in SME contracting firms is struggling to gain acceptance in the construction industry. Research into construction business marketing (CBM) is also sparse and many contributing factors account for these paucities. The resolution of such challenges will inevitably facilitate the alignment of appropriate marketing strategies in the construction industry. This current paper focuses on exploring the inherent challenges of professional alignment of marketing in SME contracting firms in Ghana. Cast in a quantitative research mode, the study utilized a structured questionnaire survey to gather data. The response data was subjected to rigorous analysis. Lack of in-house marketing expertise; lack of partner level acceptance of marketing as a legitimate business function; the misconception about marketing as selling game; personalized management style; resource constraint and professional limitation were found to be critical challenges of professional alignment of marketing among SME contracting firms in Ghana. The research findings will be useful to construction professionals who are exploring strategic approaches of improving their business prospects. Further research is recommended to consider marketing strategies of these SME contracting firms.

Keywords: business, contracting firm, marketing, professional, SME, strategy

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INTRODUCTION

Following decades of hypothetical contributions of the marketing concept, its possible effects and benefits to firms have been agreed upon by marketing scholars. The viability and advantages of a marketing strategy in sectors such as exports (Hinson et al., 2008), manufacturing (Appiah-Adu and Ranchhod, 1998; Kuada and Buatsi, 2005), pharmaceuticals (Mahmoud et al., 2010), and construction have consequently been confirmed by several studies. To enjoy these superior advantages of marketing, most firms in the above mentioned sectors have developed and adopted effective marketing strategies to facilitate the marketing concept in their business functions within the organisation. This is not to say that the development and adoption of such strategies in the organisation is always smooth without challenges. This study is however initiated to uncover the challenges inheriting marketing strategies in the construction sector. Most marketing studies have focused on large scale organisations (Hinson and Mahmoud, 2011). Nevertheless, there are few studies on the subject of marketing in the small business sector and desolately, most of these studies have been undertaken in the developed western countries of Europe and the USA (Keskin, 2006) leaving out developing countries such as Ghana, Nigeria, Senegal, Togo, etc. Consequently this study has focused on SME contracting firms operating within the Ghanaian Construction Industry.

Awareness of the importance of involving marketing in the management function of enterprises as a way to adapt themselves not only to the continuous changes in their industry, but also to satisfy their clients' demands, while being competitive and improving their business strategy is common among construction enterprises nowadays (Naranjo et al., 2011). Marketing is a management function that seeks to increase a target market, to build long-term relationships, to satisfy clients, to ensure the desired profitability (Arditi et al., 2008) and to strengthen competitive advantage (Mckenna, 1991). Marketing is a popular discipline in many sectors of the economy. However, in the construction industry, marketing is not properly understood. There are several contributing factors accounting for this paucity, rendering the development and application of marketing strategies in SME contracting firms a challenging business function. The resolution of these challenges for better marketing performance in construction businesses is dependent on the identification of the challenges. It has therefore become very important to go all out to investigate the inherent marketing challenges making the implementation of appropriate and rewarding marketing strategies a problematic phenomenon in the construction industry. In an attempt to address this problem, this current study was conceived with the broad aim and objective to explore the inherent challenges of marketing strategies of SME contracting firms in Ghana, justifying the need for this study. The research question of what are the inherent challenges of marketing strategies of SME contracting firms in Ghana? will therefore be answered by this study.
The paper is divided into three main sections. First, the key themes of marketing challenges in earlier literature were briefly reviewed. Second, the empirical survey data was analysed and discussed. Finally, the key research implications are presented with suggestions for future research.

CONCEPTUAL DEFINITIONS OF MARKETING AND SMES

There have been many and varying definitions of marketing (Arslan et al., 2009). Kotler and Armstrong (2005) define marketing as a social and managerial process by which individuals and groups obtain what they need and want through creating and exchanging value with others. On the other hand, the American marketing Association (AMA) defines marketing as the performance of business activities that direct the flow of goods and services from producer to consumer or user (AMA, 2004). Moreover, Yisa et al. (1995) describes the concept of marketing as focusing the activities of all departments of a company on the needs of the customer, and then organizing the company’s resources to identify and satisfy those needs profitably. Furthermore, Arditi and Makinde (2008) described marketing as consisting of activities such as contacts with potential clients, gathering information regarding conditions, potential customers, and projects: prequalifying with clients: estimating project cost: submitting proposal: entering into contracts, negotiating changes and claims, and finally, developing new technology of different contract forms.

Table 1: SME Definitions by Multilateral Institutions

<table>
<thead>
<tr>
<th>Institution</th>
<th>Maximum number of Employees</th>
<th>Max. Revenues or Turnover ($)</th>
<th>Maximum Assets ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Bank</td>
<td>300</td>
<td>15,000,000</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Multilateral Investment Fund of the</td>
<td>100</td>
<td>3,000,000</td>
<td>(none)</td>
</tr>
<tr>
<td>Inter-American Development Bank (MIF – IADB)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African Development Bank</td>
<td>50</td>
<td>(none)</td>
<td>(none)</td>
</tr>
<tr>
<td>Asian Development Bank</td>
<td>No official definition. Uses only definitions of individual national governments.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the other hand, concerning Small and Medium-sized Enterprises (SMEs), which are the main focus of this study in the construction industry, there are variations in the ways in which they (SMEs) are defined. Thus in the very developed versus developing countries like Ghana (Hinson and Mahmoud, 2011). Globally, SMEs have been defined in several ways by different researchers and institutions. However, according to the Central Bank of the Republic of Turkey (2010), there is no globally accepted uniform definition of SMEs and this has led to these varying definitions. By the definition of the World Bank, at least two of these three requirements (employees, assets, annual sales) have to be met by an
enterprise to be an SME (*Ibid*). Nevertheless, several definitions and meanings of SMEs exist (Lucky, 2012). This is due to their global diversity and characteristics. Many countries have defined SMEs in terms of manpower, management structure and capital investment limit (Lucky, 2012). Table 1 below gives a summary of general definitions of SMEs by some selected multilateral institutions globally.

Besides, the European Union’s Director General defines businesses as follows:

- Micro 0-9 employees;
- Small 10-99 employees;
- Medium 100-499 employees; and
- Large 500+ employees; (Blankson and Stokes, 2002).

Similar to the Global context, SMEs have been defined in various ways in Ghana. In this regard, Kayanula and Quartey (2000) propound that, SMEs have been variously defined in Ghana, but the most underlining criterion used is the staff complement of the enterprise. This definition is often confusing in respect of the arbitrariness and cut off points used by the different official sources (Mahembe, 2011). For instance, within the Association of Ghana Industries (AGI) provided the following size classification of businesses:

- Micro enterprises-those employing up to 5 employees;
- Small enterprises-employ between 6 and 29 employee; and
- Medium enterprises-employ between 30 and 99 employees; (Mensah, 2004).

Also, according to the Ghana Statistical Service (GSS), firms with less than 10 employees are regarded as small scale enterprises (SSEs) and their counterparts with more than 10 employees as medium and large-sized enterprises (MLSEs) (Mahembe, 2011).

**CHALLENGES OF CONSTRUCTION BUSINESS MARKETING STRATEGIES**

Friedman (1984) is of the view that construction firms in the past were not met with difficulties in obtaining the required level of works to maintain survival and profit but this cannot be said of firms in the 21st century. This made the firms relied heavily on their reputation and quality of their work to continue winning new orders preventing them from recognizing the essence of marketing. Also, in this contemporary world, firms are struggling and are reluctant to utilize the marketing function effectively. A number of factors have been identified to be responsible for the low utilization of marketing by professional service firms (Yankah 2013). These factors controls or limits the firms’ growing need for greater commercialization of their services in a highly competitive market.
Such factors include: equating marketing to selling, association code of ethics, disdain of commercialism (Kotler and Conner, 1977), lack of in-house marketing expertise, professional limitations, lack of partner level of acceptance of marketing as a legitimate business function and resource constraint (Morgan et al., 1994).

**Equating Marketing to Selling**

Even though marketing is a much larger idea than selling, professional firms show miniature interest in it because they equate it to selling which the professional body place embargo against. Correspondingly, Fisher (1989) found that to a large number of firms, marketing is seen as synonymous with selling. Yisa et al. (1995) attributes this to ignorance or misunderstanding of the concept of marketing in the construction industry. Dickman et al. (2005) similarly described equating marketing to selling as one of the misconceptions about marketing in the industry. This in the view of Yisa et al. (1995) can be attributed to the fact that literature on marketing in construction is sparse, suggesting that the industry’s professionals are being educated without a systematic study of marketing which is an important aspect of management.

Besides, Wilson (1985) goes on to point out the distinction between selling and marketing. While selling is concerned predominately with ensuring the purchase by clients of products and services offered by a firm, marketing adopts an orientation which is more concerned with ensuring that only products and services required by the clients are provided by the firm. This means that selling is only one among numerous other tools under the marketing continuum which utilizes an assortment of appropriate marketing tools and messages to convert a potential client into an actual client (Pheng, 1991).

**Association Code of Ethics**

Some associations have rules that must be followed by member firms while others have what they describe as Standards of Good Practice that firms must adhere. Kotler and Conner (1977) observed that professional associations have erected stringent rules against commercial behavior. In some professions, an absolute prohibition exists against anything that resembles selling activity. He noted that advertising, direct solicitation, and referral commissioning, have been banned.

Jaafar et al. (2008) observed that the action of some professional associations to ban the use of marketing activities such as advertising, direct solicitation and referral commission has led to the limited use of effective marketing strategies. The adherence to certain “standards of good practice” by some professional firms as mentioned above have also tend to limit the use of effective marketing and sales techniques or strategies in the construction industry.

**Disdain of Commercialism**

Kotler and Conner (1977) noted that a few professionals live to think of themselves as businessmen, they rather show that they are motivated by service to their clients than the money they receive for carrying out such
service. This attitude is making the firms reluctant to pursuing any effective marketing programme even though there is a growing need for greater commercialization of their services because of the stiff competition prevailing in the market (Morgan et al., 1994).

**Lack of In-House Marketing Expertise**

The findings of Yisa et al. (1995) revealed that, in a larger percentage of firms, marketing is managed by a partner/director/senior manager, in addition to other responsibilities. They indicated the percentages as 95%, 80% and 22% for architects, engineers and contractors respectively. This signposts a lack of importance placed on marketing and as a result no expert is employed to oversee it, rather it is added to the responsibilities of others who may even have no knowledge about it. The lack of in-house marketing expertise can also be attributed to the issue of low consultation fees that reduces the firms’ revenue thereby making it difficult for the firms to pay for the services of a marketing expert.

**Professional Limitation**

Yisa et al. (1995) noted that when construction management function such as estimating, scheduling and cost control is compared, marketing lacks adequate literature. They concluded that the industry’s professionals are not properly educated on marketing as an important management function. Similarly, Harris (1991) observed that professional education has always aimed at the production of highly scientifically, trained professionals from the universities with little or no management training. Harris (1991) also confirms that professional education and training is always streamlined and narrow to achieve that aim. It is the content of the training that makes the professionals handicap of marketing management techniques.

Again, Pearce (1992) points out that, in many cases, contractors and professionals alike believe that the most important part of the organization is the production side. They look for opportunities that fit their capabilities as contactors, rather than adapting their capabilities to suit current and future market opportunities. As a result, the professionals become limited in their ability to perform as managers, particularly on issues regarding marketing. These events end up with a lack of in-house marketing expertise to prepare and oversee the marketing program.

**Lack of Partner level Acceptance of Marketing as a Legitimate Business Function**

In some firms, marketing is managed by partners/directors/senior managers. Many firms depend on either directors or partners to do the marketing work (Jafaar et al., 2008). In events where such partners are members of the professional bodies and therefore do not accept marketing as a legitimate business function, then the firms may not be able to mount any effective marketing programme.
Constraint
Several marketing research have looked at resources for managing marketing in an organization in terms of manpower, skills and budget. The adequacy of these resources can guarantee a successful marketing program in the construction industry. However, because of the low consultation fees charged (Jaafer et al., 2008), the firms are not able to allocate adequate funds to support marketing activities. Much attention is paid to the production side (Pearce 1992) than the management side of which marketing is key (Dikmen et al., 2005).

The limited budget prevents the firm from sourcing the services of external marketing experts. Because the available funds are used to cover operating costs and production related issues such as supervision that are considered as most important part of the firm. Regarding marketing skills, the professionals are handicapped because their education and training are geared towards production of highly scientifically trained profession with little or no management training. This is because the professionals believe that the important part of the organization is the production aspect but not the management aspect (Pearce, 1992) of which marketing is an important tool.

As far as the manpower requirements are concerned, it is either lack of funds that limits the number of employees or the low levels of salaries to workers that do not encourage them to stay. Jafaar et al. (2008) observed a shortage of supporting employee especially Computer Aided Design (CAD) operators and attributed that to the low salary schemes offered by the firms compared with the manufacturing and other sectors. This in the view of Oglesby et al. (1989) can be attributed to the reason that firm owners (professionals) do not seem to be aware of the economic payoff to be derived from the appropriate use of modern management systems and are, as a consequence, unwilling to incur the cost of operating these systems on their construction projects.

Engineers Paradigm
Dikmen et al., (2005) explains that the presence of cultural barriers in the construction industry is a resistance to marketing-oriented approach to management of in the industry. Seymour and Rooke (1995) observe that management practices are dominated by the engineers’ paradigm which has resulted in the limited use of market-driven strategic management. This in the view of Richardson (1996) is a hurdle that needs to be overcome if marketing can be adopted and used effectively in the industry.

Personalized Management Style
One study found that 95% of SMEs owners make marketing decisions either by themselves or in consultation with a partner in the firm (Stokes et al., 1997). Also, SMEs tend to have more personalized management style than large firms, with the typical owner-manager involved in all aspect of management and not shearing key marketing decisions with others (Stokes and Wilson, 2010). Subsequently, marketing in SMEs follows this pattern, owner-manager tend to assume responsibility not only
for the development of marketing strategy but also for implementing of marketing programs (Stokes and Wilson, 2010). As owner-managers are such a dominant influence, so their competency and attitudes towards marketing are a major factor in the development of marketing programs in SMEs (Carson et al., 1995). Therefore in the case where the owner-manager has little or no expect knowledge of marketing, the firm suffers the penalty.

RESEARCH METHODOLOGY AND DESIGN

The literature review and a preliminary survey conducted by the researcher provided the basis for developing the questionnaire used in surveying responding professionals. This was conducted to reconnoitre the inherent challenges of the marketing strategies of SME contracting firms in Ghana with a view to determine the major challenges for the purpose of establishing resolution mechanisms for these challenges. This study adopted mainly the quantitative approach for data collection.

Research Data collection

For the purpose of this study, the target respondents for the survey questionnaire comprised top managers, CEOs, sole proprietors, partners and marketing directors of SME contracting firms surveyed in Ghana. This was done to establish the level of significance attached to the marketing strategies challenges by this group of respondents in the construction industry. These respondents were requested to rank in their own opinions and depending on their level of experience in the industry using a five-point Likert scale (1 = strongly disagree and 5 = strongly agree). Respondents were selected conveniently and purposively from a sampling frame including all top managers, CEOs, sole proprietors, partners and marketing directors of selected SME contracting firms in the Kumasi Metropolis based on their experience and involvement of activities in the contacting firms considered in the study to respond appropriately to the questions in the survey questionnaire. Questions asked were clear, simple and self-understanding requesting respondents to agree or disagree to whether or not each challenge identified on the questionnaire is or not a challenge facing marketing strategies of SME contracting firms in Ghana. In selecting the firms for this study, the names of the firms were available on the Registrar General’s (Ghana) company registration list, however the point of location of the firms as indicated by the registered list were in most cases nonexistent and in many cases that locations were not exact to enhance identification. Lack of directional signs even worsens the situation. It appears some did not even have offices and the researcher had to contact them by other means in most cases by phone calls. These issues made it difficult to have ready access to all the SME contracting firms in the Kumasi Metropolis. Based on these reasons, firms that were easily accessible in the researcher’s convenience were selected for the study.

In the sum, 100 questionnaires were sent to respondents in selected surrounding areas or locations such as Adum, Ayigya, Amakom, Santasi,
etc., all within the Kumasi Metropolis in the Ashanti region of Ghana. Ashanti region represents the most populous regions in terms of the number of district assemblies, contractors and consultants in Ghana and also, together with the Greater Accra region, over 70% of Ghanaian Contractors tend to operate in the Ashanti Region (Ahadzie, 2007), hence their selection as a basis of data collection. In retrieving the survey questionnaires administered, a total of 89 completed questionnaires from the respondents were returned, representing a response rate of 89%. Hence, the breakdown of respondents participating in the study include, 31 top managers, 20 CEOs, 15 sole proprietors, 12 partners and 11 marketing directors of the SME contracting firms surveyed. All the completed and retrieved questionnaires were deemed valid for subsequent statistical analysis. Hence, 89 questionnaires formed the basis of data analysis presented in this study.

**ANALYTICAL TOOLS EMPLOYED IN THE STUDY**

**Mean score ranking technique**

Many researchers have adopted the “mean score” method for data analysis. For instance, Agboh (2015) adopted the mean score ranking techniques to establish the significant levels of drivers and challenges of ICT adoption by SMES in the Accra metropolis in Ghana. Also, Cheung et al. (2012) used the mean score ranking method to determine the relative importance of critical success factors for public private partnerships (PPP) between Mainland China and the Hong Kong Special Administrative Region. This is due to the ability of this technique (mean score ranking) to establish the significant levels of various factors based on obtained mean values. The data collected from the questionnaire survey of this current study was also analyzed using the same technique, within the various groups (top managers, CEOs, sole proprietors, partners and marketing directors).

The five-point Likert scale (1 = strongly disagree and 5 = strongly agree) as described previously was used to calculate the mean score for each of the challenges which was then used to establish the major challenges in descending order of significance. In computing the mean score (MS) for each challenge, the following formula was used:

$$MS = \frac{\sum (f \times s)}{N}, \ (1 \leq MS \leq 5)$$

where:

- \(S\) = score given to each challenge by the respondents, ranging from 1 to 5 (1 = strongly disagree and 5 = strongly agree)
- \(f\) = frequency of each rating (1-5) for each challenge, and
- \(N\) = total number of responses concerning that challenge
**Kendall’s concordance analysis**

According to (Legendre, 2005) Kendall’s coefficient of concordance (W) is a measure of the agreement among several raters who are assessing a given set of objects. This survey was conducted among the five main groups of respondents in the Ghanaian construction industry, i.e. top managers, CEOs, sole proprietors, partners and marketing directors. The Kendall’s concordance analysis was deemed justifiable for this study because it seeks to measure the agreement of the different respondents on their rankings of the challenges based on mean values within a particular group. If the Kendall’s coefficient of concordance (W) is significant at a pre-defined allowable significance level of, say 0.05, a reasonable degree of consensus amongst the respondents within the group on the rankings of the challenges was indicated. W for the challenges was calculated using the following formula (Siegel and Castellan, 1988):

$$W = \frac{\sum_{i=1}^{n}(R_i - \bar{R})^2}{n(n^2-1)/12}$$

where:
- n = number of challenges being ranked;
- Ri = average of the ranks assigned to the ith challenge; and
- R = average of the ranks assigned across all the challenges

The analysis procedures described above have also been used in other similar research survey studies such as Cheung et al. (2012) and Chan et al. (2003).

**DATA ANALYSIS**

In this section, analysis of data generated from the survey is systematically provided. The challenges of marketing strategies of SME contracting firms in Ghana were assessed from different perspectives among the five groups of respondents involved in the study. Consequently, the mean score of each of the challenges were calculated and ranked in descending order of significance as summarized in Table 2.

In spite of the major contribution of SMEs to a country’s economy, SMEs continue to face numerous marketing challenges. This problem is very alarming in the construction industry in Ghana and in many developing countries. In both developed and developing countries, SMEs in general experience challenges (Schreiner and Woller, 2003). It is argued by Taylor and Murphy (2004) that SMEs occupy small/clearly defined niche markets that do not need a global connectivity as reluctance to marketing strategies adoption. The analysis of the survey data revealed that SME contracting firms in Ghana experience challenges to the use of effective
marketing strategies. Respondents rated these challenges on a five point Likert scale. The rating scale ranged from 1 (strongly disagree) to 5 (strongly agree). The results in Table 2 above represent mean scores, standard deviations and ranks of the challenges. However, only challenges with mean score of 3.5 or more are regarded as major challenges and are discussed in section 5.

Table 2: Mean scores and rankings of the marketing strategies challenges

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of In-House Marketing Expertise</td>
<td>4.28</td>
<td>0.74</td>
<td>1</td>
</tr>
<tr>
<td>Lack of Partner Level Acceptance of Marketing as a Legitimate Business Function</td>
<td>3.92</td>
<td>0.67</td>
<td>2</td>
</tr>
<tr>
<td>Equating Marketing to Selling</td>
<td>3.84</td>
<td>0.99</td>
<td>3</td>
</tr>
<tr>
<td>Personalized management style</td>
<td>3.80</td>
<td>0.71</td>
<td>4</td>
</tr>
<tr>
<td>Resource constraint</td>
<td>3.77</td>
<td>0.64</td>
<td>5</td>
</tr>
<tr>
<td>Professional limitation</td>
<td>3.63</td>
<td>1.12</td>
<td>6</td>
</tr>
<tr>
<td>Association Code of Ethics</td>
<td>3.01</td>
<td>0.83</td>
<td>7</td>
</tr>
<tr>
<td>Disdain of Commercialism</td>
<td>2.71</td>
<td>1.32</td>
<td>8</td>
</tr>
<tr>
<td>Engineers Paradigm</td>
<td>2.47</td>
<td>0.77</td>
<td>9</td>
</tr>
</tbody>
</table>

Level of Agreement between Respondents (Top managers and CEOs)

Table 3 below summarizes the results Kendall's concordance analysis conducted to establish the level of agreement between the views of the top managers and CEOs who are two out of the five groups of respondents involved in the study.

Table 3: Results of Kendall's concordance analysis for the Challenges

<table>
<thead>
<tr>
<th></th>
<th>Top managers and CEOs</th>
<th>Top managers</th>
<th>CEOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of respondents (n)</td>
<td>51</td>
<td>31</td>
<td>20</td>
</tr>
<tr>
<td>Kendall’s coefficient of concordance (W)</td>
<td>0.079</td>
<td>0.108</td>
<td>0.059</td>
</tr>
<tr>
<td>Chi-square value</td>
<td>121.165</td>
<td>102.132</td>
<td>32.054</td>
</tr>
<tr>
<td>Critical Value of chi-square</td>
<td>25.524</td>
<td>25.524</td>
<td>25.524</td>
</tr>
<tr>
<td>Degree of freedom (df)</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Significance level</td>
<td>0.001</td>
<td>0.001</td>
<td>0.005</td>
</tr>
</tbody>
</table>

The Kendall’s coefficient of concordance (W) for the rankings of the challenges are 0.079, 0.108 and 0.059 for “top managers and CEOs”, “top managers” and “CEOs” respectively (see table 3). The calculated W values were all significant at 0.001. Since the number of challenges considered were above seven, the Chi-square ($\chi^2$) values would be referred to rather than the Kendall’s coefficient of concordance (W) values (Cheung et al.,
Looking at the degree of freedom, the calculated value of $x^2$ was 25.524. For all three groups (“top managers and CEOs”, “top managers” and “CEOs”), the calculated $x^2$ values were all above the critical values of $x^2$ (121.165, 102.132 and 32.054 for “top managers and CEOs”, “top managers” and “CEOs” respectively). Hence, the perceptions of top managers and CEOs on their rankings of the challenges is proved to be consistent, indicating an agreement between the views of top managers and that of CEOs of the SME contracting firms surveyed.

**Validity and Reliability Test of the Instrument**

Validity test implies ascertaining whether the research or the research instrument used in conducting the test of the research work is used in another place has the same or similar variables with the earlier data used, the result of the test will be very similar. Hence, reliability of a measurement can be said to be the extent to which a measurement is free from viable errors. This implies that a research methodology can be said to be reliable only when it produces the same result after repeated use. However, the reason for testing reliability of research work is to ensure that variability of the generalization of the conclusion (Bayode and Adebola, 2012).

**Table 4: Reliability Statistics**

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.892</td>
<td>.902</td>
<td>9</td>
</tr>
</tbody>
</table>

Cronbach’s alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. The Cronbach’s alpha coefficient, in this case is .892 (see Table 4). This value is above .7, so the scale can be considered reliable with our sample.

**RESULTS AND DISCUSSION OF FINDINGS**

This section, presents the results and discussion on the findings from the data analysis from the survey.

**Lack of In-House Marketing Expertise**

First among the major challenges is the lack of in-house marketing expertise which was cited by respondents as the most hindrance to the implementation of effective marketing strategies in SME contracting firms in Ghana with a $M=4.28$, $SD=0.74$ and $R=1$ (see Table 2). The study revealed that in Ghana, SME contracting firms lack the existence of professional with marketing knowledge and expertise and this has been a major threat to their marketing performance. Interestingly, this findings has been in consistence with Yisa et al. (1995) who also found that majority of firms in the construction industry do not have marketing
experts to handle the marketing function. In turn, partners, directors and senior managers of these firms double up in addition to their normal responsibilities to manage the marketing function. Therefore, one may not be far from the truth to judge that the same situation exists in the SME contracting firms under study and the worst of the situation is when these partners, directors and senior managers have no knowledge about marketing. This therefore becomes a major challenge to any marketing strategy that the firm may implement.

**Lack of Partner Level Acceptance of Marketing as a Legitimate Business Function**

The second major challenge cited by the respondents is the lack of partner level acceptance of marketing as a legitimate business function (M=3.92, SD=0.67 and R=2, see Table 2). Jafaar *et al.* (2008) is of the view that in most firms, marketing as a business function is undertaken by either their directors or partners. Therefore, the mounting of any effective marketing strategy or program becomes problematic in the firm when partners are members of the professional bodies and they do not accept marketing as a legitimate business function. This is a major hindrance to marketing strategies in SME contracting firms in Ghana.

**Equating Marketing to Selling**

The misconception about marketing as selling game in Ghanaian SME contracting firms was also identified by this study as the third major challenge of their marketing strategies with a M=3.84, SD=0.99 and R=3 (see Table 2). There is great distinction between marketing and selling. Meanwhile, it seems that firms are still struggling to separate the two functions, leading to a confusion in distinguishing marketing from selling. It is evident that this is a major marketing challenge in SME contracting firms in Ghana as far as this study is concerned. The findings here confirms that of Fisher (1989) who stated that construction business marketing in a large number of firms is seen to be the same as selling, ignoring the distinction between the two functions. This problem can be attributed to the lack of understanding of the marketing concept in the construction industry. The equation of marketing to selling is a major challenge of marketing strategies in SME contracting firms in the sense that, paying attention to selling instead of marketing as a whole means that other numerous aspects of the marketing function have been betrayed with emphasis on only one aspect (selling).

**Personalized Management Style**

According to Stokes *et al.* (1997), majority of SME owners manage the marketing function and therefore make marketing decisions all by themselves or they sometimes do that by consulting a partner in the firm. This means that SMEs owners who are managers by themselves tend to assume responsibility for the development of marketing strategies and also the implementation of marketing programs in the firm. This is known as the personalized management style in SMEs. The major question here is that, do these owners really have marketing knowledge and expertise? Personalized management style was revealed by this study as the fourth
major challenge of marketing strategies of SME contracting firms in Ghana. The factor obtained M=3.80, SD=0.71 (see Table 2).

Resource constraint
Fifth among the major challenges of marketing strategies of SME contracting firms in Ghana is resource constraint (M=3.77, SD=0.64 and R=5) confronting the firms’ ability to utilize the marketing function. Resources for managing marketing in an organization may include manpower, skills and budget. A firm may be successful in implementing and managing the marketing function with an adequacy of these and other resources. On the other hand, the lack of these resources can be a major source of problem to construction business marketing. This assertion is deemed valid as far as the findings of this study is concerned with respondents reporting that resource constraint is a major challenge of marketing strategies of SME contracting firms.

Professional limitation
Professional limitation was cited as the sixth major challenge of marketing strategies of SME contracting firms in Ghana (M=3.63, SD=1.12 and R=6). This is in agreement with many studies conducted on construction business marketing. For instance, Harris 1991) mentioned that construction professionals are limited or handicapped in the area of marketing as an important business function. This is because the industry’s professionals are not properly educated on the management aspects of organisations which marketing is part. This is a major issue of concern in SME contracting firms in Ghana as revealed by this study.

CONCLUSION AND RECOMMENDATIONS
The study was set to investigate what the major challenges of marketing strategies of SME contracting firms in Ghana are in order to facilitate their resolution by concerned professionals. First, a preliminary survey and a global extensive and intensive literature review was conducted on the marketing challenges to identify the relevant challenges and then several professionals from the study scope were asked to express their views on the challenges to increase the understanding of the challenges specific to marketing strategies of SME contracting firms in Ghana.

The main findings of this paper suggested that to marketing strategies in SME contracting firms in Ghana, there are several major inherent challenges. The key challenges mentioned by all the respondents appear to be resource constraint; lack of partner level acceptance of marketing as a legitimate business function and personalized management style. In addition, the findings of this paper suggest that marketing strategies of SME contracting firms in Ghana are constrained by the misconception about marketing as a selling game; lack of in-house marketing expertise; and professional limitation.
It would seem that the challenges of marketing strategies in SME contracting firms do not differ from that of the general marketing concept in the built environment—especially in terms of resource constraint; lack of partner level acceptance of marketing as a legitimate business function and personalized management style in the industry. Some of the characteristics of the challenges identified here resemble the challenges discussed in general construction business marketing literature. In addition, the study findings add to earlier construction business marketing literature, directing its findings towards challenges confronting the successful implementation of effective marketing strategies in contracting firms. Contributing to literature, the study has highlighted exact challenges of marketing strategies of SME contracting firms. Most importantly, these challenges have been ranked in descending order of significance. This indicates clearly, those challenges which require urgent attention in the construction industry. Although existing literature mention the existence of challenges in construction business marketing, it is silent on which challenges needs urgent attention and vice versa. Hence, the findings of this study are important contributions to construction business marketing literature. Practically, the findings of the study will serve as a guide and be useful to construction professionals who are exploring strategic approaches of improving their business prospects.

Based on the empirical observations in this paper, the key challenges of the marketing strategies in SME contracting firms can be addressed. Fundamentally, innovative management resolution mechanisms are needed to enable construction companies and stakeholders to succeed in the implementation of marketing strategies in the industry. Moreover, the construction industry has to be able to develop a customer-oriented and a fast innovation management process that holistically incorporate the marketing function. Furthermore, professional education in the built environment should in future include marketing in the curriculum.

This study has some important limitations that must be regarded when generalizing based on the results. The implications made from this study should be considered suggestive only since the data collected through the questionnaire survey for the study is limited in number and geographically. Likewise, it should be pointed out that all the respondents surveyed were top level professional in their firms. The way these respondents perceive marketing in their firms may be biased towards top-down perspective and experience.

Several leads for future research are set forth by this paper. It would be highly interesting to study further into the marketing strategies of SME contracting firms and the contributions of marketing in achieving success for the firms. Moreover, more research attention should be given to explore innovative ways for mounting effective marketing programs in construction firms.
REFERENCES


PROJECT MANAGEMENT COMPETENCIES OF INDIGENOUS CONTRACTORS IN NIGERIA

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All over the world, governments are talking about reducing spending of capital and recurrent expenditures. Capital expenditures cover cost for major projects such as infrastructure. Moreover, the wealth and worth of a nation is a function of the availability and quality of its infrastructure. It has been noted that indigenous construction firms do not represent a strong source of competition. Consequently, most construction markets in Africa are dominated by expatriates. Governments of most African countries pay huge amount of money to expatriates because of deficiencies in indigenous capacity. The study therefore, aimed at identifying and assessing critical project management competencies required by indigenous construction firms. A quantitative research method was adopted for the study and 72 copies of the questionnaire were distributed to indigenous construction firms in Lagos and Abuja, Nigeria. The study revealed cost management, site management, time management and quality management as the most critical project management competencies required by indigenous construction firms. The study suggested that indigenous construction firms should sagaciously allocate more resources for development of the critical project management competencies identified in the study so as to audaciously become major players in the Nigerian construction market.

Keywords: construction firm, construction market, project management competency, Nigeria

INTRODUCTION

The construction industry plays a key role in the economic development of all nations in terms of contributions to Gross Domestic Product (GDP). In developed countries, contribution of the construction industry to GDP ranges between 7% and 10% while in developing countries construction industry contribution to GDP is about 3% to 6% (Lowe, 2003).

Nigeria has one of the most vibrant construction markets in Africa (Odediran et al., 2012). In the Nigerian construction market, 95% of all the construction firms are indigenous while the remaining 5% are foreign in origin (Ibrahim et

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Indigenous construction firms in Nigeria are construction firms established under the enterprise promotion decree of 1972 and have no other home base but Nigeria. Their entire capital and any other proprietary interests in the enterprise are owned and controlled by Nigerian citizens or associations and most or all of their technical and managerial undertakings are manned by Nigerians (Olateju, 1991).

The construction industry is a project – centered industry because the growth and survival of firms depend on the success achieved in projects (Isik et al., 2009). Even though projects in the construction industry are one-off the management process is usually uniform across projects in a company. Since the major duty of construction businesses is to carry out construction projects, then ability to develop competency in project management is vital to the success of construction firms. Moreover, construction project performance is highly dependent on the competence of contractors (Odediran, et al. 2012). Contractors manage construction projects (Inuwa et al. 2013) and their roles include: making design and management decisions, physical building production, final accounting, renovation and maintenance of existing facilities (Windapo, 2013). As a result, construction requires high specialization (Muazu and Bustani, 2004). According to Freeman (2011), it is practically impossible to successfully run a construction firm without the necessary project management competencies.

However, there are reports of deficiencies in project management competencies of indigenous construction firms in Nigeria (Ekundayo et al., 2013; Aniekwu and Audu, 2010; Achuenu, et al. 2000; Adams, 1997) which inhibit their competitiveness (Inuwa et al., 2014; Odediran, et al. 2012).

Foreign construction firms operating in Nigeria possess a significant comparative advantage over their indigenous counterparts in terms of project management competences. For instance, Idoro (2010) reported that foreign construction firms deliver high quality work than indigenous construction firms. Moreover, Idoro and Akande – Subar (2008) revealed that projects executed by indigenous contractors recorded greater magnitude of defective work and that the amount of retention fee spent to rectify defects that occurred during the defect liability period was higher than their foreign counterparts. Hence, construction clients in Nigeria have a penchant for foreign construction firms.

How significant can the contributions of foreign construction firms be to GNI of their home countries? From the periods between 2010 and 2013 the volume of projects awarded under the Nigerian Federal Ministry of Works alone was approximately 26 Billion Naira. However, indigenous construction firms in Nigeria could only boast of approximately 8 billion Naira worth of construction work during the same period (Budget Office of the Nigerian Federation, 2013).

In an era when governments all over the world are emphasizing the need for reduction in capital and recurrent expenditure, it behooves on governments in developing countries particularly in Nigeria to reduce cost of providing basic infrastructure (capital spending). One way to achieve this is for construction
clients in Nigeria particularly the government to minimize the use of foreign construction firms and increase patronage of indigenous construction firms. However, patronage of indigenous construction firms would increase when indigenous construction firms improve on project management competencies; an area in which foreign construction firms have a significant comparative advantage. Furthermore, improvement and development of critical project management competencies by indigenous construction firms would bring about: increased market share, increase in level of profits earned and sustainability of indigenous construction firms.

Hence, the aim of this study is to identify and assess critical project management competencies required by indigenous construction firms in Nigeria.

LITERATURE REVIEW

Project Management Competencies

Project Management Competencies refer to the knowledge and skill possessed by project managers to manage projects professionally, with the application of best practices in design and management of the construction (production) process. According to Gareis and Huemann (1999) project management competencies require knowledge and experience in construction project, which enables the project to achieve its objectives. Moreover, project management competencies are made up of the combination of the knowledge acquired during training and the skills developed through experience (Mahmood et al., 2006). It is the use of acquired construction knowledge and construction experience that creates project management competencies.

Project management competencies have been identified in literature. Isik et al., (2009) highlighted nine project management competencies. These include: time management, cost management, quality management, human resource management, risk management, supply chain management, claims management, knowledge management, and health and safety management.

Cost Management - Cost management includes all the processes required in cost planning, controlling and monitoring of project cost from inception, to completion and commissioning stages with the aim of staying within the budgeted figure for the works and to pro-actively make provision for handling changes that may occur in course of profit implementation (Enenmoh, 2010). Furthermore, cost management of projects includes the process required to ensure that the projects are completed within the approved budget and it comprises of the following: resource planning, cost estimating, cost budgeting and cost control (PMBOK, 2004).

Time Management - According to NEDO (1983) time management is the disciplined effort required to complete a construction project on time. Time management involves meeting all time limits during pre-contract and post contract stage (Nwachukwu and Emoh, 2011). Proper time management facilitates the achievement of clients’ objectives of cost and quality performance (Bowen et al., 2012).
Quality Management - Managing quality in construction is best viewed from a holistic approach. Frequently the term total quality management has become a buzz word as far as construction quality is concerned. Total quality management is the integration of all functions and processes within an organization in order to achieve continuous improvement of the quality of goods and services. Bowen et al. (2012) identified 3 drivers of quality: integration of the project team, a customer focus and a process of continuous improvement in the management of the construction project.

Human Resource Management - Human resource management (HRM) is the management process of an organization's workforce, or human resources (Raj and Kothai, 2014). HRM is regarded as one of the most critical elements of business success because people are the medium by which organizational goals are translated to reality. The basic functions of HRM include employee selection and recruitment, devising job description employee training, performance appraisal systems, reward systems, employee relationships (Loosemore et al., 2003).

Risk Management - Uher (2003) defined risk management as the management tool that aims at identifying sources of risk and uncertainty, determining their impact, and developing appropriate management responses. Smith (2003) noted that there are more risks in the construction industry than many other industries. The huge risk in construction business may be due to the unique features of construction, such as intense competition, relatively low profit margin, increasing inability to predict project outcomes and dynamism of the business environment.

Supply Chain Management (SCM) - Supply chain management can be defined as network of different organizations, linked upstream and downstream in a chain, aiming to produce quality and value in the services and products for the end consumers through integrated processes and activities (Khalfan et al., 2004). Supply chain management has become a necessity for construction firms because contractors have become increasingly reliant on other actors in the construction supply chains, such as, suppliers and subcontractors. Consequently, the traditional approach to the control of the construction supply chain is not adequate any more, and a shift of method for managing the supply chain is needed (Vrijhoef and Koskela, 2000).

Claims Management – involves the seeking of consideration or change by one of the parties involved in the construction process (Arditi, and Patel, 1989). Claims can be resolved in two ways. (1) Claim avoidance and (2) claims management where the occurrence of claims cannot be avoided. Ren et al., (2000) explained that claim avoidance ensures that construction projects start right, while claims management ensures that construction projects stays right. Tochaiwat and Chovichien (2007) identified seven procedures for claims management. They are : (1) recognition and identification of change, (2) notification of change, (3) systematic and accurate documentation of change, (4) analysis of time and cost impacts of change, (5) pricing of change, (6) negotiation of claim, and (7) dispute resolution and settlement.
**Health and Safety Management** - The aim of health and safety management is to reduce the number of accidents and its effects on project costs such as the cost of insurance, inspection and conformance to regulations (Ringen et al., 1995). Health and safety problems can be solved by providing safety booklets, safety equipment, and a safe environment; appointing a trained safety representative on site; training workers and supervisors; and using new technologies (Sawacha et al., 1999).

**METHODOLOGY**

The study was based on a quantitative research design with the use of questionnaire. The research sample was drawn from indigenous construction firms that are registered with the Nigerian Institute of Building (NIOB). Although there are several indigenous construction firms operating outside formal bodies like the NIOB, the NIOB list of construction firms was used in this study because the study hinges on best practices in construction. The NIOB is connected to the Council for Registered Builders of Nigeria (CORBON), a body recognized by law to regulate building production (construction) practice in Nigeria (Federal Republic of Nigeria, 2006). Hence, it suffices the researcher to say that all construction firms registered with the NIOB meet the requirements for good construction practice and also have potentials to compete with foreign construction firms.

The sampling frame for this study comprised of 92 indigenous construction firms located in Lagos and 25 in Abuja. Thus a total of 117 indigenous construction firms constituted the sampling frame for this study. All the twenty-five (25) indigenous construction firms in Abuja were studied because they are less than thirty (30). All the members of a population are studied in situation where samples from the population are less than 30 (Sutrisna, 2004; Munn and Drever, 1990). However, in determining the sample size for indigenous construction firms located in Lagos, a formular adapted from Czaja and Blair (1996) was employed assuming an infinite population:

\[
SS = \frac{Z^2 \times P \times (1-P)}{C^2}
\]

Where SS  = sample size
Z = Z value (e.g. 1.96 for 95% confidence level)
P  = Percentage of respondents picking a choice, expressed as a decimal (0.50 assumed)
C = Confidence interval  (± 10% = 0.1 assumed)

\[
SS = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.1^2} = 96 \text{ Indigenous construction firms}
\]

Correction for Finite Population:

\[
SS \text{ new} = \frac{SS}{1+(SS-1)/POP}
\]
Where \( \text{POP} = \) population in this case 92 indigenous construction firms in Lagos state

\( \text{SS} = \) sample size (96) assuming an infinite population

Therefore new sample size\(= \frac{96}{1+(96-1)/92} = \frac{96}{1+95/92} = \frac{96}{2.032} \approx 47.24 \approx 47 \) construction firms

Forty seven (47) indigenous construction firms constituted the sample size for indigenous construction firms that were studied in Lagos. Total sample size for the study was seventy-two (72) indigenous construction firms a summation of forty-seven indigenous construction firms in Lagos and twenty-five indigenous construction firms in Abuja.

As has been indicated earlier, samples from a population of less than 30 are regarded as small samples and all members from such a population are studied. Hence, all the twenty-five (25) indigenous construction firms in Abuja were studied. However, systematic random sampling was adopted for selecting the 47 indigenous construction firms from a population of 92 indigenous construction firms based in Lagos.

Apart from general information about the firms surveyed, the questions in the questionnaire were ordinal in nature. Respondents were asked to indicate how critical project management competencies were to construction firms. A five point likert scale ranging from 1- not critical at all to 5- very critical was used. Cronbach’s alpha was used to test for the reliability of items in the questionnaire. Cronbach’s alpha coefficient ranges from 0 to 1 with alpha coefficients \( > 0.70 \) representing a satisfactory reliability (Nunally, 1978). Twenty five items made up the construct project management competencies. Cronbach’s alpha coefficient for the construct measuring project management competencies was 0.897 indicating a high degree of internal consistency.

Response Rate

Seventy two questionnaires were distributed out of which 53 were properly filled and returned. This gives a response rate of approximately 74%.

**Characteristics of Firms Surveyed**

**Size of Workforce**

Out of the 53 indigenous construction firms surveyed in this research, 64.2% had less than 50 people in their work force, 20.8% had between 51-100 people in their work force, 7.5% had between 101-150 people in their work force, 3.8% of the indigenous construction firms surveyed had between 151-200 and another 3.8% had more than 200 people in their work force (*Table 1*). This indicates that majority of the indigenous construction firms surveyed have a workforce less than 50. This may be due to the fact that most of the indigenous construction firms surveyed might not be able to sustain a work force that is greater than 50.
Twenty six indigenous construction firms had a turnover of less than 0.20 billion Naira. Eleven indigenous construction firms had turnover of between 0.21 and 0.50 Billion Naira. Eight indigenous construction firms had turnover of between 0.51 and 0.70 Naira. Five indigenous construction firms had turnover of between 0.71-1 Billion Naira and only three indigenous construction firms had turnover that was greater than 1 Billion Naira (See Table 2). Majority of the firms surveyed have a turnover of less than 0.20 Billion Naira.

**Table 2 Turnover in Billions**

<table>
<thead>
<tr>
<th>Number of jobs secured</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.20 billion Naira</td>
<td>26</td>
<td>49.1</td>
</tr>
<tr>
<td>0.21-0.50 billion Naira</td>
<td>11</td>
<td>20.8</td>
</tr>
<tr>
<td>0.51-0.70 billion Naira</td>
<td>8</td>
<td>15.1</td>
</tr>
<tr>
<td>0.71-1 billion Naira</td>
<td>5</td>
<td>9.4</td>
</tr>
<tr>
<td>&gt; 1 billion Naira</td>
<td>3</td>
<td>5.7</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>100</td>
</tr>
</tbody>
</table>

**Critical Project Management Competencies**

The mean and standard deviation for all items measuring project management competencies were generated by entering the results into the SPSS. Thereafter, the mean values were used to rank the project management competencies. The study adopted the technique of Lu (2006) where a mean value of 4.00 was used as the benchmark for identifying significant competitiveness parameters. Hence, a mean value of 4.00 was used as the benchmark for identifying critical project management competencies for the indigenous construction firms surveyed. In a situation where two items have the same mean then the item with the smaller standard deviation was ranked higher. Refer to table 3 for descriptive statistics.
Table 3 Critical Project Management Competencies

<table>
<thead>
<tr>
<th>Project Management Competencies</th>
<th>N</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness of cost controlling methods</td>
<td>25</td>
<td>4.62</td>
<td>0.686</td>
<td>1</td>
</tr>
<tr>
<td>Effectiveness of site management</td>
<td>25</td>
<td>4.58</td>
<td>0.908</td>
<td>2</td>
</tr>
<tr>
<td>Effectiveness of time management</td>
<td>25</td>
<td>4.42</td>
<td>0.770</td>
<td>3</td>
</tr>
<tr>
<td>Clients' satisfaction with quality</td>
<td>25</td>
<td>4.38</td>
<td>1.004</td>
<td>4</td>
</tr>
<tr>
<td>Number of qualified human resource</td>
<td>25</td>
<td>4.34</td>
<td>0.618</td>
<td>5</td>
</tr>
<tr>
<td>Existence of contract administration system</td>
<td>25</td>
<td>4.32</td>
<td>0.915</td>
<td>6</td>
</tr>
<tr>
<td>Availability of contract managerial resources</td>
<td>25</td>
<td>4.30</td>
<td>0.845</td>
<td>7</td>
</tr>
<tr>
<td>Availability and effectiveness of price information system</td>
<td>25</td>
<td>4.25</td>
<td>0.939</td>
<td>8</td>
</tr>
<tr>
<td>Availability of quality management system</td>
<td>25</td>
<td>4.21</td>
<td>0.689</td>
<td>9</td>
</tr>
<tr>
<td>Previous records about construction delays</td>
<td>25</td>
<td>4.21</td>
<td>0.793</td>
<td>10</td>
</tr>
<tr>
<td>Availability of health and safety protection resources</td>
<td>25</td>
<td>4.11</td>
<td>0.751</td>
<td>11</td>
</tr>
<tr>
<td>Availability and effectiveness of safety management</td>
<td>25</td>
<td>4.06</td>
<td>0.818</td>
<td>12</td>
</tr>
<tr>
<td>Personnel management system</td>
<td>25</td>
<td>4.06</td>
<td>0.980</td>
<td>13</td>
</tr>
<tr>
<td>Labour management system</td>
<td>25</td>
<td>4.06</td>
<td>1.099</td>
<td>14</td>
</tr>
<tr>
<td>Effectiveness of motivation for personnel and labour</td>
<td>25</td>
<td>4.04</td>
<td>0.831</td>
<td>15</td>
</tr>
<tr>
<td>Job satisfaction of personnel and labour</td>
<td>25</td>
<td>4.04</td>
<td>0.876</td>
<td>16</td>
</tr>
<tr>
<td>Existence of regular training facilities</td>
<td>25</td>
<td>4.02</td>
<td>0.772</td>
<td>17</td>
</tr>
<tr>
<td>Adequacy of personnel structure</td>
<td>25</td>
<td>3.98</td>
<td>0.951</td>
<td>18</td>
</tr>
<tr>
<td>Educational levels of personnel</td>
<td>25</td>
<td>3.96</td>
<td>0.759</td>
<td>19</td>
</tr>
<tr>
<td>Existence of human resource development strategy</td>
<td>25</td>
<td>3.96</td>
<td>0.940</td>
<td>20</td>
</tr>
<tr>
<td>Effectiveness of accident settlement 'process'</td>
<td>25</td>
<td>3.89</td>
<td>0.891</td>
<td>21</td>
</tr>
<tr>
<td>Existence of personnel recruitment plan</td>
<td>25</td>
<td>3.77</td>
<td>1.086</td>
<td>22</td>
</tr>
<tr>
<td>Availability of resources for dispute resolution</td>
<td>25</td>
<td>3.77</td>
<td>1.235</td>
<td>23</td>
</tr>
<tr>
<td>Dispute resolution skills</td>
<td>25</td>
<td>3.75</td>
<td>1.159</td>
<td>24</td>
</tr>
<tr>
<td>Contract claim and dispute resolution</td>
<td>25</td>
<td>3.74</td>
<td>1.041</td>
<td>25</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td></td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussions of Results

A total of 25 parameters were identified as critical project management competencies for indigenous construction firms surveyed (Table 3). Only the five most critical project management competencies are discussed because of constraint in number of pages required for this paper. The most critical project management competency for indigenous construction firms is effectiveness of cost controlling methods (Table 3). Cost control comprises all the methods adopted in a construction project to ensure that construction work is completed within agreed cost limits and without compromising quality of work. Stiff competition in the Nigerian construction industry has forced many indigenous construction firms to present low bids compared to their competitors. Effective cost control methods could enhance profit of construction firms in a business environment that is characterized by
relatively low profit margin. Effective cost control method is necessary for securing jobs and for maximizing profit. Effectiveness of cost controlling method has been ranked the most critical project management competency for indigenous construction firms.

Effectiveness of site management was ranked as the second critical project management competency for indigenous construction firms (Table 3). As noted earlier, profit margin for most construction projects is relatively low. Consequently, indigenous construction firms look for legitimate means of maximizing profit. Effective site management is one of the ways of maximizing profit because it determines how much profit can be made or lost from a construction project depending on the efficient use of materials, labour and other resources (Jimoh, 2012).

The third critical project management competency as perceived by indigenous construction firms is effectiveness of time controlling methods (Table 3). Ineffective time controlling methods can impact negatively on the profit of construction firms. It can ultimately lead to extra expenses, disputes and litigations. Hence, it has been ranked the third critical project management competencies for indigenous construction firms.

Client satisfaction with quality was ranked the fourth critical project management competency. Today’s clients more than ever are eager to get value for money in terms of quality of construction work and service. Client satisfaction with quality is advantageous to construction firms. It provides opportunity for repeat jobs (Egemen and Mohammed, 2005) and it is a source of competitive advantage over rivals (Arditi and Kale, 2002).

The fifth critical project management competency for indigenous construction firms surveyed is the number of qualified human resource. The human resource is a vital resource for firms particularly for labour intensive firms like construction firms. Human resource facilitates the translation of organisational goals into reality. The more qualified the workforce of a construction firm in terms of relevant work experience the easier it would be for such firms to achieve project goals especially of time, cost and quality performance.

**RECOMMENDATIONS**

The following recommendations are made from the findings of this study:

i. Since most of the indigenous construction firms surveyed have a workforce of less than 50 persons and turnover of less than 0.20 billion Naira, indigenous construction firms should explore the idea of forming alliances through mergers, partnering or other forms of collaborative relationships in order to enjoy economies of scale.

ii. Indigenous construction firms should give priority to the development of critical Project Management Competencies (PMCs) such as cost management, site management, time management and quality management by allocating sufficient resources aimed at improving
these critical PMCs through training and other staff development programmes.

iii. Indigenous construction firms should embark on brand development programmes that showcase firms’ project management competencies

CONCLUSION

Critical project management competencies have been identified in this study and it includes: effectiveness of cost management, effectiveness of site management, effectiveness of time management and client satisfaction with quality. The study therefore recommends that indigenous construction firms should sagaciously allocate more resources for the development of critical project management competencies identified in the study and also to embark on brand development programmes that showcase firms’ project management competencies thereby, audaciously taking over the Nigerian construction market as major players.

REFERENCES


PROJECT QUALITY MANAGEMENT PRACTICES IN MULTINATIONAL AND INDIGENOUS CONSTRUCTION FIRMS OF NIGERIA

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\textit{Department of Building, Ahmadu Bello University, Zaria, Kaduna, Nigeria.}

As it is currently found in the Nigerian construction industry that multinational construction firms dominates major projects, a dolorous situation that calls for deep and sober reflection. The circumstances warranting that has, conversely, been incubated by deficiencies, failures, poor quality, etc. of the indigenous construction capacity coupled with mounting demand of construction clients for better project quality, more satisfactory production cost thereby eliminating or minimizing the twin consequences of defects and rework that has come a long way to explain why multinationals are far ahead of the indigenous in terms of client patronage. The research looks at the efforts made by both multinational & indigenous construction firms in achieving project quality. Three parameters of Human Resource (HR), Process, and Technology were identified, studied and then compared. A field survey was used to conduct the research using a structured questionnaire and oral interview. A total of one hundred (100) questionnaires were administered, forty-five (45) were returned and analyzed. Descriptive statistics, percentages, tables, bar charts, frequency and mean were used. Results of the study revealed that both multinational & indigenous construction firms strive to achieve quality during construction as specified in the production information and contract documents. The multinational construction firms have an uncompromising attitude towards quality unlike their counterparts...the indigenous. Moreover, it was observed that certain factors such as technical capability, training of human resources, quality of material resources, etc. needs to be revisited by the indigenous construction firms if at all they are to compete with the multinationals. As such, a number of recommendations were made at the end such as bridging the wide communication gap for improved professional integration, project timely delivery to design and specification, unswerving supply management to checkmate defective building materials & components should be put in place; and finally that Project Quality Management Plan (PQMP) shall be adhered to strictly during construction.

Keywords: construction firm, Nigeria, project, quality management practice, total quality management

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INTRODUCTION

Construction is the process of building, erecting and fabrication of physical infrastructures that require detail and adequate planning for the successful execution of projects. The nature of any given construction industry is complex due to the fact that it heavily rely on and highly demand the inputs of different professionals from project inception through to completion in the quest for achieving project quality in conformity with design and specification. Both public and private projects are being handled by multinational and indigenous construction firms, of which the former enjoy high patronage by both public and private clients as found currently in Nigeria, an issue which has become a subject of great concern to various stakeholders. Above all, the Nigerian construction industry has long been associated with poor quality of construction end products and is an industry that is responding to change at a low pace; (Mohammed & Rotimi, 2002), for it has made little progress in reducing cost of reworks; and defects occurs just as often as they ever did. As clients have also become more aware of the quality standards required in the structure commissioned, the public at large believe that the industry fails to offer value for money, take too long to complete and are too prone to failure (Bamisile, 2004).

The Nigerian construction industry is beset with many problems such as uncompleted project resulting from delay and cash flow problems leading to time and cost overruns, poor quality (defects and rework) & low level of productivity, especially in projects handle by indigenous construction firms. Hence, the reason for embarking on this research is to articulate existing knowledge on project quality management techniques & methods; the aim of the study is to make a comparative study of project quality management practices in multinational and indigenous construction firms of Nigeria. Having the belief & perception in many quarters that the multinationals performs better than the indigenous in terms of project quality delivery, it would be in order to learn ‘something’ from the multinationals by the indigenous, whereas the objectives of the study are as follows:

i. To examine the processes of best quality management practices as stipulated in Quality Standards with special emphasis on the procedures

ii. To investigate efforts made by both multinational and indigenous construction firms in achieving quality

iii. To compare the efforts made by both multinational and indigenous construction firms in achieving quality

iv. To examine the clients’ perception of quality performance of multinational and indigenous contractors

LITERATURE REVIEW

According to Love and Li (2000: 479), quality failures have become an epidemic of the procurement process in construction and invariably lead to
time and cost overruns in projects. The procurement system adopted for projects can be a major determinant in the achievement of quality in construction projects and argued that in order to improve the performance of projects, it is necessary to identify the causes and costs of re-work.

There are project quality management techniques, standards, policies, systems, procedures, audits, manuals, planning, records, surveillance, etc. but they are seldom applied during project execution, which emanates to poor project quality, high maintenance/running cost, reduced building performance and high probability of occupants discomfort. Quality is conformance to standards that represents the products or services basic characteristics, and are based on customer needs and expectation (Aubrey, 2005). Quality of a product should meet the desired requirement at lowest cost (Sharma, 2006). Dodo (2008) opined that the quest to achieving optimal quality entails the effective functioning and integration of informed clients, skillful designers, knowledgeable suppliers/component manufacturers, and competent contractors. Ozaki (2003) stated that quality management has a three-fold meaning in construction: that is getting the job done on time; ensuring that the basic characteristics of the final project fall within the required specifications; and getting the job done within budget. Poor quality impacts companies in two ways; higher cost and lower customer satisfaction (Pyzdek, 2003). Quality can be defined as the totality of features and characteristics of an entity that bear on its ability to satisfy stated or implied needs (ISO 9000:2000); where an entity can be a product, a component, a service, or a process. Quality management has developed from product-related quality control to company-related Total Quality Management, aiming for continuous process improvement (Seaver, 2003). PMI’s PMBOK (PMI, 2002) states that project quality management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken.

Harris and McCaffer (2005) refer to quality inspection as a process of checking that what is produced is what is required. Quality assurance refers to the systematic action necessary to provide adequate confidence that a product will perform satisfactory in service. Quality assurance incorporates all planned and systematic actions necessary to provide adequate confidence that a product or a service will satisfy the requirement for quality (Sharma, 2006). The ISO 9000 series is a framework for improving quality in the construction industry (Kumaraswamy and Dissanayaka, 2000). The ISO 9000 standard was developed to move away from the original ‘prescriptiveness’ approach of its predecessors and to achieve a more flexible framework which allows organizations to develop their own policies and procedures (Harris and McCaffer, 2005). The ISO 9000 family of standards operates on the assumption that the following factors can have influence on the quality of a product or service provided by an organization:

i. Design, Purchasing & Management
ii. Work patterns, job description, inspection and testing
iii. Reporting relationships, policies and procedures
iv. Record keeping systems, inventory control & training
v. Customers, technologies, resources & planning methods
vi. Production processes, transportation services & communication patterns
vii. Service delivery practices, employee knowledge and skills

In Nigeria, there is Standard Organization of Nigeria (SON), the activities of which are similar to that of British Standard Institution (BSI) and ISO. SON has officially adopted ISO 9000 series for quality management in Nigeria. There are three (3) main standards covered by the ISO 9000 family of standards and they collectively provide guidance for quality management and the general requirements for quality assurance.

These families are the ISO 9000, 9001, 9002 and 9003. The requirements of this standard primarily aim at achieving client/customer satisfaction by preventing non-conformity at all stages from design through to servicing. Quality management attempts to identify and correct as many non-conformities-problems, mistakes, and defects-as possible, hence Harris and McCaffer (2005) defined quality management as all the activities that managers perform in an effort to implement their quality policy. According to Mohammed (2011), TQM is an acronym which stands for total quality management. It is a senior management-led process to obtain the involvement of all employees in the continuous improvement of the performance of all activities, as part of normal business, to meet the needs & satisfaction of the customer whether internal or external.

It is an umbrella for continuous improvement & incorporates quality assurance (QA), quality control (QC) and quality inspection (QI) whereas Harris and McCaffer (2005), defined TQM as a management approach that tries to achieve and sustain long-term organization’s success by encouraging employee feedback & participation, satisfying customer needs & expectations, respecting societal values & benefits and obeying government’s statutes and regulation. It is an integrated organizational approach in delighting customers on a continuous basis through everyone's involvement with the organization working on continuous improvement in all product process along with proper problem-solving methodology (Sharma, 2006).

Total quality management is a philosophy that focus on teamwork, increasing customer satisfaction, and lowering costs (Zairi, 2000). Quality improvement focuses on the process to help bring product and services to the next level with the aim to improve the overall quality of products and services. TQM provides principles, tools and techniques for cultural change and continual improvement of quality.
Oakland’s step to TQM (Oakland, 1995)

However, the overall aim of TQM in construction is to ensure achievement of synergistic design through interdisciplinary teamwork (Mohammed, 2011). Quality standards and codes provisions are the product of statistical analysis, which give tolerances for slight variations in building materials performance and those inherent in the methods of production and fabrication. (Mohammed and Rotimi, 2002).

However, Idoro (2009) identified staff strength, qualification, skills, expertise, remuneration & welfare, quality awareness & adequate supervision, labour wages & incentives, attitudes to the provision for testing of materials as the factors affecting quality achievement; whereas employee productivity, recruitment, training, efficiency, fair compensation, safe working environment as the factors affecting employee of construction firms.

RESEARCH METHOD

The method employed in this research is the review of relevant literatures which include journals, online sources, textbooks, etc. as primary sources of data. The research approach adopted both quantitative and qualitative methods based on semi-structured questionnaire to interview and interact with the staff of both multinational & indigenous construction firms in Nigeria on how the concept of project quality management is employed and implemented in their firms and its effects on construction processes and the quality of the finished product. A total of one hundred (100) construction firms was selected out of which 50 are multinationals whereas the other 50 are indigenous. Convenience sampling, also referred to as purposive sampling, is a non-probability sampling technique was used to select the construction firms that have the capacity for implementing project quality management procedures. The reason for the choice of this particular technique is that it can be used to gain some insights into people's attitudes, beliefs, motivation and behaviours. It yields a very accurate result if the population of the study is homogeneous (Burgess et. al, 2003) and the fact that there are known and popular construction companies around the Federal
Capital-Abuja whose commitment to project quality is obvious hence selected as the target respondents. Hence, the population of the study is homogeneous due to the fact that the respondents carry out the same activity, i.e. construction project management, irrespective of the firms they belonged to. Data collected, however, was then analyzed using simple statistical tools such as the percentages (%), mean, tables and bar charts.

**DATA PRESENTATION, ANALYSIS & DISCUSSION OF RESULTS**

The bulk of the data collected was through the administration of semi-structured questionnaires and conducting oral interview. Moser and Kalton (1971) affirmed that the result of a survey could be considered as unbiased and significant if the return rate is not lower than 30-40%.

<table>
<thead>
<tr>
<th>Table 1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profession</strong></td>
</tr>
<tr>
<td>Architecture</td>
</tr>
<tr>
<td>Building</td>
</tr>
<tr>
<td>Engineering</td>
</tr>
<tr>
<td>Quantity Surveying</td>
</tr>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Educational Qualification</th>
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<tbody>
<tr>
<td>OND</td>
</tr>
<tr>
<td>HND</td>
</tr>
<tr>
<td>Bsc</td>
</tr>
<tr>
<td>Msc</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Working Experience</th>
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</thead>
<tbody>
<tr>
<td>0-5years</td>
</tr>
<tr>
<td>6-10years</td>
</tr>
<tr>
<td>11-15years</td>
</tr>
<tr>
<td>16years and above</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Source: Field Survey (2013)

Looking at Table 1.1 it can be observed that majority (37.78%) of the professionals are Architects. This is followed by Quantity Surveyors (22%) while the Builders and Engineers are 20% both. In terms of academic qualification, Table 1.1 further shows that 31.11% have a Higher National Diploma, while 28.88% have First Degree (B. Sc). Whereas, 40% Master Degree (M. Sc). Thus considering the professional background and academic qualifications of the respondents, they are sufficient for the validation of the results.
Figure 1: A bar chart showing a comparison of efforts made in achieving quality between multinational & indigenous construction firms

Figure 2: A bar chart showing a comparison of the factors affecting quality achievement by multinational & indigenous construction firms
Figure 3: A bar chart showing a comparison of the level of adherence to project quality management plan by both firms!

**ORAL INTERVIEW**

Face to face oral interviews were carried out with some professionals in the construction industry. The average duration for the structured interview, was two (2) hours. Six (6) professionals were chosen from Architecture and four (4) from Engineering, five (5) from Quantity surveying, while twenty (20) professional Builders were chosen. However the interview was not tape recorded for transcription.

The interview was aimed at getting detailed explanation on efforts put forward by multinational and indigenous construction firms in achieving quality of construction in the Nigerian construction industry. The objectives of the study were used as a guide in drafting questions for the interview.

All the professionals interviewed agree that poor quality of construction work leads to rework (delay, time and cost overruns). There are complex projects that require the use of sophisticated and state-of-the-art construction plant & equipment. It was however, observed that most of these projects were executed by the multinational construction firms. According to some interviewees over 90% of public projects are awarded to multinational construction firms. The oral interview conducted buttress that the stock of multinational construction firms, the nature and scope of work they are performing/carrying out, manpower composition with specific reference to managers and senior executive qualification is by far incomparable to that of indigenous construction firms, despite the fact that the employees of the multinational construction firms are substantially indigenes/citizens of Nigeria.
CONCLUSIONS & RECOMMENDATIONS

Conclusion

i. The following conclusions can be drawn from this research:

ii. Both public and private projects are being handled by multi-national and indigenous construction firms

iii. There is disparity in terms of project quality delivery between multinationals and indigenous

iv. Uncompromising attitude towards the stipulations of the contract documents in terms of design & specifications by the multinationals put them a step ahead, thus a preference over their indigenous counterparts

v. The study revealed that the professionals interviewed unanimously agree that quality can be achieved when firms can invest in quality management which cost far less than the cost of correcting defects & rework.

vi. The study finds out that Quality Officer/Quality Manager do exists in multinational construction firms whereas it is absent in indigenous construction firms. Hence, concrete cube test result and steel tensile test result falls within the responsibility of the quality officer/manager.

Recommendations

The following are recommended:

i. Substandard project execution emanating in defects and rework should be evaded or curtailed for clients to derive maximum satisfaction by achieving value for money

ii. Project timely delivery to design and specification should be the slogan of construction firms for them to uphold the confidence reposed in them by various clients thereby improving the firms public image!

iii. Wide communication gap resulting from lack of teamwork & professional integration at different phases of the project life-cycle should be bridged to avoid quality-related problems

iv. Unswerving supply chain management is indispensable in this regard to avoid supplying substandard and non-conforming construction materials and or components and rejecting the defective materials supplied.

v. Project Quality Management Plan (PQMP) prepared by a registered builder should be strictly adhered to during building production management

vi. Quality review meetings should be organized periodically say weekly, bi-weekly, monthly, bi-monthly, quarterly, etc. in order to gauge and improve quality practices.
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**PROMOTING EDUCATION ON INCLUSIVE DESIGN OF THE BUILT ENVIRONMENT AT KNUST**

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Persons with Disabilities (PWDs) represent the most marginalized, neglected and excluded persons in society hence the rise in the activities of various advocacy groups to ensure the inclusion of PWDs in society. One of the most sensitive areas of discrimination against persons with disabilities (PWDs) is barriers in the built environment. This study is aimed at promoting and improving inclusive design education and disability equality in Ghana. It therefore assessed the training of the graduates at Kwame Nkrumah University of Science and Technology (KNUST) who later become professionals of the built environment in Ghana. To achieve the objective of the study, the Course Contents of various departments that taught courses relating to the built environment were evaluated through a survey of 259 respondents made up of 23 lecturers, 127 students, 52 design professionals of the built environment and 57 Persons with Disabilities (PWDs). The findings revealed that the curricula of most of the Departments that taught built environment courses at KNUST were deficient in the principles of inclusive design. The PWDs on the other hand blamed the government and design professionals for the inaccessible built environment. The study recommends that the present curricula of all relevant Departments should be revised to incorporate elements of inclusive design and design professionals who are already practicing in the field should be given refresher courses by their respective professional bodies to make them more responsive to the changing trends of universal design.

Keywords: built environment, course content, education, inclusive design, persons with disabilities, universal design

**INTRODUCTION**

Every individual, regardless of his ability or disability, has a fundamental right of movement. This privilege includes the right to access the built environment without any hindrance. The built environment has usually been designed with the concept of what the “normal body” is; thus neglecting the varying needs of Persons with Disabilities (PWDs). For
instance in Ghana, vertical movement in public buildings is usually by means of a series of stair cases; light switches and fan regulators are positioned at heights that are usually inaccessible to a wheelchair user; pavements and walkways are often strewn with obstacles and bounded by kerbs; while the ramps in the few public buildings where they are available are constructed at steep slopes making them difficult for PWDs to use. The situation is not different even in the developed countries. For instance in the British general election in May 1997, 75% of polling offices were inaccessible to people in wheelchairs, while few had the technical aids to permit visually impaired people to mark their votes on the polling papers (Imrie 2001).

Notwithstanding, Article 9 of the United Nations Convention on the Rights of Persons with Disabilities (2006) states inter alia that to enable PWDs to live independently and participate fully in all aspects of life, state parties shall take appropriate measures to ensure PWDs have access, on an equal basis with others, to the physical environment, to transportation, to information and communication, including information and communication technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures, which shall include the identification and elimination of obstacles and barriers to accessibility, shall apply to, inter alia buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces. In spite of this and other regulations by international and local bodies, PWDs continue to face discrimination in the built environment in their daily lives.

Based on 2010 global population estimates about fifteen per cent (15%) of the world’s population is disabled (WHO, 2011). Of this, 80% are from developing countries of which Ghana is a part (UNDP, 2014). Exclusion of the needs of PWDs is evident at all stages of the design and development of the built environment. It appears that it is either because most designers are ignorant of the needs of PWDs or potential tenants and clients rarely express a demand for accessible buildings; and the regulatory controls are not strong enough (Imrie and Hall, 2001). There is therefore the need to factor the various forms of disabilities into the design of the built environment. The design of the built environment should have elements that make it inclusively accessible to all persons. The most effective way of ensuring that the built environment is inclusive will be to ensure that design professionals in the country have adequate knowledge of the needs of PWDs and are skilled to apply the necessary principles needed to produce inclusive designs (Imrie 2001).

The aim of this research was to examine the current state of inclusive design education at Kwame Nkrumah University of Science and Technology (KNUST), Kumasi – Ghana where majority of professionals of the built environment in Ghana are trained. It sought to:
• Investigate whether the curricula of Departments at KNUST where most built environment professionals in Ghana are trained contain courses related to inclusive design.

• Investigate whether design professionals who are products of these Departments incorporate inclusive design in their work.

• Know the perception of PWDs in the city of Kumasi on how accessible their built environment is.

**Inclusive or Universal Design**

The Centre for Universal Design (CUD) at North Carolina State University defines Inclusive or Universal Design as the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. It is the design of products and environments that are accessible to, and usable by, as many people as reasonably possible on a global basis, in a wide variety of situations and to the greatest extent possible without the need for special adaptation or specialized design. The CUD has established the following seven principles for the universal design of products and environments (The Centre for Universal Design, 1997):

• **Equitable use** - The design must be beneficial and marketable to people with diverse abilities.

• **Flexibility in use** - The design must be able to provide an array of individual inclinations and abilities.

• **Simple and intuitive use** – It should be easy to grasp, irrespective of the user's experience, knowledge, language skills, or present concentration level.

• **Perceptible information** - The design should properly provide the relevant information to the user, irrespective of ambient conditions or the user's sensory abilities.

• **Tolerance for error** - It must diminish threats and the adverse consequences of inadvertent or unplanned actions.

• **Low physical effort** - The design should be easily employed with little physical tiredness.

• **Size and space for approach and use** - Suitable size and space should be provided for approach, reach, operation, and use regardless of the user's body size, posture, or mobility.

In the promotion of inclusive design culture, the responsibility for the process of achieving and maintaining inclusive environments does not rest only on design professionals such as architects, engineers and planners but the whole project team and the professionals that surround them such as quantity surveyors, project managers, contractors and site operatives, service engineers, planners and developers (Hanson, 2004). Everyone who makes a decision or acts in a way that creates, alters or influences the
nature of the built environment should be conscious of making his designs inclusive. Students therefore need to acquire team working and cross-disciplinary skills to promote an ethos and awareness of inclusive design. Imrie (1996) averred that building and design professionals have little recognition of bodily and/or physiological diversity and so there is a tendency for architects and designers to design to specific standards and dimensions which revolve around a conception of what the normal body is. Most design professionals seem to conceive of architecture as an abstract, often two dimensional, visual art rather than conceiving of it as something which should be sensitized to the complexity of the human body (Imrie, 1996). In addition most designers also conceive of disabled bodies as mobility or ambulant-impaired, with little perception of the wider range of physical and/or mental impairments which need to be catered for in producing inclusive design. Where designers do produce designs for PWDs it tends to be for wheelchair users only. The challenge is, to explore and question the values held by design professionals; to encourage them to be aware of different needs and expectations.

There is now a growing realization that the knowledge and values needed to create and maintain inclusive environments, have in turn to be supported by a more extensive set of people orientated skills than built environment professionals currently utilize. From the above, it is important that the curricula of higher institutions of learning where built environment professionals are trained are tailored to include the principles of inclusive/universal design so as to equip the students early in life with the requisite knowledge and skills which they could utilise later in life.

Reasons why inclusive design should be integrated in to the curriculum of the built environment courses are many and varied. For instance a research group set up in September 2001 by the Centre of Education for the Built Environment in the United Kingdom to study on inclusive design brought out five arguments to support why inclusive design should be integrated in the curriculum of the built environment courses.

- **The moral argument;** it was argued that everybody has the alienable right to participate in community life which includes accessible built environment and so teaching inclusive design in schools will enable students to build their own set of values to support their future practices as built environment professionals.

- **The sustainability argument;** a community becomes sustainable by the establishment of inclusive environments that combine flexible, practical and pliable building forms with long term affordability and access to services.

- **The professional argument;** the import of the moral argument has been captured in the codes of conduct of many built environment professional institutions. These codes of conduct usually demand that their members should cultivate a high sense of responsibility
for the way in which their professional actions impact on both clients and users of the built environment.

- **Economic argument:** it was argued that an inclusive environment is an enlarged one which stimulates the growth of access, payment of taxes and trading in goods and services.

- **Legal argument:** the fundamental goal of all legislation is to end all forms of discrimination due to race, sex, religion and disability etc. The latter seeks to end all forms of discrimination against PWDs, which includes the design, construction and management of the built environments, and so their professionals should be equipped with the requisite training on inclusive design principles.

**Education on the Built Environment at KNUST**

Education plays a vital role in determining the quality of our built environment. The Tomar Resolution ResAP (2001) promotes the implementation of measures by universities and institutions responsible for higher and further education, as well as vocational training to include PWDs in their design curricula and also aims at promoting a consistent policy to improve accessibility. The concept of universal design should be an integral and compulsory part of the mainstream initial training of all occupations working on the built environment, at all levels and in all sectors. It recommends that adequate further training should also be made available for both active professionals and student trainees and that the curricula of the latter at under-graduate and post-graduate level should develop the following skills:

- perceiving the relationship between human beings and their constructural creations and between the latter and their environment.
- understanding the need to accord constructural creations and space in compliance with human needs.
- mastering problem-solving techniques in order to increase the usability of all their constructural creations, taking into account human diversity.

A number of Departments at KNUST offer courses that deal with the built environment but the Planning (DoP), Civil Engineering (DoCE) and Architecture (DoA) Departments are most directly involved with the design of the built environment and were therefore used for the study on inclusive design education at KNUST. The three Departments were started in the then Kumasi College of Arts, Science and Technology, now the Kwame Nkrumah University of Science and Technology (KNUST), in the late 1950s and have been responsible for the training of most built environment professionals.

For instance, the Department of Planning is the only government recognized institution in the country that trains planners (Inkoom, 2009). The Department’s main mission is therefore to train skilled personnel required to formulate and manage various development policies and programmes at all levels of national development such as the National
Vision of Socio-Economic Development which is required by the 1992 Constitution of Ghana, the Economic Management programme, the Growth and Poverty Reduction Strategy (GPRS II), and to promote and implement the improved planning system. The Department's objectives, which are in line with national objectives for tertiary education and the University expectations, are outlined as follows:

- to provide cost-effective training of students at the undergraduate and postgraduate levels, train personnel in support of national development policies and programmes of decentralization, rationalization of planning services and grassroots development.
- to improve access of women to programmes in the Department at both the undergraduate and postgraduate levels.
- to intensify the Department of Planning’s extramural activities through distance education, continuing education and provision of further assistance to needy communities and districts.
- to provide in-service training needs tailored to meet the requirements of sectoral ministries, Regional Coordinating Councils, District Assemblies, parastatals, various private sector organizations including NGOs, through continuing education.
- to gradually localize postgraduate training by increasing intake of students to enable them specialize in fields critical to overall national development and economic management.

The courses taught include; Infrastructure Planning, Development Planning Process; Environment and Development; Introduction to the Built Environment; and Settlement and Neighbourhood Design.

Presently, apart from KNUST, civil engineering education and training in Ghana is undertaken by the polytechnics and some private universities in the country. It aims at providing a challenging and stimulating educational programme, which will create a learning experience for the students in order to offer competent professional services in the development of natural resources and the provision of infrastructure in ways that are beneficial to humankind. At KNUST, the courses offered include Structures, Environmental Quality Engineering, Technical Drawing, Geotechnical Engineering and Highways Engineering. The students are trained to:

- appreciate the impact of various civil engineering activities on the quality of the environment.
- develop clarity and style in professional communication and to develop simple skills of management, planning, organization and teamwork.
- develop the ability to make rational civil engineering decisions on the basis of available relevant evidence.
appreciate professional obligations, responsibilities and ethics in relation to the needs of the society and how their quality of life can be sustained and improved through advances in technology.

• appreciate the conceptual and creative aspects of civil engineering design.

Architecture education in Ghana started in 1957 with its first students admitted in 1958. The programme was introduced in conjunction with other design programmes to train the built environment professionals to meet the simplest needs of the community. The education and delivery of appropriately skilled graduate architects is vital in the pursuit of the production of good architecture. Courses taught include Climate and Architecture, Technical Drawing, Architectural Science, Building Services and Principles of Design.

The Departments of Planning, Civil Engineering and Architecture combine lectures, studio work (workshops), and class and community presentations as teaching methods. In addition to these, the three Departments usually send their students for vacation training attachments in an attempt to link theory and practice in order to equip graduating students with the skills, attitude and motivation to meet the challenges of development in Ghana. Education on the built environment offered by these three Departments at KNUST especially the Planning Department is however hampered by a number of factors as identified by Inkoom (2009). These include high student-lecturer ratio (staff-students ratio at 1:30 for undergraduates and 1:3 for the graduate level), insufficient classroom and studio space, insufficient availability of teaching and learning aids, and insufficient access to literature and journals. The combined effect of these factors is that facilitation of teaching, learning and professional practice is adversely affected. The prevailing situation of high student numbers and general shortage of resources means that the Departments are not always able to implement to the full their training programmes. For example, the organization of familiarization trips and field visits to relevant institutions, modelling, and other activities to expose students to the appropriate design practice are hampered. Consequently to cut cost, sites for field exercises have to be restricted to communities at the fringes of the University or from among towns in the Ashanti Region of Ghana where the University is located.

**METHODOLOGY**

This study has been designed as a survey research where quantitative data was obtained by means of independent questionnaires administered to lecturers and students of the DoP, DoCE and DoA of KNUST, design professionals at the Building and Roads Research Institute (BRRI) Kumasi, Architectural and Engineering Services Limited – Kumasi, and the Development Office of KNUST. PWDs at some rehabilitation schools in Kumasi were also included in the survey. The sample size for lecturers and...
students was obtained using the Kish (1965) formula while haphazard sampling was used for design professionals and the PWDs.

Closed ended questions were used where respondents were given the option to choose from fixed options. The questions were expressed in a simple and clear manner so that respondents could understand and respond appropriately. Two sets of questionnaires were designed for the lecturers and students and they contained 18 and 19 multiple choice questions respectively. The questions were prepared in 3 categories: General personal information about the respondent, the respondent’s assessment of the current curricula of his/her Department with reference to the principles of inclusive design and thirdly, the Building code and Persons with Disability Act. The questionnaires for the design professionals comprised of 12 multiple choice questions. The professionals were required to access their own designs in relation to the principles of inclusive design and the Ghana Building Code. The questionnaires for the PWDs comprised of 10 multiple choice questions to determine the type of challenges and discrimination they face. The data gathered was organized and analysed using Microsoft Excel and SPSS after which conclusions were drawn. Data gathered during the survey are presented and analysed in the light of the standard principles of inclusive design discussed earlier. An item was rated as satisfactory (3) if it met the minimum requirements of inclusive design while items that were better than satisfactory were designated as Good (4) and Very Good (5) but those below satisfactory were rated as Fair (2) and Poor (1).

Questionnaires were used because they have the advantage of protecting the privacy of the respondent and grant the respondent the leverage to provide needed information. It also reduces the element of bias because it cuts off interviewer involvement. There is the further reduction of bias because all respondents respond to the same set of questions. Comparatively, it is less expensive and less time consuming than other methods. Finally, the tabulation of close-ended responses is relatively easier for studies like this. However, it is also conceded that the use of questionnaires has challenges which tend to serve as limitations on research findings. These include the difficulty in capturing emotions of respondents. Furthermore, since perceptions and levels of understanding differ from person to person, respondents may read different meanings into specific questions or terms. At times too, the responses to certain questions may call for further probing which the questionnaire approach does not provide for (Creswell, 2012; Marshall, 2005; Ackroyd and Hughes, 1981). Cognizant of some of these challenges, the selection of respondents was carefully done to reduce especially those related to the understanding of questions by respondents. There was much effort to also use unambiguous questions and response options. It is therefore assumed that the respondents well understood the questions and responded intelligently. The findings are accordingly reliable but limited to the study area and the period of the study.
RESULTS

Assessment of the Current Curricula by Lecturers

The Department of Planning had a total of 18 lecturers while the Civil Engineering and Architecture Departments had a total of 16 lecturers each. The number of lecturers who responded to the questionnaires at the Planning, Civil Engineering and Architecture Departments were nine, six and eight respectively. In the survey, the lecturers were requested to assess and grade the current curricula at their Departments against the standard principles of inclusive design postulated by the CUD. The outcome of their assessment is presented in Table 1. The mean of the responses indicated that 83.4%, 89.5% and 90.7% respectively of the Planning, Civil Engineering and Architecture lecturers assessed the content of the current curricula used by their Departments in the provision of inclusive design as neither good nor very good. None of the 23 lecturers from the three Departments assessed the contents of the current curricula of the various Departments in relation to inclusive design as very good. What was more worrisome was the fact that most of the lecturers in the three Departments were not very conversant with Act 715; the legislation that seeks to make built environment accessible to PWDs. From these responses, it is evident that the present curricula taught by the lecturers of the three Departments do not sufficiently equip their students to become built environment professionals who are equipped with the rudiments of inclusive design. The aspirations of the PWDs to have an accessible environment may therefore remain unrealised.

According to CEBE Special Interest Group’s research, the above mentioned lapses often occur in institutions partly because most of the lecturers have been trained to accept inclusive design as an appendage but not a vital part of the design of the built environment. For this reason, the knowledge of many of these lecturers is restricted to the teaching of technical codes. Although Lifchez (1987) avers that technical specifications alone in themselves cannot create inclusive environment the survey revealed that teaching of building codes and technical specifications in the three Departments was not even satisfactory (Table 1). Secondly it must be appreciated that the teaching of inclusive design cannot be achieved simply by the traditional teaching methods like “adding a lecture, assigning a reading, or teaching a code” to the students but should rather involve pedagogical strategies and attitudinal changes which rely on a mixture of alternative and traditional pedagogical practices (Welch and Jones 2001). Thirdly inclusive design is an evolving, fluid and complex speciality and so Continuing Professional Development (CPD) for both lecturers and professionals is essential to sustaining good inclusive design practice. In the light of the above, the faculties of the three Departments should come to terms with the complexity of inclusive design, change some of their teaching methods and course contents and involve themselves in CPD among others to improve the teaching of inclusive design in their Departments.
Assessment of the Current Curricula by Students

Tables 2 and 4 show the responses of third and final year students of the various Departments on their assessment of how inclusive their current curricula are. The survey targeted the third and final year students due to their longevity in their Departments as students. 65, 29 and 38 students from the DoP, DoCE and DoA were surveyed. Generally, like their lecturers, the students in the three Departments rated their present curricula as being non-responsive to the requirements of inclusive design. For example, only 13 (20%) of the Planning students had knowledge of the Disability Act 715 (Table 4). This implies that four out of five of the students are ignorant of the legislation that seeks to address discrimination against PWDs in the built environment. Furthermore, 36.8% of the Planning students as compared to 16.7% of the lecturers assessed their curricula as providing good or very good education on inclusive design. Responses received from the students of the DoCE (Table 2) indicate that whereas 57.1% of the respondents believe that their curricula provides satisfactory knowledge of the principles of inclusive design, only 4% of them had knowledge of the Disability Act 715. Similarly 95% of students from the DoA admitted their ignorance of the Disability Act (Table 4). On the contrary, majority of the DoA students (91.4%) intimated that they were receiving satisfactory or better training in inclusive design.

Table 1 Assessment of current curricula by lecturers of the three departments at KNUST

<table>
<thead>
<tr>
<th>DESIGN PRINCIPLES</th>
<th>PLANNING (%)</th>
<th>CIVIL ENGINEERING (%)</th>
<th>ARCHITECTURE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing the skills of students in bringing out designs that are useful and marketable to people with diverse abilities</td>
<td>0.0</td>
<td>11.1</td>
<td>33.3</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that accommodate a wide range of individual preferences and abilities</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that are easy to understand, regardless of the user's experience</td>
<td>0.0</td>
<td>33.3</td>
<td>66.7</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that minimize hazards and the adverse consequences of accidental or unintended actions, regardless of ambient conditions</td>
<td>0.0</td>
<td>22.2</td>
<td>55.6</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that can be used efficiently and comfortably and with minimum likelihood of errors</td>
<td>0.0</td>
<td>22.2</td>
<td>55.6</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that have appropriate sizes and space for approach, reach, manipulation, and use regardless of the user's body size, posture or mobility</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Educating students to the building codes and regulations that address disability discrimination</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*5 = Very Good, 4 = Good, 3 = Satisfactory, 2 = Fair, 1 = Poor
From the above it is evident that a lot of overhauling will have to take place in all the three Departments if the objectives and principles of universal design as laid out by CUD are to be realised. According to some researchers (CEBE, 2002; CUD, 1997; Avoke, 2001), these changes must include bringing students into direct contact with the different user groups during their training. This will enable the students to observe and listen to the representatives of the different user groups, represent and act as user’s advocates and even work directly with the users to foster the sense of empathy, personal understanding and knowledge. Also students of built environment professions should be advised to involve consultation, collaboration and participation as vital ingredients of communication and representation in their inclusive design education. This approach is different from the traditional form of representation which addresses the formal and organisational qualities of space.

Table 2: Assessment of current curricula by students of the three departments at KNUST

<table>
<thead>
<tr>
<th>DESIGN PRINCIPLES</th>
<th>PLANNING (%) (n=65)</th>
<th>CIVIL ENGINEERING (%) (n=62)</th>
<th>ARCHITECTURE (%) (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing the skills of students in bringing out designs that are useful and marketable to people with different abilities</td>
<td>5.0</td>
<td>4.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that accommodate a wide range of individual preferences and abilities</td>
<td>7.5</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that are easy to understand, regardless of the users’ experience</td>
<td>0.0</td>
<td>27.5</td>
<td>40.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that communicate necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities</td>
<td>2.5</td>
<td>27.5</td>
<td>65.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that minimize hazards and the adverse consequences of accidental or unintended actions regardless of ambient conditions</td>
<td>7.5</td>
<td>55.0</td>
<td>55.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that can be used efficiently and comfortably and with minimum wasted motion regardless of the user’s body size and shape</td>
<td>2.5</td>
<td>25.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Developing the skills of students in bringing out designs that have appropriate sizes and spaces for approach, reach, manipulation, and use regardless of the user’s body size, posture, or mobility</td>
<td>2.5</td>
<td>20.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Educating students in the building, codes and regulations that address disability discrimination</td>
<td>0.0</td>
<td>20.0</td>
<td>50.0</td>
</tr>
<tr>
<td>MEAN OF RESPONSES</td>
<td>3.4</td>
<td>28.4</td>
<td>63.8</td>
</tr>
</tbody>
</table>

*5 = Very Good, 4 = Good, 3 = Satisfactory, 2 = Fair, 1 = Poor

Furthermore since built environment courses tend to employ a range of teaching situations such as seminars, lectures, design studios and workshops, inclusive design principles must not only be incorporated from early stage as an important part of the curriculum but must be taught together with skills such as team working, meeting and listening to user-needs, accessible representation skills and environmental auditing.
Courses must also adopt an interdisciplinary and multi-professional approach where the students are taught to appreciate the fact that inclusive design is a chain where various professionals play their vital roles to make the environment accessible. Students should therefore acquire strong team working skills and understand their role in the team.

**Assessment of Designs Produced by Professionals**

A total number of 52 built environment design professionals made up of 13 Planners, 17 Civil Engineers and 22 Architects from Kumasi responded to the questionnaires. They were made to assess whether their designs as professionals satisfied the requirements of inclusive design. Their responses, presented in Table 3 showed that only 21.4% and 26.8% respectively of professional Planners and Civil Engineers as compared with 53.0% of Architects intimated that the level of inclusiveness in their designs was above satisfactory while 44.5%, 29.4% and 18.2% of professional Planners, Civil Engineers and Architects respectively rated the inclusiveness of their designs as below satisfactory.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Assessment of Designs Produced by Various Professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designs</td>
<td>PLANNERS (%)</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Rating</td>
<td>5</td>
</tr>
<tr>
<td>Design 1: designs that are people-friendly and accessible to people with diverse abilities</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 2: designs that accommodate a wide range of individual preferences and abilities</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 3: designs that are easy to understand, regardless of the user’s experience</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 4: designs that communicate necessary information effectively to the user, regardless of ambient conditions or the user’s sensorial abilities</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 5: designs that minimize hazards and the adverse consequences of accidental or unintended actions regardless of ambient conditions</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 6: designs that can be used efficiently and comfortably and with minimum efforts</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 7: designs that have appropriate size and space for approach, reach, manipulation, and use regardless of the user’s body size, posture, or mobility</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 8: designs that conform to building codes and regulations that address accessibility discrimination</td>
<td>0.0</td>
</tr>
<tr>
<td>Design 9: designs that conform to the Disability Act ’15</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*5 = Very Good, 4 = Good, 3 = Satisfactory, 2 = Fair, 1 = Poor*
As mentioned earlier, inclusive/universal design is a complex, fluid and ever-changing discipline that cannot be easily mastered. Inclusive design education therefore requires a philosophy of continuous learning from all its students, teachers and especially its professionals who need the cultivation of good research and self-directed study skills and more importantly, present CPD (continuous professional development) as a prerequisite for professional practice. This is very pertinent in the light of the fact that Act 715 which serves as the regulatory framework for accessibility of the built environment in Ghana was passed as recently as 2006 when most professionals had completed their studies and left the classroom. Therefore it is only CPD by their various professional bodies that can assist them to be abreast with current trends in inclusive design.

On the whole, the DoA was rated higher than the other two Departments by their lecturers, students and professionals. This was not surprising because on relative terms, the DoA’s curriculum had more slant towards inclusive design principles which in turn produced students and professionals who are relatively more informed of inclusive design than their counterparts in built environment. This affirms the assertion that whatever goes into the teaching and learning stage of a curricula will ultimately affect the professional conduct of the individual.

Responses from PWDs
A total of 57 PWDs from Kumasi where KNUST is situated responded to the questionnaires and of these, 32 were females. Majority of the respondents were between the ages of 15 and 25. They were required to answer questions concerning the challenges they face when accessing the built environment; and the agencies which, in their opinion are responsible for the problems they encounter. All the 57 respondents admitted that they encountered challenges accessing the built environment. Imrie (1996) attributed this to the fact that design professionals have little recognition of bodily and/or physiological diversity increasing the tendency for architects and designers to design to specific standards and dimensions which revolve around a conception of what the normal body is. The survey revealed that roads and pavements (25%) are the most inaccessible of the various elements in the built environment. It was followed by vertical circulation (23%) and building entrances (19%) in that order. The results of the survey also indicated that 70% of the PWDs face these challenges in the built environment on daily basis (Fig. 1). It is therefore imperative that design professionals that work in the built environment are equipped with inclusive design principles to make them responsive to the changing needs of PWDs.
Table 4 Knowledge and Use of Act 715

<table>
<thead>
<tr>
<th>Department</th>
<th>Category</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Lecturers</td>
<td>44.4</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>20.0</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>Professionals</td>
<td>15.4</td>
<td>84.6</td>
</tr>
<tr>
<td>Civil engineering</td>
<td>Lecturers</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>4.0</td>
<td>96.0</td>
</tr>
<tr>
<td></td>
<td>Professionals</td>
<td>5.9</td>
<td>94.1</td>
</tr>
<tr>
<td>Architecture</td>
<td>Students</td>
<td>5.0</td>
<td>95.0</td>
</tr>
<tr>
<td></td>
<td>Professionals</td>
<td>36.4</td>
<td>63.6</td>
</tr>
</tbody>
</table>

The PWDs were also given the opportunity to assign blame for the inaccessible built environment and their responses are presented in Fig. 2. Of the options provided, almost half (47%) of the respondents attributed the problems associated with inaccessible built environments to the design professionals. This view was corroborated by Imrie (1996), who asserted that most design professionals (which would include architects, engineers and planners) seem to conceive of architecture as an abstract, often two dimensional, visual arts rather than conceiving of it as something which should be sensitized to the complexity of the human body.

Hanson (2004) went further by saying that the responsibility of an accessible environment does not rest solely with the designers of the built environment, but with the entire project team. This therefore makes other professionals such as quantity surveyors, project managers, contractors and site operatives, service engineers and developers also culpable. The second agency blamed for the inaccessible built environment was the central government. The United Nations Convention on the Rights of Persons with Disabilities (2006) obliges party states which include Ghana to take appropriate measures to ensure that PWDs have access, on an
equal basis with others to the physical environment. Most of the respondents stressed that even though the government has enacted laws to ensure an inclusive environment, it should go further to guarantee that those laws/ regulations are fully enforced.

CONCLUSION
Major findings of this study include the following:

- Most students studying courses of the built environment at KNUST are ignorant of the Disability Act 715 of 2006; the framework that promotes equality.
- The current curricula of Departments that teach built environment courses at KNUST do not provide adequate education on inclusive design.
- Most design professionals of the built environment in Kumasi do not fully inculcate the concept of inclusive design in their professional practices and so their designs tend to discriminate against PWDs.
- PWDs blame the built environment professionals and the government for the inaccessible built environment.

These findings are disturbing considering the fact that it is almost a decade since Ghana passed the Persons with Disability Act (Act 715) which sought to improve access to the built environment. The concept of inclusive or universal design should as a matter of urgency, become an integral and compulsory part of the curricula of all built environment courses at KNUST. This will enhance the training of students, lecturers and professionals who will in turn assist to make the built environment more accessible.

RECOMMENDATIONS

a) The present philosophy, curricula and teaching methods of all Departments involved in built environment design education at KNUST should be revised to incorporate more elements of inclusive design.

b) On similar lines as the Tomar Resolution ResAP (2001), it is further proposed that the University authorities, the National Accreditation Board, the National Council for Tertiary Education and the Ministry of Education should come up with policies that will enhance inclusive design education in the KNUST generally and the relevant Departments specifically.

c) The education and training of design professionals should take an interdisciplinary and multidisciplinary approach; covering all disciplines relevant to the built environment. Linkages to other courses should offset the problem of isolating the subject in the curriculum.
d) Since the whole project team is responsible for achieving and maintaining inclusive designs (Hanson, 2004) all Departments that train students to ultimately become members of such project teams should make the teaching of inclusive designs a major component of their curricula. To further inoculate the team work ethic into the students, it is proposed that there should be joint lectures where students from the various Departments would study aspects of inclusive design together and also undertake group exercises or mini project works in inclusive design. This will serve as a good preparatory ground for their future work in inclusive design and with time ultimately impact the industry.

e) Lecturers and professionals should continually be trained to be abreast with the principles of inclusive design to enable the former transfer the skills to their students and the latter incorporate them in their professional designs. Professional bodies should employ the CPD and refresher courses to retrain their members who are already in the field to make them more responsive to the changing trends of inclusive design.

f) It is recommended that further research using other methods other than questionnaires should be undertaken. This will complement the current study since issues which could not be captured through the use of questionnaires would appropriately be unearthed. This will ultimately lead to a holistic appreciation of the problem and in consequence a more holistic solution proffered. Together, the two will serve as a stronger basis for policy direction and better impact on the various allied departments, professions and the construction industry as a whole.

ACKNOWLEDGEMENT

The authors acknowledge the assistance of Messrs Eugene Tetteh Akuaku and Mark Nana Gyesi- Mensah, former students of the Department of Building Technology, KNUST for the preliminary role they played in this research.

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PRUDENCE PRACTICE AMONG CONSTRUCTION PROJECT MANAGERS IN NIGERIA

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Department of Building, Faculty of Environmental Sciences, University of Lagos, Nigeria

Measurement of prudence practice of construction professionals is an innovation long overdue in the construction industry that is constantly in need of new strategies to deal with construction challenges. The performance of project manager’s principal responsibilities in delivering the project end-item is dependent on the prudence of a project manager in dealing with uncertainties of the construction industry. Professionals used as project managers on construction projects performed differently in managing the planned and actual resources required for a project with disputable variance in project outcomes thus, the need to analyse and compare their prudence practice on projects. Twenty-seven (27) prudent practice criteria used to test the prudence of fiduciaries were adapted to assess the prudence practice of construction project managers. A total of one hundred and twenty two (122) questionnaires were successfully retrieved using stratified random sampling. Data analysis process was carried out using statistical tools such as frequency, mean and analysis of variance (ANOVA). Project managers in the Nigerian construction industry that were surveyed performed better in the awareness of their duties and responsibilities including seven other criteria; While the Civil Engineers and Quantity Surveyors match on to high performance in prudence practice, the Architects performance is typical prudence practice. The respondents ranked Quantity Surveyors as project managers that displayed high prudence practice among the professionals although; no professional achieved excellent prudence practice.

Keywords: architect, civil engineer, professionals, prudence practice, quantity surveyors

INTRODUCTION

Prudence is as an attitude of mind, denoting the careful assessment of all uncertainties and vigilance to possible risks (rather than a systematic measurement bias) before making a judgment or decision (AAF, 1995). The essence of prudence in project management is to ensure the careful assessment of all uncertainties and vigilance to possible risks that will increase construction efficiency. An efficient construction sector is a prerequisite to effective national development since building, civil and

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industrial engineering works are usually a major contribution to Gross Fixed Capital Formation, Gross Domestic Product and National Employment (Oyewobi and Ogunsemi, 2010). The prudent investment practices by Foundation for Fiduciary Studies (FFS) (2003) edited by the American Institute of Certified Public Accountants which was adapted to the construction industry by Bello (2015) serve as variables that were used to test the prudence of construction project managers. According to FFS (2003) these Practices are easily adaptable to all types of portfolios, regardless of size or intended use and are used to test the prudence of fiduciaries. Ogunsemi, Oyediran and Ekundayo (2008) also stated that the all-encompassing project manager’s basic qualification is training in one of the listed construction related professions (architecture, quantity surveying, estate surveying, building and civil engineering), culminating in either a degree or diploma or both in a recognised institution of learning. The prudence practice of these professionals including Architects, Quantity Surveyors, Estate surveyor, Builder, Civil Engineers and Mechanical Electrical Engineering professionals were analysed and compared with the aim of rating the performance in prudence practice by these professionals.

LITERATURE REVIEW

Prudence was long considered one of the fundamental accounting concepts, determining the time for revenue recognition (HMRC, 2011). The 2001 Conceptual Framework for Financial Reporting of the IASB (International Accounting Standards Board) however listed Prudence as a characteristic of Reliability (Faithful Representation). It states that Prudence is the inclusion of a degree of caution in the exercise of the judgments needed in making the estimates required under conditions of uncertainty, such that assets or income are not overstated and liabilities or expenses are not understated (Hoogervorst, 2012).

The goal of project management in the construction industry has put the project manager in a position that any inefficiency, failure or otherwise of a project or the construction industry as a whole can easily be attributed to the project manager. This is because the principal responsibility of the project manager is to deliver the end-item in accordance with all the objectives of the project (Odusami and Ameh, 2006). As a result, there are many detrimental attributes associated with the construction industry due to imprudent practices of project managers. The fact that the construction industry is complex and fragmented with complicated processes, shape the industry’s way of functioning and its performance (Dubois and Gadde, 2001).

The purpose of performance measurement in any industry is to help organizations understand how decision-making processes or practices led to success or failure in the past and how that understanding can lead to future improvements (National Research Council (NRC), 2005). Hence, the
measurement of performance is a tool for both effective management and process improvement. According to Neely (1998) performance measurement is the process of quantifying past actions to determine the current way forward. Mbugua, Harris, Holt, and Olomolaiye (1999) defined performance as a systematic way of evaluating the production process within an organization for the purposes of benchmarking. Benchmarking on the other hand is the process of measuring, comparing to competition, and identifying opportunities for improvements (NRC, 2005) which in turn indicates prudential judgments needed in making the estimates required under conditions of uncertainty.

Project Managers are confronted by issues and undertaking additional roles that have traditionally not been part of their responsibility (Ogunsemi et al., 2008). Bresnahan (2000) also recognised this changing role for construction project managers and argued that they must supplement their traditional functions with other non-engineering knowledge and skills to meet today’s professional demands for which they become responsible. According to Nader, Ooi and Abdollahi (2011), to successfully reach the ambitious project objective or goal, the project manager is responsible for collaborating and managing all the processes.

**RESEARCH METHOD**

A total of two thousand and sixty (2060) questionnaires were distributed Civil Engineers (590), Architects (450), Quantity Surveyors (320), Builder (250), Estate surveyor (250), and Mechanical/ Electrical Engineers (200) respectively using stratified random probability sampling. The stratification was based on membership population of each professional body with a list of addresses and emails of registered construction professionals obtained from their respective institutes using internet sources and registry of members of professional institutes concerned in Lagos state, Nigeria. The electronic questionnaires were distributed to two thousand (2000) emails using Google form on the internet; this is for ease of distribution, a likely challenge is that many of the respondents might not have opened their emails regularly due to poor attitude of professionals to internet resources. Another sixty (60) of the questionnaire were distributed manually to organisations. A total of one hundred and twenty two (122) questionnaires (for both electronic and manual methods) were successfully retrieved and used for the analysis, this is an acceptable response rate going by the manual distribution of 67% response rate compared to 4% response of online questionnaire which is an indication of poor internet use or access.

**Results and Data Analyses**

From the total of 122 questionnaires received, respondents from architecture background were 23% while 22% were from quantity surveying background, 10% were from civil engineering background, 14% from building background, 11% from estate management background, 9% from mechanical/electrical services background, while another 11% of the
respondents are from other backgrounds including accountancy, law, and public relations; these were discovered to be directors and management of the respective organisations. The difference in the frequency of respondents is due to the different response rates from each group of respondents. Fifty-three of the respondents are partners of firms, twenty-four of the respondents are senior staff of firms, twenty-five of the respondents are Assistants in their firms, while twenty of the respondents fall under the ‘others’ category which includes Chief Executive Officers, Managing Directors, Directors, Head of Departments of Institution. A majority of the respondents are partners of firms. Importantly, all the respondents have professional qualifications which indicate that the respondents are well informed to provide the required information and they are all experienced. All respondents have minimum academic qualification of Higher National Diploma (HND) or Bachelor of Science (B.Sc.) with 18% having Masters Degree and seven percent having Doctorate degree.

**Professional Backgrounds of Project Managers**

In Table 1 a majority of the project managers on the projects surveyed were Architects, 34% followed by Civil Engineers, 30%; Quantity Surveyors, 16%; Estate Surveyors, 8%; Builders, 6%, MandE Services Engineers 4% and 2% were from other professions not related to the six listed in the survey. This indicates that out of the construction project managers surveyed, the Architect is the most patronised for construction project management services, closely followed by the Civil Engineer, and then Quantity Surveyor, Thus the top three most patronised.

<table>
<thead>
<tr>
<th>Professional Background of Project Manager on the Project</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>36</td>
<td>30</td>
</tr>
<tr>
<td>Quantity Surveyor</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Builder</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Estate Management</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>M and E Services Engineer</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>122</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 2 shows level of the prudence of construction project managers. The Quantity surveyors were ranked first, followed by Architects, Civil Engineers, Builders, Mechanical/Electrical Engineers and then the Estate Managers respectively. The result shows that the construction project managers surveyed from Quantity Surveying background are believed to be closer to high implementation of prudent practice but far from extremely implementing the practices. Again Architect, Civil Engineer, and Quantity Surveyor are reliable as indicated by the stability in their standard deviation.
Table 2: Level of Prudence of Construction Professionals

<table>
<thead>
<tr>
<th>Rank</th>
<th>Quantity Surveyor</th>
<th>Architect</th>
<th>Civil Engineer</th>
<th>Builder</th>
<th>M and E Services Engineer</th>
<th>Estate Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.75</td>
<td>4.10</td>
<td>3.91</td>
<td>3.90</td>
<td>3.59</td>
<td>3.53</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.04</td>
<td>1.06</td>
<td>1.03</td>
<td>1.23</td>
<td>1.18</td>
<td>1.51</td>
</tr>
</tbody>
</table>

A one-way between-groups analysis of variance was conducted to explore the impact of the professional background of project managers on levels of prudence they exhibited, as shown in Table 3.

Table 3: Anova Project Managers Variables

<table>
<thead>
<tr>
<th></th>
<th>Sun of Squares</th>
<th>df</th>
<th>Means Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>118.93</td>
<td>5</td>
<td>23.79</td>
<td>16.89</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1022.15</td>
<td>726</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1141.08</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was a statistically significant difference at the p < .05 level in the level of prudence scores for the professional groups as a whole: F (5, 726) = 16.9, p = .000. This is an indication of disagreement among the respondent professionals.

Thus, Bonferroni Test was carried out to determine the differences among the groups stated in Table 2 with a view to assess the significance of the positions given to each professional project managers as presented in Table 4. Post-hoc comparisons using the Bonferroni test indicated that Quantity Surveyors (M = 4.75, SD = 1.04) are the only project managers that are significantly different in all other groups apart from their group as shown in Table 4; Architects (M = 4.10, SD = 1.06); Civil Engineers (M = 3.91, SD = 1.03), Builders (M = 3.90, SD = 1.23), Estate Managers (M = 3.53, SD = 1.51) and M and E Engineers (M = 3.59, SD = 1.18). The result of the analysis shows that there is statistical significant difference in the level of prudence exhibited by the Architect, Quantity Surveyor, Civil Engineer, Builder, Estate Manager, and M and E Services Engineer. From the Standard Deviation it is revealed that the Quantity Surveyors, Architects and Civil Engineers are more stable in the assessment than any other professional group thus, these three professionals shall be discussed further.
Table 4: Post Hoc Tests: Multiple Comparisons Dependent Variable: Project Managers Variables. Bonferroni

<table>
<thead>
<tr>
<th>(I) Project Managers Score</th>
<th>(J) Project Managers Score</th>
<th>Mean Differences (I-J)</th>
<th>Std. Error</th>
<th>Sig</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>Architect</td>
<td>-0.66</td>
<td>* .15</td>
<td>.000</td>
<td>-1.10</td>
<td>-0.21</td>
</tr>
<tr>
<td>Quantity Surveyor</td>
<td>Civil Engineer</td>
<td>0.19</td>
<td>.15</td>
<td>1.000</td>
<td>-0.26</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>0.20</td>
<td>.15</td>
<td>1.000</td>
<td>-0.25</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>0.57</td>
<td>* .15</td>
<td>.003</td>
<td>0.12</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>M and E Services Engineer</td>
<td>0.51</td>
<td>* .15</td>
<td>.013</td>
<td>0.06</td>
<td>0.96</td>
</tr>
<tr>
<td>Quantity Surveyor</td>
<td>Architect</td>
<td>-0.66</td>
<td>* .15</td>
<td>.000</td>
<td>-0.21</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>Civil Engineer</td>
<td>0.84</td>
<td>* .15</td>
<td>.000</td>
<td>0.40</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>0.85</td>
<td>* .15</td>
<td>.000</td>
<td>0.41</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>1.22</td>
<td>* .15</td>
<td>.000</td>
<td>0.77</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td>M and E Services Engineer</td>
<td>1.16</td>
<td>* .15</td>
<td>.000</td>
<td>0.72</td>
<td>1.61</td>
</tr>
<tr>
<td>Civil Engineer</td>
<td>Architect</td>
<td>-0.19</td>
<td>.15</td>
<td>1.000</td>
<td>-0.64</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Quantity Surveyor</td>
<td>-0.84</td>
<td>* .15</td>
<td>.000</td>
<td>-1.29</td>
<td>-0.40</td>
</tr>
<tr>
<td></td>
<td>Civil Engineer</td>
<td>0.01</td>
<td>.15</td>
<td>1.000</td>
<td>-0.44</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>0.38</td>
<td>.15</td>
<td>0.199</td>
<td>0.07</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>0.32</td>
<td>.15</td>
<td>0.536</td>
<td>-0.13</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>M and E Services Engineer</td>
<td>0.31</td>
<td>.15</td>
<td>0.611</td>
<td>-0.14</td>
<td>0.76</td>
</tr>
<tr>
<td>Builder</td>
<td>Architect</td>
<td>-0.20</td>
<td>.15</td>
<td>1.000</td>
<td>-0.64</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Quantity Surveyor</td>
<td>-0.85</td>
<td>* .15</td>
<td>.000</td>
<td>-1.30</td>
<td>-0.41</td>
</tr>
<tr>
<td></td>
<td>Civil Engineer</td>
<td>-0.01</td>
<td>.15</td>
<td>1.000</td>
<td>-0.46</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>0.37</td>
<td>.15</td>
<td>0.231</td>
<td>-0.079</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>0.31</td>
<td>.15</td>
<td>0.611</td>
<td>-0.14</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>M and E Services Engineer</td>
<td>0.06</td>
<td>.15</td>
<td>1.000</td>
<td>-0.50</td>
<td>0.39</td>
</tr>
<tr>
<td>Estate Manager</td>
<td>Architect</td>
<td>-0.57</td>
<td>* .15</td>
<td>.003</td>
<td>-1.01</td>
<td>-1.2</td>
</tr>
<tr>
<td></td>
<td>Quantity Surveyor</td>
<td>-1.22</td>
<td>* .15</td>
<td>.000</td>
<td>-1.67</td>
<td>-0.77</td>
</tr>
<tr>
<td></td>
<td>Civil Engineer</td>
<td>-0.38</td>
<td>.15</td>
<td>0.199</td>
<td>-0.82</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>-0.37</td>
<td>.15</td>
<td>0.231</td>
<td>-0.82</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>0.06</td>
<td>.15</td>
<td>1.000</td>
<td>-0.39</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>M and E Services Engineer</td>
<td>0.51</td>
<td>* .15</td>
<td>.013</td>
<td>-0.96</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td>Quantity Surveyor</td>
<td>-1.16</td>
<td>* .15</td>
<td>.000</td>
<td>-1.61</td>
<td>-0.72</td>
</tr>
<tr>
<td></td>
<td>Civil Engineer</td>
<td>-0.32</td>
<td>.15</td>
<td>0.536</td>
<td>-0.77</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Builder</td>
<td>-0.31</td>
<td>.15</td>
<td>0.611</td>
<td>-0.76</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Estate Manager</td>
<td>0.06</td>
<td>.15</td>
<td>1.000</td>
<td>-0.39</td>
<td>0.50</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the .05 level
The result in Table 5 shows the Descriptive Statistics and Analysis of Variance (ANOVA) for the opinions of respondents on the level of prudence of project managers in the Construction Industry.

### Table 5: Analysis of Respondents’ Opinions on the Level of Prudence of Project Managers

<table>
<thead>
<tr>
<th>Respondents Means</th>
<th>Anova (Between Groups)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ARC</td>
</tr>
<tr>
<td>Arc</td>
<td>3.61</td>
</tr>
<tr>
<td>QS</td>
<td>4.04</td>
</tr>
<tr>
<td>Project Managers</td>
<td>Civil Eng</td>
</tr>
<tr>
<td></td>
<td>Build.</td>
</tr>
<tr>
<td>Group</td>
<td>Est. Mgt.</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

A between-groups analysis of variance was conducted to Investigate Respondents’ Opinions on the Level of Prudence of Construction Professionals as measured by the questionnaire. The project managers were grouped based on the professional backgrounds as Architects, Quantity Surveyors, Civil Engineers, Builders, and Estate Managers, and M and E Services Engineers. There was a statistically significant difference at the p < .05 level in all groups of project managers except Quantity Surveyors: F (6, 726) = 0.800, p = .573 and Estate Managers: F (6, 726) = 0.856, p = .529. It is worthy of note that the low frequency of respondents from Estate Management (14), Building (17), M and E Services Engineering (11) and Civil Engineering (12) may have played a part in influencing the result as compared to the Quantity Surveyors (27) and Architects (28). This indicates that all the professionals unanimously agreed on the opinion ranking of the Quantity Surveyors as professionals that implements high prudence practice.

### ANALYSES AND DISCUSSION OF PRUDENCE PRACTICE CRITERIA BY PROFESSIONALS

The respondents were required to give information on a previous project which they were involved and the measurement for prudence practice were chosen from a scale of 1 to 6 representing ‘not prudent’ to ‘very highly prudent’ respectively. Data analysis process was carried out using statistical tools such as frequency tables, mean and analysis of variance (ANOVA). The prudence practice assessment on Mean value ranking is as shown in Table 6 which reveals that Prudence Practice No2 (PP2); ‘the project manager was aware of his/her duties and responsibilities’ was
ranked first with a Mean value of 4.84 from a scale of 6 which is close to being highly practiced according to the scale of measurement. This is followed by seven other practices comprising PP13, 9, 1, 4, 14, 17 and PP21 depicted as ‘the contract defined the duties and responsibilities of all parties involved in the project (4.79)’, ‘the construction contract duration was identified (4.78)’, ‘the project was managed in accordance with applicable statutory laws, construction documents, and the client’s brief (4.73)’, ‘contract provisions and the contract were in writing, and do not contain provisions that conflict with the project manager's professional standards of work (4.71)’, ‘the contract defined guidelines that ensured that the project is not deviated from achieving the client’s objectives (4.70)’, ‘the procurement method clearly defined procedure for controlling and accounting for construction cost (4.58)’, and ‘the financing method is appropriate for the project size (4.58)’ respectively. All other practices were ranked as being averagely or typically practiced while the least on the scale is PP3 which is ‘the project manager and other service providers were not involved in self-dealing’ ranked twenty-seventh with a Mean of 3.80 a relative drop from being typically practised. From Table 6, other areas of low prudence include inability to properly identify risk levels in construction projects; lack of proper utilisation, application, and documentation of compensations that are paid in projects; inconsistency in ensuring that the fees for project consultants are consistent with contract agreements and with the law among others.

RESULTS FOR ALL THE PROFESSIONALS

From Table 6, it can be seen that project managers in the Nigerian construction industry that were surveyed performed better in the areas of awareness of their duties and responsibilities; defining the duties and responsibilities of all parties in projects; identifying the duration of construction contracts; managing construction contracts in accordance to applicable statutory laws, construction document and clients’ brief; putting contract provisions in writing with no conflicts with the project manager’s professional standard of work; and ensuring that the project is not deviated from achieving clients’ objectives as seen by their rankings on the Table 6. These are areas that the project managers exhibited high prudence.

From Table 6, it can also be seen that the low points of construction project managers in the Nigerian construction industry that were surveyed (areas of low prudence) lack of periodic reviews of qualitative and/or organizational changes of project consultants; the division of projects were not consistent with risk, project returns and contract duration; non-existent of models of expected returns to meet clients’ construction objectives; and involvement in self-dealings as their weakest points.

Table 6 generally shows that the construction project managers surveyed performed above average as regards to the knowledge and practice of prudent practices in the construction industry. The construction project
Managers surveyed obtained a lowest mean item score of 3.78 which indicates that their lowest prudence exhibited was in the area of self-dealings. This means that involvement in self-dealing is a serious issue of concern in the Nigerian construction industry.

**Table 6: Professionals’ Prudence Practice Criteria**

<table>
<thead>
<tr>
<th>PP No</th>
<th>Prudence Criteria</th>
<th>ARC</th>
<th>CE</th>
<th>QS</th>
<th>Generally</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP1</td>
<td>The project was managed in accordance with applicable statutory laws, construction documents, and the client’s brief.</td>
<td>4.57</td>
<td>5.14</td>
<td>3</td>
<td>4.35</td>
<td>21</td>
</tr>
<tr>
<td>PP2</td>
<td>The project manager was aware of his/her duties and responsibilities.</td>
<td>4.45</td>
<td>5.44</td>
<td>1</td>
<td>4.75</td>
<td>6</td>
</tr>
<tr>
<td>PP3</td>
<td>The project manager and other service providers were not involved in self-dealing.</td>
<td>3.67</td>
<td>3.75</td>
<td>27</td>
<td>3.75</td>
<td>27</td>
</tr>
<tr>
<td>PP4</td>
<td>Contract provisions and the contract were in writing, and do not contain provisions that conflict with the project manager’s professional standards of work.</td>
<td>4.69</td>
<td>4.64</td>
<td>16</td>
<td>4.55</td>
<td>12</td>
</tr>
<tr>
<td>PP5</td>
<td>There was documentation to show timing (programme of works) and distribution of cash flows (cash flow analysis) and the payments of valuations.</td>
<td>4.26</td>
<td>5.08</td>
<td>4</td>
<td>3.80</td>
<td>26</td>
</tr>
<tr>
<td>PP6</td>
<td>Project funds were within the jurisdiction of a legal court, and are protected from theft embezzlement e.g. client’s designated bank/account for the project.</td>
<td>3.83</td>
<td>4.69</td>
<td>14</td>
<td>4.30</td>
<td>22</td>
</tr>
<tr>
<td>PP7</td>
<td>The risk level in the project was identified. E.g. Adequacy of contingency fund.</td>
<td>3.90</td>
<td>4.25</td>
<td>25</td>
<td>4.55</td>
<td>12</td>
</tr>
<tr>
<td>PP8</td>
<td>An expected, modeled return to meet client’s construction objectives was identified (in regards to budget and completion date).</td>
<td>3.57</td>
<td>4.47</td>
<td>22</td>
<td>4.45</td>
<td>16</td>
</tr>
<tr>
<td>PP9</td>
<td>The construction contract duration was identified.</td>
<td>4.62</td>
<td>5.28</td>
<td>2</td>
<td>4.70</td>
<td>9</td>
</tr>
<tr>
<td>PP10</td>
<td>The division of the project (Work Breakdown Structure (WBS) or elements) was consistent with the identified risk, return, and contract duration.</td>
<td>3.80</td>
<td>21</td>
<td>4.11</td>
<td>26</td>
<td>4.30</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>PP11</td>
<td>The division of the project (WBS or elemental breakdown) was consistent with size of the subcontract.</td>
<td>3.90</td>
<td>15</td>
<td>4.36</td>
<td>23</td>
<td>4.55</td>
</tr>
<tr>
<td>PP12</td>
<td>There were details to implement different stages of the project e.g. construction methodology/method statement.</td>
<td>3.90</td>
<td>15</td>
<td>4.89</td>
<td>10</td>
<td>4.10</td>
</tr>
<tr>
<td>PP13</td>
<td>The contract defined the duties and responsibilities of all parties involved in the project.</td>
<td>4.60</td>
<td>3</td>
<td>5.03</td>
<td>5</td>
<td>4.75</td>
</tr>
<tr>
<td>PP14</td>
<td>The contract defined guidelines that ensured that the project is not deviated from achieving the client’s objectives.</td>
<td>4.45</td>
<td>5</td>
<td>5.03</td>
<td>5</td>
<td>4.80</td>
</tr>
<tr>
<td>PP15</td>
<td>The contract conditions defined due diligence criteria for selecting construction methodology in regards to the methods of construction procurement.</td>
<td>3.74</td>
<td>2</td>
<td>4.64</td>
<td>16</td>
<td>4.45</td>
</tr>
<tr>
<td>PP16</td>
<td>The project management was clear in defining the procurement route/method. The project’s procurement method is clear in defining the type of contract and the choice of contractor.</td>
<td>3.98</td>
<td>1</td>
<td>4.92</td>
<td>8</td>
<td>4.80</td>
</tr>
<tr>
<td>PP17</td>
<td>The procurement method clearly defined procedures for controlling and accounting for construction cost</td>
<td>4.07</td>
<td>1</td>
<td>5.00</td>
<td>7</td>
<td>4.85</td>
</tr>
<tr>
<td>PP18</td>
<td>The project management strategy defined appropriately structured, environmentally friendly and socially responsible construction methods in regards to Health, Safety, Environment and Quality (HSEQ)</td>
<td>3.83</td>
<td>1</td>
<td>4.67</td>
<td>15</td>
<td>4.75</td>
</tr>
<tr>
<td>PP19</td>
<td>The project management of the contract was implemented in compliance with the required level of prudence (project manager is professionally liable for other professionals as though he is the actual professionals)</td>
<td>3.88</td>
<td>1</td>
<td>4.58</td>
<td>20</td>
<td>4.60</td>
</tr>
</tbody>
</table>
The project manager followed provisions to ensure that only competent professionals are involved in the project (If he is responsible for appointing other professionals).

The financing method was appropriate for the project size.

Due diligence process was followed in selecting the contractor, subcontractors and suppliers; including the project manager.

Periodic reports (financial statement/statement report) were used to compare construction performance against an appropriate index, similar project, and past performances.

Periodic reviews were made of qualitative and/or organizational changes of project consultants e.g. adherence to standards and guidelines on the project.

Control procedures were in place to periodically review policies for best execution of contract and payments e.g. valuation of actual work done without overpayment for over measured or inapplicable items.

Fees for the project consultants were consistent with contract agreements and with the law.

All forms of compensation that had been paid for the project was appropriately applied, utilized, and documented (valuations and variations leading to claims).

* The mean difference is significant at the 0.05 level.

**Prudence Practice of Project Managers from Architectural Background**

Project managers from architectural background implements about high prudence in PP4: ‘Contract provisions and the contract were in writing, and do not contain provisions that conflict with the project manager’s professional standards of work’ which was ranked first with a mean of 4.69, PP9: ‘the construction contract duration was identified’ was ranked second with a mean of 4.62 and PP13: ‘the contract defined the duties and responsibilities of all parties involved in the project’ was ranked third with a mean of 4.60 and, PP1: ‘the project was managed in accordance with applicable statutory laws, construction documents, and the client’s brief’
was ranked fourth with a mean of 4.57. Others were ranked as typical prudence practice while to the bottom of the list are PP26: ‘fees for the project consultants were consistent with contract agreements and with the law’ and PP3: ‘the project manager and other service providers were not involved in self-dealing’ were ranked 25th with a mean of 3.67; ‘an expected, modelled return to meet client’s construction objectives was identified (in regards to budget and completion date)’ was ranked 27th with a mean of 3.57. These three are about being a typical prudence practice. Generally speaking, the architect is typically prudent for twenty of the prudence practice criteria used.

Prudence Practice of Project Managers from Civil Engineering Background

The prudence practice criteria for project managers from civil engineering background is shown in Table 6; PP2 ‘the project manager was aware of his/her duties and responsibilities’ was ranked 1st for civil engineers with a mean of 5.44; PP9 ‘the contract duration was identified’ was ranked 2nd with a mean of 5.28; PP1 ‘the project was manage in accordance with applicable statutory laws, construction documents, and the client’s brief’ was ranked 3rd with a mean of 5.14; PP5 ‘there was documentation to show timing (programme of works) and distribution of cash flows (cash flow analysis) and the payments of valuations’ was ranked 4th with a mean of 5.08; PP14 ‘the contract defined guidelines that ensured that the project is not deviated from achieving the clients objectives’ and PP13 ‘The contract defined the duties and responsibilities of all parties involved in the project’ were ranked 5th with a mean of 5.03 respectively. The downside of the analysis shows that PP26 ‘Fees for the project consultants were consistent with contract agreements and with the law’ was ranked 24th with a mean of 4.33; PP7 ‘the risk level in the project was identified. e.g. Adequacy of contingency fund’ was ranked 25th with a mean of 4.25; PP10 ‘The division of the project (Work Breakdown Structure (WBS) or elements) was consistent with the identified risk, return, and contract duration’ was ranked 26th with a mean of 4.11; while PP3 ‘the project manager and other service providers were not involved in self-dealing’ was ranked 27th with a mean of 3.75. It is clear that the Civil Engineers exhibited high level of prudence practice in the criteria

Prudence Practice of Project Managers from Quantity Surveying Background

For the Quantity Surveyors, PP21 ‘the financing method was appropriate for the project size’ was ranked 1st with a mean of 5.30; PP22 ‘due diligence process was followed in selecting the contractor, subcontractors and suppliers; including the project manager’ was ranked 2nd with a mean of 5.00; PP17 ‘the procurement method clearly defined procedures for controlling and accounting for construction cost’ was ranked 3rd with a mean of 4.85; PP16 ‘The project management was clear in defining the procurement route/method, clear in defining the type of contract and the choice of contractor’ and PP14 ‘the contract defined guidelines that ensured that the project is not deviated from achieving the client’s
objectives’ were ranked 4th with a mean of 4.80 respectively while PP13: ‘The contract defined the duties and responsibilities of all parties involved in the project’, and PP18: ‘The project management strategy defined appropriately structured, environmentally friendly and socially responsible construction methods in regards to Health, Safety, Environment and Quality (HSEQ)’ and PP3: ‘The project manager was aware of his/her duties and responsibilities’ were ranked 6th with a mean of 4.75. On the down side, PP5: ‘There was documentation to show timing (programme of works) and distribution of cash flows (cash flow analysis) and the payments of valuations’ was ranked 26th with a mean of 3.80; while PP3 ‘The project manager and other service providers were not involved in self-dealing’ was ranked 27th with a mean of 3.75. The analysis of prudence practice of Quantity Surveyors range between high prudential practices to somewhat typical and in fact it is illustrative that priorities of professionals on projects differ as sharply noticed in the assessment of quantity Surveyors’ prudence practice in construction project management.

CONCLUSION

The top three most patronised professionals for construction project management services are Architects, Civil Engineers, and Quantity Surveyors. Project managers display inability to properly identify risk levels in construction projects and there is inconsistency in ensuring that the fees for project consultants are consistent with contract agreements and with the law. This could culminate in the involvement in self-dealing by project managers in the Nigerian construction industry. The Quantity Surveyors and Civil Engineers exhibit a relatively higher prudence practice than the Architects thus requiring an assessment of the professionals that exhibit a very high level of prudence practice although none of the professionals exhibit excellent prudential practices. Although, there is significant difference in the level of prudence exhibited by all professionals yet there was agreement by other professionals that the Quantity Surveyors are believed to have high level of prudential practice. The study has exposed further area for research development and innovation especially in education, training and assessment of prudence practice in construction industry.

REFERENCES


PUTTING RESEARCH INTO PRACTICE: EXPLORING THE INHERENT CHALLENGES OF RESEARCH UPTAKE IN THE BUILT ENVIRONMENT FACULTIES IN GHANA

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Existing literature on Research Uptake (RU) have focused on exploring communication gaps between researchers and the audience. Unfortunately, the review of literature points to the dearth of research studies on Research Uptake within the Built Environment (BE). Recent studies have concentrated on improving uptake strategies neglecting the challenges of RU. The resolution of such challenges will inevitably facilitate the uptake of research. This paper aims to explore the inherent challenges of research uptake in the Built Environment faculties. A structured questionnaire survey was used to elicit perceptions of Researchers on the challenges identified from literature and the preliminary survey. The data were analysed using descriptive statistics (mean score ranking) to examine the severity of the challenges. The findings of the study revealed that lack of resources, policymakers’ perception about research and lack of collaborative research are the main challenges to research uptake in the Built Environment faculties in Ghana. Subsequently, the Kruskal-Wallis Test was used to compare the scores on the main challenges across the various department. It revealed that there is a difference in the challenge pertaining to policymakers’ perception about research. However, the difference in the other main challenges proved to be statistically insignificant. The challenges presented indicate that research in the Built Environment needs intense management and resources intervention to facilitate its uptake with demonstrated outcome benefits. This study provides rich insights of the challenges to the uptake of research in the Built Environment. Little study in the literature has provided such insights that link the challenges to the uptake of research in the Built Environment. The findings from the research would be of significance to both researchers, policymakers, advocates and potential policy beneficiaries, among others. Further research is recommended to examine the challenges from the perspective of policymakers.

Keywords: built environment, challenge, faculty, research, strategy, uptake

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INTRODUCTION

The significant contributions of research to the development of countries, both developed and developing, cannot be overemphasized (University Relations Office, URO, 2013; Department for International Development, DFID, 2012; Stephenson and Hennink, 2002). Scientific and technical research play eminent role for evolution of a knowledge based and innovation driven economy (Tufail and Ehsan, 2012). Performance in research provides particular importance, especially in gaining competitive advantage over other countries across the globe. According to Salter and Martin (2001) the linkage between research and economic performance is important against the background of the governments fund spent on such basic research. Despite the considerable government resources expended on such basic research in universities, institutes and elsewhere (Salter and Martin, 2001), a consistent finding is that the utilization of such research can be slow and haphazard (Eccles et al., 2005). Also, the continuing trend towards evidence-based policy formation dictates that research outputs need to be clear and should provide concise policy-relevant findings (Sumner et al., 2011; WHO, 2000 as cited in Stephenson and Hennink, 2002).

Generally, Higher Education is the progenitor of research imperative to development (Pastor et al., 2014). That is the sustainable approaches that harness the resources of a country in order to momentously transform the economy to improve the living standards of its citizenry aforementioned are only arrived at through the conduct of research works. Unfortunately, Roberts (2013) opined that many of the world’s largest donors too often perceived Higher Education as something less worthy of international support in comparison with pressing development challenges. The good thing is that this perception has changed over time. It is now widely recognised that the capacity to create knowledge with development potentials is the way forward in resolving development challenges (Banzi et al., 2011), especially as countries are moving into the ‘knowledge-based economy’ (Martin and Etzkowitz, 2000). In consequence, universities have been identified as indispensable in the creation of knowledge with development potentials (Senaratne et al., 2005; Martin and Etzkowitz, 2000). Roberts (2013) further argued that universities are central to developing sustainable approaches to agriculture, to enterprise, to governance and to improving living standards of the citizenry.

These recent trends invariably demand that researchers have to explore appropriate research strategies for the effective dissemination and the uptake of their research findings (DFID, 2012; Stephenson and Hennink, 2002; Waddell, 2001). However, effective communication between researchers and end users provides a continual challenge (Hennink and Stephenson, 2004). The review of literature points to the dearth of research studies on Research Uptake (RU) within the BE, and most of the existing literature have focused on exploring the communication gaps between researchers and users in the health sector (e.g. Hennink and Stephenson, 2004; Landry et al., 2001; Wright et al., 1996; Walt 1994;
Little is known of the challenges in the Built Environment. The Built Environment (BE) falls under vocational and applied science discipline (Senaratne et al., 2005). As aptly postulated by Srinivasan et al. (2003), the BE encompasses all buildings, spaces and products that are created or modified by people. BE impacts indoor and outdoor environments and subsequently health and quality of life as already observed. Jackson (2003) examined the impact of the Built Environment on health of people. Also, Leyden (2003) explored the relationship between the Built Environment and social capital. In both studies, the authors concluded on the essentials of the BE. Essentially, the performance of an economy is only as good as the health of its citizenry.

With these gaps identified, this study sought to explore the inherent challenges of research uptake in the built environment faculties. In achieving this aim, the research question – what are the challenges of Research Uptake in the Built Environment faculties in Ghana? – was asked. It is essential to study this issue since the resolution of the challenges would inevitably drive the uptake of research (Dunne, 2011) in the BE. This paper presents an initial exploration of disentangling the technical term of RU, and provides insight into the challenges of RU in order to effectively and efficiently manage RU in the BE.

EXPLAINING RESEARCH UPTAKE

In recent years, much have been written by academics on the concept of research uptake, but its definition still eludes people even those who are familiar with it (Cilliers, 2013). The name may be relatively new, but the concept has deep roots in intermediary field and development of earlier models of handling research (Cilliers, 2013; DFID, 2012). Traditionally, research uptake is taken to mean getting research to the audience regardless of its impact. For instance, Development Research Uptake in Sub-Saharan Africa (DRUSSA) (2013) defines research uptake as a process whereby research findings enter the domain of intended but also unintended audiences. This definition is flawed with the general perception that research uptake has been unilateral or one-way flow of information into the awaiting hands of the audience or policymakers (Landry et al., 2001). Research is supposed to have an impact; and it is clear that the impact of research evidence on policy and practice has been gathering momentum (Sumner et al., 2011), hence, its uptake must not end with the mere reception of research by the potential user (Landry et al., 2001). It is also worth pointing out that researchers are not the only group interested in research uptake and evidence-based policy making (Sumner et al., 2011). To elaborate on this point, research uptake is supposed to engage all stakeholders; and in lower- and middle-income countries, the resolution of development challenges is in the collective interest, and so therefore all (stakeholders) share an interest in research with development impact (Roberts, 2013).
Schillinger (2010) also defines research uptake as the acquisition and the review of research knowledge and its utilization, including incorporation into decision-making. Conversely, Cilliers (2013) asserted that sharing of this information does not always follow the upward trajectory into the awaiting hands of decision-makers. However, a more elaborative definition was given by Roberts (2013) as a cooperative, informed, non-didactic approach to the management of research, directly involving a host of external stakeholders who have an interest in research impact. According to DFID (2012), this includes all the activities which facilitate and contribute to the evidence use of research by audience. Here the emphasis lies on research uptake not being unilateral knowledge transfer.

In this study, Research Uptake is defined as the non-unilateral sharing and facilitation of research to enable its utilization.

**RESEARCH UPTAKE: WHAT WENT WRONG?**

Despite the importance of RU, it is not being done very well and this dominant theme runs through scholarship on science communication (Treise and Weigold, 2002). According to Waddell (2001), getting good research into practice or access to such published research still remains a herculean task. Many interacting factors account for these barriers from research to practice, including economic and social policy as well as scientific factors (Morris et al., 2013; Schillinger, 2010). These barriers to the uptake of research is a widespread problem (Stephenson and Hennink, 2002) and can be looked at from three perspectives; the researcher, the audience and mutual barriers. Consequently, researchers and policymakers argue differently on how best to get research into use (Wooding et al., 2007). To date, most theoretical developments and empirical research on RU challenges has been from the perspective of the audience (policymakers) and has treated the researchers as a black box. Indeed, little or no empirical studies exist that explore these problems from the perspective of the researchers (cf. Treise and Weigold, 2002). In this study, the authors endeavour to open the black box that is the Researchers and examine the inherent challenges of RU inside. How these challenges influence the uptake of research in the BE is further investigated.

**Policymakers’ perception about research**

Lack of strong evidence-based culture in policy development is a major setback to the uptake of research (Stephenson and Hennink, 2002). Consequently, the impact of research is too little and policymakers seem not to fully appreciate its contribution to policy formation (Stephenson and Hennink, 2002). Moreover, policymakers’ limited understanding of researchers’ work settings deepens this barrier (Lomas, 1997; as cited from Waddell, 2001). Furthermore, audiences are least likely to use research if they have to spend greater amount in trying to overcome the difficulties of reading and understanding the research findings (Von Grebmer, 2005; Landry et al., 2003). Evidently, research is given low priority by
policymakers in developing countries and as such research is not valued in policy formation (Hennink and Stephenson, 2004). Also, research is perceived as an unnecessary expenditure in developing countries (Hennink and Stephenson, 2004) given the scarcity of resources. All these perceptions prevent the uptake of research.

**Lack of dissemination skills and access to policymakers**

Lack of dissemination and poor dissemination skills have been identified as a significant barrier to research uptake (Oliver et al., 2014). This is echoed by the study conducted by Stephenson and Hennink (2002), where it was observed that most researchers lack the skill of disseminating research outside the academic circles. According to Dunne (2011), the most significant barriers to the uptake of research are issues associated with communication. Landry et al. (2003) noted that recent works do not only focus on the variables relating to the characteristics of research products but also other explanatory factors – the relationship or links between researchers and the users of research. Accordingly, ignorance can only best be reduced via effective communication about research or science and without sufficient knowledge, people might turn against it (Von Grebmer, 2005; Weigold, 2001). The frequent change of government portfolios in Africa means difficulty in developing and maintaining links with policymakers (Stephenson and Hennink, 2002). Researchers often expressed difficulties at identifying and accessing policymakers to communicate research findings (Stephenson and Hennink, 2002). This challenge is summarised by Neal Lane⁵ in his broad statement:

> We do not know how to communicate with the public. We do not understand our audience – we have not taken the time to put ourselves in the shoes of a neighbour – to understand why it's difficult to hear us speak. We don’t know the language and we haven't practiced it enough (Cited in Treise and Weigold, 2002).

**Lack of resources**

The issue of research funding have had an evolving past, dating back as far as post-World War II. There has been a wide-ranging debate on the advantages and drawbacks of the rational of resource allocation to university research (Geuna, 2001). Whereas public and industrial spending on research increased in European Union (EU) countries (Geuna, 2001), the same cannot be said of developing countries particularly African countries. Indeed, Stephenson and Hennink (2002) identified lack of resources as a fundamental barrier to research uptake in developing countries where funds are not available to conduct research and dissemination activities. Chan and Costa (2005) narrowed the challenge to the weak infrastructure and capacity needed to absorb research findings and information, thus leading to low levels of scientific output. This lack of resources often hinder researchers’ presentation of findings to the audience (Stephenson and Hennink, 2002). Hennink and Stephenson (2004) further opined that there is no national research fund available for

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⁵ Director, Office of Science and Technology Policy – USA.
the conduct of research in Malawi and Tanzania. This situation is similar across many developing countries, including Ghana. These situations cripple and constrain the conduct of research and consequently its uptake.

**Practical difficulties**
The failure of researchers to communicate with the audience is not merely a matter of lack of dissemination skills as aforementioned, but researchers have also been heavily criticised for unwilling to present or communicate their work in easily understood ways (Treise and Weigold, 2002). As a result the need to produce research in alternative formats and invoicing serve as disincentives to researchers (Saywell et al., 2013). A number of studies have been conducted on the importance of research findings, and in each of them clarity of the findings was reported as an important factor affecting RU (Oliver et al., 2013). Stressing on the reason for the practical difficulties, Saywell et al. (2013) opined that time constraint is also an additional constraint, especially when competing against production of academic papers which have perceived intellectual credibility making it difficult to translate the findings from scientific to basic understanding. Moreover, the expectation in the educational settings is that research works will be published in academic channels – peer reviewed papers, journals, conference proceedings, etc. without working directly with practitioners in utilising the research findings (Wooding et al., 2007; Alberta Association of Registered Nurses (AARN), 1997). Hence the practice of the fundamental breakdown of research findings that has the tendency to distort the research findings is usually not done.

**Limited access to research outputs**
The quality of decision-making, be it scientific or democratic debate is enhanced by access to accurate information (Head et al., 2014). The advances in information and communication technologies suggest that global dissemination of research findings seem effortless (Edejer, 2000). However, this seems not to be the case. As aptly postulated by Stephenson and Hennink (2002), accessing research outputs is one of the greatest difficulties faced by audiences (policymakers) in utilising research. Ten years afterwards it seems the situation has not improved and consequently, Oliver et al. (2014) observed lack of access to research as a highly reported factor affecting the use of research. It is imperative that research be easily accessible in the practice setting (AARN, 1997). Policymakers and users are often somewhat prevented from access to research outputs since research is mainly disseminated in academic circles which are seldom accessed by policymakers (Lang, 2003; Stephenson and Hennink, 2002).

**Organisational setting**
The similarity between the settings of the sender and recipient of message is crucial in the effectiveness of communication (Lang, 2003). Landry et al. (2003) opined that policymakers or managers of government agencies are reluctant to use university research mainly because of difference in organisational culture – that is to say they do not share the norms and values of researchers. These settings not only influence the way people
think but also the kind of research evidence needed, preferred or used (Waddell, 2001). The political will and the resources to implement or uptake resources also influence decision-makers in translating research into practice (Schillinger, 2010). In consequence, the focus of recent scholarship on research uptake has been to understand how and under what circumstances policy-makers and other practitioners access and use academic research (Head et al., 2014). Bridging the gap between the very seemingly different organisational cultures is indispensable to the uptake of research (Head et al., 2014). Existing literature have tended to promote solutions that focus on developing better communication and interaction between these organisations. Others, also examined structural and cultural factors that allow organisations to be more receptive to externally generated knowledge (Howlett and Welstead, 2011; Meagher et al., 2008).

**Lack of central source of research outputs**

Central depository is imperative to the utilisation of research particularly in less developed countries where means of communicating research outputs are less developed. This offers opportunity for the audience to identify a source whereby findings of research can be located. This assertion is in line with the findings of Antelman (2004) that freely available research have a greater research impact. Unfortunately, Policymakers often find it difficult locating research findings – mostly unpublished works, because of lack of central depository of research outputs (Stephenson and Hennink, 2002). This barrier is pervasive in many developing countries (Willinsky, 2006).

**Quality of research**

The characteristics of research evidence and its impact on RU has been extensively studied (Oliver et al., 2014). The relevance and reliability of research findings are identified by Oliver et al. (2014) to affect the uptake of research. According to Stephenson and Hennink (2002), the quality of local research discouraged some policymakers from using local research work and thus resort to research works from international agencies. Adding to this, Waddell (2001) argued that the quality of research evidence published annually to actually inform decisions by policymakers is still uncertain and debatable.

**RESEARCH METHODS**

The paper utilised the survey questionnaire approach to elicit the views of Researchers in various departments under the Built Environment faculties in Kumasi. The survey research offered the scope for large representative sampling of researchers in the Built Environment from where reliable information were extracted about the challenges to the uptake of research in Ghana. Survey was preferred to interview because it allows a wider scope (Fisher, 2007). Also, this methodology is considered as cost effective and time saving in order to achieve better results in shorter duration (Warris et al., 2014). The traditional techniques for collecting responses from the targeted respondents are postal mails, fax and
electronic mails. However, for this research work, questionnaires were administered in person for getting feedbacks from the respondents. This section discusses the method employed for the study and particularly explains the development and administration of the questionnaires.

Questionnaire design
The need to develop, adapt and customise available instruments for the specific environment targeted by a research study is imperative to a local study (Carless and De Paola, 2000). Thus, to customise the data collection tool for the BE context, the basic instrument was presented to 10 Researchers with more than 10 years of experience in the conduct of research. The questionnaire was approved by the researchers, with their suggestion that the term Research Uptake should be fully explained. As a result central definition was added to the questionnaire to further make the objectives clear for potential respondents. Sending the questionnaires to the Researchers was supported by conventional thinking which states that ‘industry experts’ should be involved in the pre-testing of the questionnaire (e.g. Carless and De Paola, 2000).

The departments within the BE faculties differ in size, their mode of conduct of research is different and likewise the research principles. Moreover, the research philosophy or principle of the various institutions under study may be different, likewise their size of operation. Hence, the study adopted clustered sampling technique since there is the tendency for the respondents to be influenced by the aforementioned factors.

In Ghana, Kumasi is noted to be a major hub of BE education with various institutions of Higher Education on BE (i.e. Universities, Research Establishment and a Polytechnic) and usually engage in research activities. In consequence, researchers in the BE faculties in the Kumasi Metropolis were targeted. The survey questionnaire comprised two sections. The first section covered the demographic variables of respondents; the other section was anchored on RU and tailored to elucidate perceived challenges to RU in the BE.

Data collection
The lists of researchers were collected from the registry of the various faculties. Kumasi Polytechnic (K’Poly) –19, Building and Road Research Institute (BRRI), Kumasi –42, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi -58, University of Education, Winneba – Kumasi (UEW-K) - 11. Thus giving an approximate total population of one hundred and thirty (130). Sample in the various clusters were randomly selected from the list giving a total of seventy (70). Samples per cluster were as follows: K’Poly – 11; UEW-K – 5; BRRI – 22; and KNUST – 32. This was done to provide the elements equal chances of being included in the sample (Fisher, 2007). Out of the 70 questionnaires distributed, 53 questionnaires representing 75.71 percent were completed and retrieved. The analyses of the results is based on these number of questionnaires retrieved and consequently formed the basis of the findings of this research. Although the sample may seem small, it actually represents
researchers in the BE effective in research activities. Researchers in the faculties were chosen because it was assumed that their engagement would place them near or at the forefront of research uptake and thus the challenges encountered are relevant to research uptake.

**Data analysis**
The five-point Likert scale was employed to measure the respondents views on the challenges to RU (where 1= Not severe; 2= Not very severe; 3=Neutral; 4=Severe; and 5=Very severe). In evaluating the result for the challenges to research uptake in the BE faculties in Ghana, this endeavour was interested in the extent of each challenge to research uptake in the BE faculties. Hence, in establishing the extent of the challenges, descriptive statistics (i.e. Mean score Ranking) was used.

**Agreement analysis**
The Kruskal-Wallis Test was used to compare the scores on the challenges across the departments. The Kruskal-Wallis Test is a nonparametric test. Non-parametric tests are also referred to as distribution-free tests. These tests do not require the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than means and, as a result, if the data include one or two outliers, their influence is excluded.

**Significance test**
In the Table 1 presented above the significance level were .004, .074, .082, .059 and .073 for Policy makers' perception about research, lack of resources, organisational setting, quality of research and lack of collaborative research respectively. Except Policy makers’ perception about research, the other had significance level above the alpha level of .05, so these results suggest that there is no difference in the challenges across the different departments. Conversely, the significant value of the challenge - Policy makers' perception about research is less than the alpha level of .05, so these results suggest that there is a difference in the challenge across the different age groups.

**Table 1: Test Statistics**

<table>
<thead>
<tr>
<th></th>
<th>Policy makers’ perception about research</th>
<th>lack of resources</th>
<th>organisational setting</th>
<th>quality of research</th>
<th>lack of collaborative research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>17.211</td>
<td>10.027</td>
<td>9.755</td>
<td>10.620</td>
<td>10.065</td>
</tr>
<tr>
<td>df</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.004</td>
<td>.074</td>
<td>.082</td>
<td>.059</td>
<td>.073</td>
</tr>
</tbody>
</table>

a. Kruskal Wallis Test
b. Grouping Variable: Department within the Built Environment of respondents
RESULTS AND DISCUSSION OF RU CHALLENGES IN THE BE FACULTIES

Table 2: Respondents contextual information

<table>
<thead>
<tr>
<th>S/N</th>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Respondent Department</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Architecture</td>
<td>05</td>
<td>9.43%</td>
</tr>
<tr>
<td></td>
<td>Building Technology</td>
<td>20</td>
<td>37.74%</td>
</tr>
<tr>
<td></td>
<td>Civil Engineering</td>
<td>09</td>
<td>16.98%</td>
</tr>
<tr>
<td></td>
<td>Land Economy</td>
<td>03</td>
<td>5.66%</td>
</tr>
<tr>
<td></td>
<td>Planning</td>
<td>11</td>
<td>20.75%</td>
</tr>
<tr>
<td></td>
<td>Geodetic Engineering</td>
<td>05</td>
<td>9.43%</td>
</tr>
<tr>
<td>B</td>
<td>Academic Qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PhD</td>
<td>14</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>MPhil/MSc</td>
<td>39</td>
<td>74%</td>
</tr>
<tr>
<td>C</td>
<td>Respondent Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>less than 5 years</td>
<td>07</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>From 5 to 10 years</td>
<td>20</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>more than 10 years</td>
<td>26</td>
<td>49%</td>
</tr>
<tr>
<td>D</td>
<td>Number of Research Works undertaken</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>less than 10</td>
<td>22</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>From 10 to 20</td>
<td>17</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>More than 20</td>
<td>14</td>
<td>26%</td>
</tr>
</tbody>
</table>

5.1 Background and general information

Demographic information is imperative to a meaningful quantitative analysis (cf Warris et al., 2014). Hence, during the empirical survey background and general information of the respondents were sought. As the aim of the research is focused on the challenges of RU in the BE so it was envisaged to get on board the researchers in the BE having satisfactory experience in research in the BE. Out of the 70 questionnaires distributed, 53 questionnaires representing 75.71 percent were completed and retrieved. Table 1 shows the summary of respondent’s demographic information. Analysis of the feedback shows that respondents are researchers in the BE and have satisfactory research experience. Among them, 49% of the respondents have more than 20 years of research experience, 38% have research experience in the range of 5 to 10 years, while 13% of the respondents have less than 5 years in the field of research. The result of the survey shows that 74% have completed their Master's education (MPhil/MSc). Some of the respondents have also acquired additional postgraduate qualification i.e. PhD with a percentage of 26%. Demographic data also show the number of research work
undertaken. Forty-two (42%) have less than ten research works, 32% have from 10 – 20 research works and 26% have undertaken more than 20 number of research works. The respondent’s demographic information reveals that they have good academic background and satisfactory knowledge for providing sufficient details and inputs for the outcome of this research work. The statistics represent that the questionnaires are mostly filled by the experienced researchers having vast experience in research in the BE. Their opinions and views are quite important and valuable in order to establish the findings.

5.2 Challenges of Research Uptake in the Built Environment
From Table 3 most challenges had a standard deviation greater than one indicating there was varied consistency in respondent’s agreement to these challenges. However, the remaining challenges had a standard deviation less than one indicating otherwise. Notwithstanding, Table 2 shows that, the standard error had 0.1103 (min. value) and 0.21014 (max. value). These are quite close to 0.0 indicating that the sample chosen is a probable reflection of the population (e.g. Ahadzie, 2007). Table 4 presents the results of the challenges to research uptake strategies against the mean score 3.0

Lack of resources
In an interactive workshop involving the ACU during an International Network of Research Management Societies (INORMS, 2014) held in Washington DC, the message was that resources and time need to be invested for research to make impact (Falk, 2014). The participants, particularly those from Africa highlighted lack of resources as a major challenge of research uptake in Africa. The results from the survey also show that research uptake in the BE is inundated with challenges that impede the successful communication of research findings to facilitate their practice. Research is financed and undertaken to contribute progressively to humanity. This can only be achieved if resources are made available to researchers at the right time and in the right amounts (von Grebmer, 2005). Indeed, Crivello and Murray (2012) noted that in their consultation in both Ethiopia and India; even where research is relevant to the policy environment and is well communicated, it is not a foregone conclusion or automatic that it will be used. One practical reason for this is a lack of resources. Prior to this observation by Crivello and Murray in 2012, Stephenson and Hennink (2002) some decade back argued that the fundamental barrier to the uptake of research in developing economies is Lack of resources; especially where funds are not available to conduct effective research and dissemination activities. It was therefore not surprising that Lack of resources was ranked first with a mean score of 4.3208 and a standard deviation of 0.803 amongst the challenges to the uptake of research in the BE faculties in Ghana (see Table 4). Moreover, time is also an issue to contend with. The end users which include policymakers have a variety of information and issues to deal with. Thus the increasingly scarce resource of time makes competition for their
attention even stiffer (von Grebmer, 2005). In Ghana, the issue of lack of resources is compounded by the government’s attempt to cut-off research and book allowance available to faculty researchers.

**Policymakers’ perception about research**

Also, *policymakers’ perception about research* was ranked the second most challenging barrier to research uptake by respondents (see Table 4). It is understandable that the variable is a major challenge to research uptake; since policy development is not strongly premised on evidence-based culture in developing countries including Ghana (Stephenson and Hennink, 2002). Seemingly, policymakers do not appreciate the benefits of research. This is confirmed by a large body of research that has explored the extent to which policymakers use research findings (Ouimet et al., 2010, 2009; Landry et al., 2003; Landry et al., 2001). The findings of the various studies point to the apparent disregard of research by policymakers. Correspondingly, Head et al (2014) noted a widespread disappointment concerning the apparently low uptake by government agencies of research knowledge generated by the university sector. Researchers and Academic institutions may not be concerned about policy impact but can be satisfied with the publication of research reports (von Grebmer, 2005), but for the policymakers the challenge does not end with the published research. Eventually, policymakers believe that research is a drain on the state resources especially when the desired impacts of research are not easily identified and quantified. These may be the probable reasons for the historically neglect of research in policymaking.

**Lack of Collaborative research**

For research to have a pervasive effect and thus make an impact outside the academic circles, researchers and academic institutions have to leave their ‘comfort zones’. This calls for a close collaboration between the audience and the researchers. The benefits of collaborative research has been widely acknowledged. It was widely signalled by Dearing and Garrick reports into higher education and by government, funding bodies and the research councils (Smith and Katz, 2000). The recognition of collaborative is further espoused by the Association of Universities and Colleges of Canada (2009). According to the Association, collaboration also plays a key role in the training and development of highly qualified personnel in the form of co-supervision of research students. At its basic form, collaboration occurs when researchers engage informally in consultations, provide advice, participate in site visits, conferences or create complementary research agendas. However, deeper forms of cooperation can occur in the form of joint research projects, sharing of research facilities and major infrastructure, allowing access to research data and discoveries, and the linking of research centres and virtual networks (Association of Universities and Colleges of Canada, 2009).

Collaboration is now actively promoted with a view to breaking down the barriers between universities and between universities, industry, commerce, government and the public services (Smith and Katz, 2000). This seems to be working in the developed world (Neresini and Bucchi,
2011) as the Association of Universities and Colleges of Canada (2009) observed that researchers often partner with colleagues abroad. Many factors are instrumental for this current trend including the growth of the knowledge economy and attempts to strengthen the economic and social contribution of research; a shift towards more applied research in collaboration with other knowledge creators and users, etc. This new approach seems to be trickling down to developing countries and as a result, although was identified a challenge in the literature; the findings proved that as not a significant challenge. The challenge – lack of collaborative research – obtained a mean value of 3.36.

**Table 3: Descriptive Statistics of Challenges to Research Uptake**

<table>
<thead>
<tr>
<th>Challenges</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy makers' perception about research</td>
<td>53</td>
<td>3.9623</td>
<td>.89791*</td>
<td>.12334</td>
</tr>
<tr>
<td>Lack of dissemination skills and access to research</td>
<td>53</td>
<td>2.8491</td>
<td>1.08124</td>
<td>.14852</td>
</tr>
<tr>
<td>Lack of resources</td>
<td>53</td>
<td>4.3208</td>
<td>.80320*</td>
<td>.11033</td>
</tr>
<tr>
<td>Practical difficulties/format of research</td>
<td>53</td>
<td>2.9434</td>
<td>.88611*</td>
<td>.12172</td>
</tr>
<tr>
<td>Organisational setting</td>
<td>53</td>
<td>3.2830</td>
<td>1.11592</td>
<td>.15328</td>
</tr>
<tr>
<td>Quality of research</td>
<td>53</td>
<td>3.0943</td>
<td>.88283*</td>
<td>.12127</td>
</tr>
<tr>
<td>Lack of formal channels of communication</td>
<td>53</td>
<td>2.3962</td>
<td>1.23007</td>
<td>.16896</td>
</tr>
<tr>
<td>Lack of collaborative research</td>
<td>53</td>
<td>3.3585</td>
<td>1.19445</td>
<td>.16407</td>
</tr>
<tr>
<td>Political influences</td>
<td>53</td>
<td>2.9245</td>
<td>1.52982</td>
<td>.21014</td>
</tr>
<tr>
<td>Lack of absorptive capacity of recipient</td>
<td>53</td>
<td>3.2642</td>
<td>1.12918</td>
<td>.15510</td>
</tr>
</tbody>
</table>

**Practical difficulties/format of research**

Much of the literature on the relationship between research and practice, especially policy points out that policymaking is a non-linear process, more often shaped by political circumstances than research evidence, and that research producers need to become better aware of policy contexts and processes (Porter 2010). Decision-making usually and in most cases arises from the need to select the best possible course of action from set of alternatives (Sanden and Meijman, 2012). These are usually based on data obtained from research and the findings as presented by the researcher. Thus research reports, albeit technical, have to be simplified and condensed in close cooperation with the researchers and presented in a way that is appealing to the end users (von Grebmer, 2005). However, generally the format of the presentation is usually not ‘audience-friendly’ since the condensation and simplification of the findings is perceived as a threat to the scientific appeal of their published work (von Grebmer, 2005). This is confirmed in a policy brief by Crivello and Murray (2012) that established that in India researchers are criticised for producing ‘technically correct research’ but failing to produce results to conform with
context. Accordingly, *practical difficulties/format of research* was identified as a challenge to the uptake of research in the BE faculties in Ghana. This results confirm the long existence critique of researchers unable to communicate their findings in simple terms (Crivello and Murray, 2012; von Grebmer, 2005). Although the challenge is not significant (Mean value= 2.92; Std. Dev. =0.89), however, its persistence and importance cannot be overlooked if meaningful impact is expected to be achieved outside the academic circles.

Table 4: Mean Score Ranking of Challenges to Research Uptake

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>lack of resources</td>
<td>3.9623</td>
<td>.89791</td>
<td>2</td>
</tr>
<tr>
<td>Policy makers' perception about research</td>
<td>3.3585</td>
<td>1.19445</td>
<td>3</td>
</tr>
<tr>
<td>lack of collaborative research</td>
<td>3.2830</td>
<td>1.11592</td>
<td>4</td>
</tr>
<tr>
<td>organisational setting</td>
<td>3.2642</td>
<td>1.12918</td>
<td>5</td>
</tr>
<tr>
<td>lack of absorptive capacity of recipient</td>
<td>3.0943</td>
<td>.88283</td>
<td>6</td>
</tr>
<tr>
<td>quality of research</td>
<td>2.9434</td>
<td>.88611</td>
<td>7</td>
</tr>
<tr>
<td>practical difficulties/format of research</td>
<td>2.9245</td>
<td>1.52982</td>
<td>8</td>
</tr>
<tr>
<td>Political influences</td>
<td>2.8491</td>
<td>1.08124</td>
<td>9</td>
</tr>
<tr>
<td>Lack of dissemination skills and access to research</td>
<td>2.3962</td>
<td>1.23007</td>
<td>10</td>
</tr>
</tbody>
</table>

**CONCLUSION AND RECOMMENDATION**

Scientific research is indispensable in the development of a nation, especially towards the movement to a knowledge-based economy. However, as demonstrated throughout this study through the lens of extant literature research and its utilisation is saddled with challenges. The resolution of challenges of research uptake would inevitably facilitate the uptake of research. Also, there is a potential of improving services when research are utilised by government agencies. Nonetheless, RU in developing countries, particularly in the BE is saddled with a lot of challenges. The paper has made an attempt to analyse the challenges inherent in the uptake of Research in the BE. In fulfilling this, respondents were asked to indicate the severity of the challenges to the uptake of research. Hitherto, literature review was conducted to identify the various challenges to RU. However, the challenges appeared to be foreign. Throughout extant literature studies of this nature require contextual situation. As a result, preliminary investigation was undertaken and ten (10) challenges established. The study sought the views of researchers on the challenges of RU in the BE. The results showed that out of the ten (10) challenges the top (5) significant challenges arranged in descending order of severity are:
lack of resources
- Policy makers' perception about research
- lack of collaborative research
- organisational setting
- lack of absorptive capacity of recipient

The other challenges appeared as not significant and surmountable. Also, the Kruskal-Wallis Test was used to compare the difference in the main challenges across the various department. It revealed that there is a difference in the challenge pertaining to policymakers’ perception about research. Whereas the difference in the other main challenges proved to be statistically insignificant.

To make meaningful impact with research, a national research fund should be instituted by the government and other institutions. The aim for them is to provide resources, assistance and support to researchers particularly research with potential impact on humanity. Socially and economically, funding institutions are a strong base for the promotion of research in any country and consequently the institution of such bodies is indispensable in the uptake of research. The gap between research and uptake may be bridged if there is industry support for the research by the various faculties. In some parts of the world, especially in the developed economies such as Hong Kong industry provides research support in the form of funding of Ph.D. education.

It can be seen from the literature reviewed that research uptake was alien to researchers in the BE. Although the dearth of evidence suggest studies have been done in developed countries, there are no comparable studies in the literature from developing countries, particularly in the BE. Therefore, there must also be orientation and sensitization programmes about research uptake and the palpable contribution of such research.

Among the challenges identified, practical difficulties or format in producing the research is critical in the uptake of research. This is because the appreciation of the research findings is dependent on the format is presented in. In producing and communicating their work, researchers need to engage with contextual factors, including changing political and socio-economic circumstances. Most importantly the format of the research must be tailored to enhance the understanding of the users. Additionally, research findings must be relevant and targeted to address specific stakeholder objectives. Contextualising research findings help realise their potential meaning and relevance for practice.

Finally, group (collaborative) researching in particular fields of study must also be encouraged. As demonstrated from literature, the collaboration could be in the form of between faculties; and also making users of the research more of active than passive partakers of the research.

This paper has demonstrated epitome in the discipline of RU and also a ground-breaking study in the BE to spur future studies in the same
This study provides rich insights of the challenges to the uptake of research in the Built Environment. The research findings would be of utility to both researchers and policymakers. It is important to acknowledge the limitations of this study. The study was limited to only researchers in the faculties, and relative small sample size used for the study. Consequently, analyses of the dependent variables were constrained by the fact that those variables with mean less than the hypothesized mean is subjective; and the possibility that the mean scores may change when a larger sample size including end users is chosen. Notwithstanding, the demographic profile of the respondents suggest that they have reasonable experience in research which should generate some credibility in the responses received. However, further research is recommended to examine the challenges from the perspective of policymakers.

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QUALITATIVE ADEQUACY OF PURPOSE BUILT HOSTELS IN WA

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This study sought to assess the level of adequacy of some hastily constructed purpose-built hostels around the Wa campus of the UDS to meet the growing students’ population in the Wa township. It sought to find out the qualitative adequacy levels of the accommodation provided by these private hostels and how the accommodation provided by the private sector adequately supports the educational needs and requirements of students. It also sought to identify the key housing attributes and services (facilities) whose improvement will enhance the level of satisfaction derived from these hostels. It was a post-occupancy evaluation based on survey questionnaires of 31 housing attributes. A five-point Likert scale was used in measuring the level of qualitative adequacy of five purpose-built hostels. The data was analysed with descriptive statistical techniques. Respondents found the hostels fairly adequate for academic purposes. No hostel was either very inadequate or very adequate. The building component attributes rated were mainly found to be adequate whiles the ancillary services needed by students were mostly found fairly adequate. Fire safety and internet services were found to be inadequate and contributed least to the overall adequacy of the hostels. The results suggest the need for regulation in the planning, design and construction of hostels in Wa since about one-half of the attributes used were generally rated fair and none found very adequate. Fire safety is critical in students housing due to the multitenant nature of hostels. This was however found inadequate; necessitating urgent attention to avert any future disaster.

Keywords: adequacy index, facilities, Ghana, student housing, Wa

INTRODUCTION

One of the major challenges to tertiary education in Ghana is the provision of students’ accommodation. Due to a rapidly increasing tertiary students’ population and a disproportionate government funding, the number of halls of residence provided on university campuses does not meet the
demand for accommodation for students on almost all the campuses (UDS Basic Statistics, 2011; University of Ghana (UG) Special Reporter, 2009; Adu, 2009; Danso and Fugar, 2008; Takyiwaa et all, 2007). In the University for Development Studies (UDS), for instance, students’ admission numbers has gradually increased from 39 students in 1993/94 academic year to 7,184 in 2010/11 academic year (UDS Basic Statistics, 2011). Thus, the burgeoning poor students’ housing situation in the country has become a source of concern to higher education stakeholders. This constitutes a serious threat to the welfare of Ghanaian students and negates the quest for sustainable education in Ghana (Takyiwaa et al, 2007).

A huge backlog of accommodation deficit now exists in most towns and cities with tertiary educational institutions like Wa. This deficit is hastily filled by the profit seeking informal private sector. In an attempt to meet the exponential growth in demand, a number of both purpose and non-purpose-built hostels are springing up around the Wa campus of the UDS. The quality and type of housing units provided by the private sector to meet specific needs of these vulnerable students are questionable and must be of interest to all stakeholders. The comfort, socio-economic, cultural and religious needs of these students appear to have been overshadowed by the pecuniary interest of these developers. It appears that some of the purpose-built private hostels around the Bamahu campus of the UDS in Wa are generally of low quality. Students’ housing challenges in Wa are therefore of both quantitative and qualitative in nature. The latter is very critical as it influences the attribute of living and affects the psyche of the students.

Although some few studies have evaluated students housing in Ghana, the scope has been mainly on estate management of public second cycle and tertiary educational facilities (Danso and Fugar, 2008; Tudzi and Ansaah, 2006; Tudzi, 2006). These studies concentrate on post ante management (or the lack of it) of the physical fabric with little or no emphasis on the quality and adequacy of the building components and ancillary services for meeting the needs of the users. Thus, there is no assessment of whether the building meets the purpose for which it was built from the perspective of those who use it. In addition, the few studies mostly considers the infrastructure of government educational institutions, neglecting private built infrastructure which now houses a greater percentage of tertiary students in Ghana. Very little attention (if any) is given to the qualitative adequacy of these facilities in meeting the educational needs of students. But qualitative adequacy evaluations of occupied buildings (Preiser, 1995) are required to allow for feedback into next building delivery cycle (Preiser and Schramm, 2002). This suggests that building faculties, regulators and designers must frequently undertake such evaluations to identify building components and services that require improvement for maximum benefits. This is not yet done in the Wa hostel market in particular and not regular in higher educational institutions in Ghana generally.
The Wa hostel market was chosen because of the perceived lack of adherence to standards and supervision in hostel development and management in the area by the development control department of the local government. There is very little data (if any) on the qualitative adequacy of these hastily constructed private students’ hostels in Wa in particular and even in Ghana, generally. This study therefore sought to fill this gap by assessing the level of adequacy of some newly constructed purpose-built hostels around the Wa campus of the UDS. This was meant to answer three main questions. First, what are the qualitative adequacy levels of the accommodation provided by these private hostels? Second, how does the accommodation provided by the private sector adequately support the educational needs and user requirements of the students? Third, what are the key housing elements and services (facilities) whose improvement will enhance the level of satisfaction derived from these hostels? These are important for at least two reasons. First, as long as the government cannot meet the accommodation needs of tertiary students, the private sector shall continue to partner and fill that need. Therefore, checking and regulating the activities of the private sector becomes extremely important. Second, continuous evaluation of these private students’ housing schemes then becomes essential to guide and regulate the design and construction of such projects (Preiser, 2002; Amaratunga, 2000).

THE STUDY AREA

This study focused on the private property sector of Ghana, with particular emphasis on the private hostel segment in Bamahu, a suburb of Wa, in the Upper West region of Ghana. Wa is located in the north-western part of Ghana and lies between latitude 10°4’N and 2° 30’W (WMA; 2012). It is the regional capital of the Upper West Region. Bamahu is a suburb of Wa located at the south-eastern part of Wa. It shares boundaries with Sinhg to the east, Kapaguri to the west, Kumfabiala to the south-east and the UDS to the south west. Quite a number of hostels are springing up in this area because of the presence of the university. Very little attention is however given to the planning and development control of this suburb, giving rise to the construction of various structures for housing students.

The Wa-Campus of the UDS was established in 2002 and, in terms of infrastructure, not well developed like the other public universities in Ghana. Accommodation for students on campus is woefully inadequate, forcing more than 80% of the students’ population to look for accommodation in near-by suburbs like Bamahu. A huge backlog of accommodation deficit therefore exists in these suburbs of Wa. This deficit is hastily filled by the profit seeking informal private sector. In an attempt to meet the exponential growth in demand, a number of both purpose and non-purpose-built hostels are springing up around the Wa campus of the UDS. The quality and type of housing units provided by the private sector to meet specific needs of these vulnerable students are questionable and
must be of interest to all stakeholders. This is what necessitated the need to undertake this study in the area to evaluate the qualitative adequacy of some of these structures to provide data on building components and services that need urgent attention for improvement.

OVERVIEW OF ADEQUATE STUDENTS’ HOUSING

A review of contemporary housing research literature, especially in Africa, reveals two aspects of housing adequacy: qualitative and quantitative adequacy. Whereas qualitative adequacy relates to sufficiency in quality to meet the need for something (Ibem and Amole, 2011), quantitative adequacy addresses how to increase the number of dwellings to address the overall housing deficit (Obeng-Odoom and Amedzro, 2011). Thus, the housing problem of any society may relate to any of these or both. Whereas quantitative adequacy of students’ accommodation has received significant attention (Takyiwaa et al., 2007; University of Ghana (UG) Special Reporter, 2009; UDS Basic Statistics, 2011; Danso and Fugar, 2008) in Ghana, very little (if any) has been said about qualitative adequacy. The students’ housing challenge in UDS, Wa campus, is both qualitative and quantitative in nature. Quantitative adequacy has received some attention and it is what researchers and commentators often talk about when it comes to students’ housing generally in Ghana and in Wa in particular. On one hand, as long as funding tertiary education remains a challenge (Takyiwa et al., 2007), little can be said about quantitative adequacy and requires another set of studies to address that challenge. As mentioned in the introduction, that is what the private sector seeks to address by investing in the provision of students’ accommodation. On the other hand, it is worthy to know how the accommodation provided by the private sector adequately supports educational goals and user requirements. Unfortunately, many higher educational stakeholders are most inclined to respond to quantitative rather than qualitative needs (Fianchini, 2007). This study therefore seeks to answer the question: How does the accommodation provided by the private sector adequately support the educational needs and user requirements of the students?

To this end, it is important to identify the attributes set in the literature for a qualitatively adequate house. Ibem and Amole (2011) argue that adequate housing can be viewed as the general characteristics of housing which determines the extent it satisfies users’ need. What is ‘adequate housing’ is however thought to be relative and hence idiosyncratic. It is influenced by one’s value systems and expectations which are also shaped by his/her experience (Rapoport, 1977; Kantrowitz and Nordhaus, 1980 and Filfil, 1999). This means that what one may deem as adequate may be inadequate to another person. Evaluating one’s adequacy therefore requires subjective approach (Canter, 1984). Mohit et al. (2010) in that light proposed the components of such a subjective evaluation approach to include measurement of perceptions, adequacy, aspiration and disappointment. That notwithstanding, objective approach to housing
evaluation is also advocated in the literature. It is documented that the objective approach could be used to evaluate the physical characteristics, facilities, services and the environment based on some predetermined attributes of comparison against which the building is judged. Local and international attributes may therefore be engaged in assessing the qualitative adequacy of housing. Various specific attributes have thus been established in the literature (Ibem and Amole, 2011; Ornstein et al, 2009; Horgen and Sheridan, 1996; Amaratunga, 2000; Amaratunga and Baldry, 1999). The UN definition of an adequate shelter as aforementioned provides a rather widely applicable attributes often adopted and adapted for most post-occupancy evaluations like this study (See for instance Ibem and Amole, 2011). This definition is considered appropriate because it provides for basic attributes whose provision should not necessarily attract extra exorbitant cost. Therefore, upon careful consideration of the definition, other studies and the context of Wa, thirty one (31) housing attributes were found most appropriate and relevant (see table 1 on page 8) for assessing the qualitative adequacy of the hostels.

The Post-Occupancy Evaluation Concept

Post-occupancy evaluation (POE) has been variously defined in diverse cultures and contexts (Hadjri and Crozier, 2008) and for different uses (Fianchini, 2007). One of the earliest definitions, seen as ‘an anthropological element’ in the definitions of the concept (Hadjri and Crozier, 2008), is: “examinations of the effectiveness for human users of occupied design environments” (Zimring and Reizenstein, 1980 as quoted in Hadjri and Crozier, 2008). A rather professional definition from the Royal Institute of British Architects – RIBA’s Research Steering Group is: “a systematic study of buildings in use to provide architects with information about the performance of their designs and building owners and users with guidelines to achieve the best out of what they already have” (RIBA, 1991, p. 191). A definition from Preiser, a renowned author in the subject, sees POE as “…a process of systematically evaluating the performance of buildings after they have been built and occupied for some time” (Preiser, 2002:42). Previously, from the point of view of Facility Management, Preiser, (1995) saw POE as a diagnostic tool for evaluating the performance of a building once occupied. In addition, Preiser and Schramm (2002) provide a dynamic and evolving POE process model which allows feedback into next building delivery cycle. This same idea was later conceptualised by Ornstein et al in 2009 (see figure 1). A more recent and related definition of the concept is “a systematic evaluation of opinion about buildings in use, from the viewpoint of the people who use them” (Adewunmi, et al, 2010).

After a thorough evaluation of the definitions of POE, Hadjri and Crozier, (2008, pp.23) concluded that POE “...is a process that involves a rigorous approach to the assessment of both the technological and anthropological elements of a building in use.” In all these definitions, the human-building interface is apparent. This interface was actually described by Preiser (1988) as the ‘fit’ between the users, the building and the organisation (See also Amaratunga and Baldry, 1999). In this study, the fit between the
building and the users (students) is considered, and the question that arises in the context of Wa is: What is the fit between the hostels and the purported users (students)?

Figure 1: Feedback cycle of the POE


POE has being in existence for more than four decades now and as such it is an old tool (Turpin-Brooks and Viccars, 2006). However, what is new is its recent functional value expressed by Kauntze (2008) as “a business management tool by today’s occupiers and as a crucial building appraisal system for property owners, managers and designers”. POE has become an important building evaluation tool for, at least, the past three decades, especially in the USA, Canada and Australia (Adewunmi, et al, 2010) due to its ‘mutability’ to measure complex interactions in the real world, making it “social” rather than ‘scientific’ barometer in building performance assessment (Hadjri and Crozier, 2008; Fianchini, 2007; Amaratunga and Baldry, 1999). It allows users to measure the performance of buildings based on their experience of the built environment (Horgen and Sheridan, 1996). Turpin-Brooks and Viccars (2006) stressed that, POE involves the systematic evaluation of opinion about buildings in use, from the perspective of the people who use them.

It is accentuated that the importance of POE has greatly increased in recent years in the “western” world as earlier stated (particularly in Europe and US) than it is in most developing countries (Adewunmi et al, 2010). Thus, the picture in Ghana is no exception. POE as a building performance evaluation is a new concept and not a common activity (if any) in Ghana generally and in higher education buildings in particular.
Its importance has not caught the attention of many executives of organizations in this country. The importance of POE activities could emanate from the quote below:

_The recent expansion of student intake combined with financial cutbacks has revealed to many institutions the functional shortcomings of their buildings. The need to understand the part played by buildings, teaching spaces, [halls of residence] in particular, in delivering the goals of a complex modern HE [Higher Education] establishment has never been greater. This has been recognised by the requirement of the university funding body, the Higher Education Funding Council for England, that HE establishments should integrate buildings into their plans rather than “in many cases limit their consideration of estate matters to a list of projects they wish to pursue” (Amaratunga and Baldry, 1999, p. 48/49)_

This quote is in the context of higher education in England, but the prevalence of the problem and relevance of the admonishing in the context of Ghana (UDS, Wa campus in particular) is unquestionable. The exponential increase in student intake in Ghanaian educational institutions, coupled with declining funding, has been experienced in the past few decades (Takyiwaa et al, 2007). But very few studies (if any) have been undertaken to show the resultant functional shortcomings of educational built infrastructure. The few studies (Tudzi, 2006) rather describe the conditions of these buildings without evaluating their performance to provide feedback into future projects. This is what Adewunmi, et al (2010) described as “a phenomenon in third world countries... attributed largely to the reactive maintenance “syndrome”. It is expected that the evaluation of the overall performance of higher educational buildings should influence strategic planning, development and policy decision-making in order to improve the efficiency of built infrastructure (Housley, 1997; Asiabaka, 2008). What are the key housing elements and services (facilities) in the Wa hostel market that need to be improved to enhance the efficiency of (level of satisfaction derived from) these buildings? This, among others, is what the study seeks to do.

**Student Hostels Performance Components**

The design intention of a building dictates the performance criteria for POEs of that particular building and these building performance criteria have bearing on the organizational and occupants performance (Preiser, 2002). In this wise, performance criteria of every building depends on the needs of both occupants and the organization. Particularly, findings from POE studies on hostels globally suggest that the use of performance criteria for assessment of hostel facilities has been more robust and focused. For instance, Hassanain’s (2007) work on a student housing facility which examined the use of indoor environmental qualities particularly used criteria such as thermal, acoustic, visual comfort and indoor air quality. Another study on a student housing facility by Hassanain (2008) examined the use of five technical performance requirements, including: thermal comfort; acoustic comfort; visual comfort;
indoor air quality; and fire safety. In addition, according to Hassanain (2007) five functional requirements of student accommodation include: interior and exterior finish systems; room layout and furniture quality; support services; efficiency of circulation; and proximity to other facilities on campus.

Furthermore the importance of reading room (Ornstein, et al, 2009), library and internet facility to students’ academic performance is well documented in literature. The link between retention, or “student persistence”, and library use is also comprehensively documented in literature drawing on sources dating back to the early 1960s (De Jager, 2002; Mezick, 2007). There are many other useful literature (e.g. Mann (1974), De Jager (2002) and Middleton (2005)) buttressing the fact that library use contributes to academic success. Hurst and Leonard (2007) stressed that “…using more library resources would automatically improve a student’s grade”. Also Primary Research Group (2009) in Alloway Library News (2009) revealed a correlation between the students’ grades and online research. Recently, Goodall and Pattern (2011) emphasized that ...students achieving a first class degree are the heaviest users of print and electronic library resources.

Moreover, Leung and Fung (2005) investigation of the impact of school facilities on the learning behaviours of students underlined that lights have influence on the health and performance of human beings. Further, they stressed that “… an appropriate level of lighting enhances productivity, quality, staff morale, and energy conservation. Bright light can alleviate seasonal depression ..., though too much sunlight can create a painful glare for both teachers and students”. Again, light comes either in the form of artificial or natural means (Leung and Fung, 2005). Furthermore, temperature sways thermal comfort that in turn affects health, working performance, and social behaviour. They asserted that a slightly cool room is more conducive to learning than a warm room (ibid; Cole and Lorch, 2002; Bordass and Leaman, 2001).

Another related criteria is ventilation which affects the health and productive performance of end-users. The sources of ventilation can be natural, artificial or both (Baker 1996 in Leung and Fung, 2005). Leung and Fung (2005) consider “sound as a physical entity, while noise is a psychological concept defined as unwanted sound”. Unnecessary and extreme noise has negative health implication on occupants. It affects their psychological relationships and working performance according to Lebo and Oliphant (1968) cited in Leung and Fung (2005). Although, too low noise or silence do not yield conducive working environment, background noise (like music) with a level of about 35 decibels can maximize alertness, allow relaxation, improve classroom ambience, aid learning, and improve academic performance (Charles, 1983; Knirk, 1987 in Leung and Fung, 2005; Hutchinson, 2003).
<table>
<thead>
<tr>
<th>No.</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Level of Cleanliness</td>
</tr>
<tr>
<td>2</td>
<td>Adequacy of natural Lighting</td>
</tr>
<tr>
<td>3</td>
<td>Control of Artificial Lighting</td>
</tr>
<tr>
<td>4</td>
<td>Adequacy of lighting levels in the corridors</td>
</tr>
<tr>
<td>5</td>
<td>Overall perception of lighting quality</td>
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<tr>
<td>6</td>
<td>Room temperature during the dry season</td>
</tr>
<tr>
<td>7</td>
<td>Room temperature during the rainy season</td>
</tr>
<tr>
<td>8</td>
<td>Overall perception of temperature in building</td>
</tr>
<tr>
<td>9</td>
<td>Air quality within building</td>
</tr>
<tr>
<td>10</td>
<td>Air quality in the corridors</td>
</tr>
<tr>
<td>11</td>
<td>Control of natural ventilation</td>
</tr>
<tr>
<td>12</td>
<td>Overall Perception of indoor air quality</td>
</tr>
<tr>
<td>13</td>
<td>Noise from outside the building</td>
</tr>
<tr>
<td>14</td>
<td>Overall perception of noise in the building</td>
</tr>
<tr>
<td>15</td>
<td>Overall comfort level in the building</td>
</tr>
<tr>
<td>16</td>
<td>Furniture arrangement</td>
</tr>
<tr>
<td>17</td>
<td>Amount of space in rooms</td>
</tr>
<tr>
<td>18</td>
<td>Common room space</td>
</tr>
<tr>
<td>19</td>
<td>Conversation privacy in room</td>
</tr>
<tr>
<td>20</td>
<td>Toilet/bath/laundry facilities</td>
</tr>
<tr>
<td>21</td>
<td>Cooking facilities</td>
</tr>
<tr>
<td>22</td>
<td>Interior design of rooms</td>
</tr>
<tr>
<td>23</td>
<td>Telephone system</td>
</tr>
<tr>
<td>24</td>
<td>Overall satisfaction</td>
</tr>
<tr>
<td>25</td>
<td>Car/Motor bike parking</td>
</tr>
<tr>
<td>26</td>
<td>Fire safety</td>
</tr>
<tr>
<td>27</td>
<td>Security level</td>
</tr>
<tr>
<td>28</td>
<td>Internet facilities</td>
</tr>
<tr>
<td>29</td>
<td>Visual Privacy in room</td>
</tr>
<tr>
<td>30</td>
<td>Response to complaints</td>
</tr>
<tr>
<td>31</td>
<td>Distance to lecture facilities</td>
</tr>
</tbody>
</table>

Many earlier researchers have done more works on decoration. Decoration accounts for a comfortable environment. Suitable decoration can improve learning environment. Particularly, learners do well and are more attentive in rooms with pleasing pastels since people normally prefer light to dark colors, saturated colors to unsaturated colors, and colors from the “cool” end of the spectrum to “warm” colors (Bennett, 1977; Child and Iwao, 1969; Mehrabian and Russell, 1974) as indicated by Leung and Fung (2005).
Over-clouded room can affect performance of end-users, in that individuals who work in a crowded area may perform their work poorly; as they develop high stress, high blood pressure, or another type of illness; and experience dissatisfaction (ibid). Clouded room affects privacy, conversation privacy in room, visual privacy in room and the cleanliness of the rooms. Clouded rooms also influence and reduce the overall comfort level in building, common room space and overall satisfaction of the rooms. Again, clouded rooms have poor furniture arrangement which in turn affect comfort level and performance of end-users. Other articles on the topic of student housing highlight the importance of telephone system (Tibu’rcio and Finch, 2005); Fire safety (Dailey, 2000; Watson, 2000; Thompson, 2001; Comeau, 2003; Bruno, 2006); Security (Preiser (1995); Response to complaints (Cohen et al., 2001; Cole and Lorch, 2002 and Bordass and Leaman, 2001); distance to lecture facilities and Car/Motor bike parking (Jauzens et al.,2002); Toilet/bath/laundry facilities and Cooking facilities (UN Habitat, 1996).

From the foregoing, a number of qualitative attributes for assessing the qualitative adequacy of hostels emerge. But the Ghanaian (particularly Wa) context of this study is important in selecting the most appropriate attributes. From a careful evaluation of the definition of qualitatively adequate (student) housing, building performance evaluation studies and the context of the study, 31 hostel attributes (presented on table 1 below) were found most appropriate for this study.

**RESEARCH DESIGN**

The qualitative adequacy measurement in this study was in the form of a post-occupancy evaluation which mainly used the survey questionnaire approach adopted from similar studies (Ibem and Amole, 2011; Ornstein et al, 2009; Leung and Fung, 2005; Horgen and Sheridan, 1996) and adapted to this current one. A questionnaire survey of purpose-built private hostels around the Wa campus of UDS was carried out by the researchers between January and March, 2013. Five purpose built hostels within a kilometre radius (from the University boundaries) were randomly selected. For the purposes of confidentiality, these hostels are labelled A, B, C, D and E. Using stratified random sampling, each hostel was taken as a stratum and 100 students were selected from each stratum, given a total sample size of 500 students. The 100 students from each stratum were randomly selected from the list of students obtained from the hostel managers. This was deemed adequate since a similar study sampled only 30 respondents (Hassanain and Mudhei, 2006). A total of 329 valid questionnaires representing 65.80% of the distributed questionnaires were retrieved. This response rate is considered adequate since a similar study which reported a response rate of 61.98% in Nigeria (Adebayo, 2006) was still considered valid. Table 2 below shows the number of respondents who rated each of the five hostels.
Table 2: Response rate

<table>
<thead>
<tr>
<th>Hostel</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>70</td>
</tr>
<tr>
<td>C</td>
<td>70</td>
</tr>
<tr>
<td>D</td>
<td>50</td>
</tr>
<tr>
<td>E</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>329</td>
</tr>
</tbody>
</table>

A definition of purpose-built hostel in this study is adopted from the Adelaide City Council’s Development Assessment (2007) which finds similarities between student accommodation and housing in general. The only difference is that “student accommodation is housing specifically designed to accommodate students, such as a ‘live-in’ residential college, boarding house or other purpose built development containing student units with other ancillary facilities (i.e. study areas, communal lounge, and kitchens)”. An adequate hostel, for the purpose of this study, can therefore be seen as ‘similar’ to ‘adequate housing’ with some specific characteristics which determine the extent it satisfies students’ need. The UN Member States define adequate housing in the following terms:

*Adequate* shelter means adequate privacy; adequate space; physical accessibility; adequate security; security of tenure, structural stability and duration; adequate lighting, heating and ventilation; adequate basic infrastructure, such as water, sanitation and waste management facilities; suitable environmental quality and health-related factors; and adequate and accessible location with regard to work and basic facilities; all of which should be available at an affordable cost (UN Habitat, 1996b).

It is however acknowledged that adequacy often varies from country to country since it depends on specific cultural, social, environmental and economic factors. Therefore, the attributes in this definition were adopted and adapted for the purpose and context of this study (as mentioned earlier). The selection of attributes was also informed by the ‘seven key dimensions of building performance’ for building-in-use assessment developed by Horgen and Sheridan (1996); as well as other studies referred to in the literature review. A total of 31 hostel attributes were extracted and used for the study (see table 1 on page 9).

Questionnaires were administered to elicit information needed for calculating the adequacy indices of the attributes and the hostel. The respondents were asked to rate the level of adequacy of each of the hostel attributes using a five-point Likert scale with very adequate, adequate, fairly adequate, inadequate and very inadequate rated as 5, 4, 3, 2 and 1 respectively.

The data was analysed as follows in two ways. Firstly, for each of the five hostels, adequacy index (AIH) was obtained by finding the sum of the actual scores a respondent gave to each of the 31 attributes (i.e. Hostel
Adequacy Score – HAS) and expressing it (HAS) as a percentage of the possible total maximum score (HAS_{max}) a respondent could give using all the 31 attributes, expressed mathematically as:

\[
AI_H = \left( \frac{\Sigma HAS}{\Sigma HAS_{max}} \right) \times 100
\]

Where

AI_H – Hostel adequacy index
HAS – a respondent’s actual scores for all the 31 attributes for a hostel
HAS_{max} – possible total maximum score for a hostel by a respondent using all the 31 attributes

Thus, from the scale of 1 – 5, the possible total maximum hostel adequacy score (HAS_{max}) is 155 (5 x 31); and the possible total minimum hostel adequacy score is 31 (1 x 31). Hence, the possible minimum and maximum hostel adequacy indexes (AI_H) were also 20 [i.e. (31/155) x 100] and 100 [i.e. (155/155) x 100], respectively (see Ibem and Amole, 2011). The actual scores of a respondent determined his/her rating index which must fall within this range. This was used for assessing the adequacy of each hostel from the perspective of the respondents (users). Secondly, the adequacy indices for the attributes were calculated as the sum of all the scores given to a particular attribute, \( a \), by all respondents, \( \Sigma y_a \); divided by the possible total maximum score for the attribute, \( \Sigma Y_a \); multiplied by hundred. This percentage gave the adequacy index (\( AI_a \)) for that particular attribute \( a \), from the perspective of all respondents. This is expressed algebraically:

\[
AI_a = \left( \frac{\Sigma y_a}{\Sigma Y_a} \right) \times 100
\]

Where:

\( AI_a \) – the adequacy index of a particular attribute ‘\( a \)’ (determined by all respondents),
\( y_a \) – respondents’ actual scores for a particular attribute \( a \)
\( Y_a \) – the possible maximum score for a particular attribute \( a \).

Similarly, given the scale of 1 – 5, the possible total maximum score for an attribute (\( Y_a \)) is 5\( n \) (where \( n \) is the number of respondents, 329); and the possible total minimum score for an attribute is \( n \) (i.e. 1n). Therefore, the possible minimum and maximum attribute adequacy indices (\( AI_a \)) were 20 [i.e. (329/1645) x 100] and 100 [i.e. (1645/1645) x 100], respectively. Using the above scale, the respondents’ ratings of the attributes were calculated.
from the above formula and the ratings were expected to be within the range of 20 – 100. This was used in assessing the adequacy of each attribute as well as the contribution of each of the 31 attributes to the overall adequacy of all the five hostels.

Table 3 below provides the framework for interpreting the results obtained from the adequacy indices (both $A_{1\alpha}$ and $A_{1H}$). The indices that were within the ranges (e.g. 20 – 35) were identified, counted and recorded under the frequency for easy interpretation. Since the ratings of each respondent generated an index, the number of hostel adequacy indices generated for each hostel needed to correspond with the number of respondents in the hostel. And using the index per respondent and the framework, the researchers identified how many respondents rated a hostel very inadequate, inadequate, fairly adequate, adequate and very adequate. The results are presented and analysed in the next section.

**Table 3: Adequacy Indices**

<table>
<thead>
<tr>
<th>Adequacy Level</th>
<th>Adequacy Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very inadequate</td>
<td>20 - 35</td>
</tr>
<tr>
<td>Inadequate</td>
<td>36 - 51</td>
</tr>
<tr>
<td>Fairly adequate</td>
<td>52 - 67</td>
</tr>
<tr>
<td>Adequate</td>
<td>68 - 83</td>
</tr>
<tr>
<td>Very adequate</td>
<td>84 - 100</td>
</tr>
</tbody>
</table>

Source: Ibem, 2011 (Tabulated by researchers)

**ANALYSIS OF RESULTS**

**Features of the Respondents and Halls of Residents**

**Table 4: Sex Distribution of Respondents and features of the Halls**

<table>
<thead>
<tr>
<th>Features of the Respondents and Halls</th>
<th>Frequency (n = 329)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>1.22</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>30.09</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>11.55</td>
</tr>
<tr>
<td>4</td>
<td>172</td>
<td>52.28</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>3.95</td>
</tr>
<tr>
<td>Reading Room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>107</td>
<td>32.52</td>
</tr>
<tr>
<td>No</td>
<td>222</td>
<td>67.48</td>
</tr>
<tr>
<td>Library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
<td>1.82</td>
</tr>
<tr>
<td>No</td>
<td>323</td>
<td>98.18</td>
</tr>
</tbody>
</table>
Table 2 indicates that the maximum and minimum occupancy rates are 6 (3.95%) and 1 (1.22%) persons to a room, respectively and a modal occupancy rate of 4 persons (52.28%) to a room. All respondents answered the question on room occupancy. Less than half (32.52%) of the respondents indicated the availability of reading rooms in their respective hostels with the greater percentage (67.48%) indicating otherwise. In hostels A and E, the respondents unanimously indicated that they had no reading rooms in their hostels whereas in the others (B, C, and D), the students were divided on the availability of reading rooms in their hostels. Only 6 (1.82%) respondents indicated the presence of library facilities in their hostels. It could be a mistake on the part of some respondents for indicating this given the larger number (98/18%) of responses to the contrary. A reading room could have been mistaken for a library.

**Qualitative Adequacy of Individual Hostels**

Table 5 presents the adequacy index for all the attributes for Hostel A. Only 5.71% of respondents (or, of the indices computed) from the hostel found it **very inadequate** and 12.86 found it **inadequate**. Whereas a greater percentage of 64.29 rated it **fairly adequate**, the remaining 17.14% found the hostel **adequate**. None rated the hostel **very qualitatively adequate** for academic work. Overall, the hostel may be qualitatively described as **fairly adequate**.

**Table 5: Qualitative Adequacy of Hostel A**

<table>
<thead>
<tr>
<th>Adequacy Scores</th>
<th>Rating</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>4</td>
<td>5.71</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>9</td>
<td>12.86</td>
</tr>
<tr>
<td>52-67</td>
<td>Fairly</td>
<td>45</td>
<td>64.29</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>12</td>
<td>17.14</td>
</tr>
<tr>
<td>84-100</td>
<td>Very Adequate</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>70</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

From Table 6, 1.43% and 4.29% of the respondents respectively found the attributes of hostel B **very inadequate** and **inadequate** for academic work. A significant proportion of 24.29% found it to be **fairly adequate**. More than half of the respondents (67.14%) rather found the attributes of this hostel to be **adequate**; with a very small fraction (2.86%) indicating that it is **very adequate** for its purpose. It is the highest rated hostel out of the five.

**Overall Adequacy of the Five Hostels**

The overall evaluation of the five hostels are summarised in table 10. Overall, the hostels are found to be fairly **adequate** by simple majority of 48.94% of all the respondents (all the indices computed). This notwithstanding, quite a significant proportion (37.39) also indicated that the hostels are qualitatively **adequate**. Only 5 out of 329 (1.52%) actually found these hostels very qualitatively **adequate** for the purpose of academic work.
Table 6: Adequacy Index of Hostel B

<table>
<thead>
<tr>
<th>Adequacy Scores</th>
<th>Rating</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>3</td>
<td>4.29</td>
</tr>
<tr>
<td>52-67</td>
<td>Fair</td>
<td>17</td>
<td>24.29</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>47</td>
<td>67.14</td>
</tr>
<tr>
<td>84-100</td>
<td>Very adequate</td>
<td>2</td>
<td>2.86</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

As can be seen from Table 7, respondents from hostel C were of diverse opinions on the adequacy of it. Whereas 4.29% and 1.43% found it to be very inadequate and very adequate respectively, 22.86% and 25.71% also respectively found it to be inadequate and adequate. Unlike hostels A and B, only 45.71% (less than half) of the respondents found hostel C fairly adequate. By the rule of simple majority, the respondents here averagely rated this facility.

Table 7: Adequacy Index of Hostel C

<table>
<thead>
<tr>
<th>Adequacy Scores</th>
<th>Rating</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>3</td>
<td>4.29</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>16</td>
<td>22.86</td>
</tr>
<tr>
<td>52-67</td>
<td>Fair</td>
<td>32</td>
<td>45.71</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>18</td>
<td>25.71</td>
</tr>
<tr>
<td>84-100</td>
<td>Very Adequate</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 8: Adequacy Index of Hostel D

<table>
<thead>
<tr>
<th>Adequacy Scores</th>
<th>Rating</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>2</td>
<td>4.00</td>
</tr>
<tr>
<td>52-67</td>
<td>Fair</td>
<td>30</td>
<td>60.00</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>16</td>
<td>32.00</td>
</tr>
<tr>
<td>84-100</td>
<td>Very Adequate</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>50</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 8 shows that quite a significant majority (60%) of the respondents rated hostel D to be fairly adequate. A significant proportion (32%), though not the majority, found the hostel to be qualitatively adequate. From table 9, no respondent found hostel E very inadequate, only one student found it inadequate and very adequate in each case. The hostel is found adequate by a significant percentage (43.48%) of the respondents with about 53.62% of them fairly rating its adequacy.
Table 9: Adequacy Index of Hostel E

<table>
<thead>
<tr>
<th>Adequacy Scores</th>
<th>Rating</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>1</td>
<td>1.45</td>
</tr>
<tr>
<td>52-67</td>
<td>Fair</td>
<td>37</td>
<td>53.62</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>30</td>
<td>43.48</td>
</tr>
<tr>
<td>84-100</td>
<td>Very Adequate</td>
<td>1</td>
<td>1.45</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>69</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 10: Overall Adequacy of the five hostels

<table>
<thead>
<tr>
<th>Adequacy Index</th>
<th>Rating</th>
<th>Total</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>Very inadequate</td>
<td>9</td>
<td>2.74</td>
</tr>
<tr>
<td>36-51</td>
<td>Inadequate</td>
<td>31</td>
<td>9.42</td>
</tr>
<tr>
<td>52-67</td>
<td>Fair</td>
<td>161</td>
<td>48.94</td>
</tr>
<tr>
<td>68-83</td>
<td>Adequate</td>
<td>123</td>
<td>37.39</td>
</tr>
<tr>
<td>84-100</td>
<td>Very Adequate</td>
<td>5</td>
<td>1.52</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>329</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Contributions of the Attributes to Overall Adequacy

Table 11 summarises both the attribute scores and adequacy indices of the 31 attributes used in this study arranged in descending order of their adequacy indices and contribution to overall adequacy of the hostels. An examination of the results from the table reveals that eleven (11) attributes had adequacy indexes between 69.18 and 78.05; which are mostly lighting and ventilation attributes (hall unit attributes) of the hostels found to be adequate by the respondents. The attributes with indices between 52.52 and 67.48 comprising mainly ventilation, internal configuration as well as internal facilities attributes were found to be fairly adequate. The hall attributes with indices between 42.05 and 47.60, found inadequate by the respondents, were mainly services, security issues and external facilities. No attributes were found to be very adequate and very inadequate. Out of the 31 attributes used, the table shows that the level of cleanliness, a facilities management attribute, had the highest attribute score of 1284 (78.05) and thus contributed most to adequacy of the hostels. This was followed by adequacy of natural lighting (77.69). On the other hand, internet facilities, a hostel service attribute, contributed least (42.01) to the adequacy level of the hostels. The results also show that despite the perceived congestion in some of the hostels, respondents were still fairly satisfied with the amount of space in the rooms. In all, hall attributes found to be adequate by the respondents contributed most to adequacy level. Those evaluated as fair made moderate contribution while attributes found to be inadequate made low contributions to the adequacy index of the respondents. Overall, the attributes, as well as the hostels,
can best be qualitatively rated as fairly adequate, using average and median statistics and the rule of simple majority.

The results again show that level of cleanliness contributed most to the overall adequacy of hostels A and E. For hostels B and C, it is the lighting attributes that enhanced their adequacy most. Interestingly, it is the washroom facilities (toilet/bath/laundry) that rather contributed most to hostel D. Thus, although the hostels are in the same location and of similar designs, data suggest that different factors enhanced their adequacy levels. On the other hand, whereas distance to lecture facilities was rated lowest by the respondents of hostels A and B, internet facilities rather received the least ratings by the respondents of hostels C, D and E.

**DISCUSSION OF KEY FINDINGS**

**Room occupancy rate**

Table 11: Adequacy Levels of Attributes

<table>
<thead>
<tr>
<th>Hostel</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Respondents (n)</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>65</td>
<td>69</td>
<td>353</td>
</tr>
<tr>
<td>Number of Respondents (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>93</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Maximum Score (Based on 1-4)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Index: AL - (25/100 x M)</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Score (0-100)</td>
<td>Index</td>
<td>Score (0-100)</td>
<td>Index</td>
<td>Score (0-100)</td>
<td>Index</td>
<td>Score (0-100)</td>
</tr>
<tr>
<td>Level of Cleanliness</td>
<td>271</td>
<td>57.74</td>
<td>90</td>
<td>55.85</td>
<td>73</td>
<td>65.85</td>
</tr>
<tr>
<td>Adequacy of natural lighting</td>
<td>295</td>
<td>59.10</td>
<td>95</td>
<td>61.96</td>
<td>76</td>
<td>68.49</td>
</tr>
<tr>
<td>Adequacy of toilet/bath/laundry facilities</td>
<td>360</td>
<td>74.29</td>
<td>90</td>
<td>85.71</td>
<td>93</td>
<td>90.00</td>
</tr>
<tr>
<td>Ambience in the corridors</td>
<td>279</td>
<td>74.00</td>
<td>90</td>
<td>85.71</td>
<td>93</td>
<td>90.00</td>
</tr>
<tr>
<td>Overall perception of lighting levels in the corridors</td>
<td>219</td>
<td>60.14</td>
<td>80</td>
<td>80.00</td>
<td>90</td>
<td>88.88</td>
</tr>
<tr>
<td>Comfort of artificial lighting</td>
<td>237</td>
<td>61.71</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.00</td>
</tr>
<tr>
<td>Air quality within buildings</td>
<td>289</td>
<td>70.86</td>
<td>90</td>
<td>83.33</td>
<td>93</td>
<td>81.80</td>
</tr>
<tr>
<td>Room temperature during the rainy season</td>
<td>221</td>
<td>65.14</td>
<td>90</td>
<td>80.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Overall comfort level in the building</td>
<td>210</td>
<td>68.57</td>
<td>90</td>
<td>80.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Overall perception of lighting quality</td>
<td>231</td>
<td>62.29</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.00</td>
</tr>
<tr>
<td>Control of natural illumination</td>
<td>219</td>
<td>68.57</td>
<td>90</td>
<td>80.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Overall perception of temperature in the building</td>
<td>219</td>
<td>61.71</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.80</td>
</tr>
<tr>
<td>Air quality environmentally friendly</td>
<td>216</td>
<td>61.71</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.80</td>
</tr>
<tr>
<td>Noise from outside the building</td>
<td>219</td>
<td>55.71</td>
<td>90</td>
<td>76.99</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>220</td>
<td>62.86</td>
<td>90</td>
<td>81.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Bedding facilities</td>
<td>249</td>
<td>78.43</td>
<td>90</td>
<td>85.71</td>
<td>93</td>
<td>85.71</td>
</tr>
<tr>
<td>Overall perception of toilets in the building</td>
<td>219</td>
<td>61.71</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.80</td>
</tr>
<tr>
<td>Complacency privacy in rooms</td>
<td>216</td>
<td>61.71</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.80</td>
</tr>
<tr>
<td>Amount of space in rooms</td>
<td>247</td>
<td>72.00</td>
<td>95</td>
<td>82.00</td>
<td>93</td>
<td>81.00</td>
</tr>
<tr>
<td>Common space in rooms</td>
<td>223</td>
<td>63.33</td>
<td>90</td>
<td>82.20</td>
<td>90</td>
<td>81.80</td>
</tr>
<tr>
<td>Interior design of rooms</td>
<td>192</td>
<td>52.00</td>
<td>90</td>
<td>75.00</td>
<td>93</td>
<td>68.00</td>
</tr>
<tr>
<td>Furniture arrangement</td>
<td>204</td>
<td>59.26</td>
<td>90</td>
<td>81.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Privacy in rooms</td>
<td>192</td>
<td>52.00</td>
<td>90</td>
<td>75.00</td>
<td>93</td>
<td>68.00</td>
</tr>
<tr>
<td>Security areas</td>
<td>192</td>
<td>52.00</td>
<td>90</td>
<td>75.00</td>
<td>93</td>
<td>68.00</td>
</tr>
<tr>
<td>Response to complaints</td>
<td>165</td>
<td>64.71</td>
<td>90</td>
<td>81.00</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Room temperature during the day season</td>
<td>171</td>
<td>68.57</td>
<td>90</td>
<td>85.00</td>
<td>93</td>
<td>81.00</td>
</tr>
<tr>
<td>Computerized booking systems</td>
<td>151</td>
<td>43.14</td>
<td>90</td>
<td>55.85</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Telephone systems</td>
<td>151</td>
<td>43.14</td>
<td>90</td>
<td>55.85</td>
<td>93</td>
<td>77.78</td>
</tr>
<tr>
<td>Fire safety</td>
<td>120</td>
<td>79.26</td>
<td>90</td>
<td>87.00</td>
<td>90</td>
<td>76.00</td>
</tr>
<tr>
<td>Internet connection to lecture facilities</td>
<td>109</td>
<td>70.86</td>
<td>90</td>
<td>83.33</td>
<td>93</td>
<td>81.00</td>
</tr>
<tr>
<td>Internet facilities</td>
<td>115</td>
<td>75.86</td>
<td>90</td>
<td>91.80</td>
<td>93</td>
<td>87.78</td>
</tr>
</tbody>
</table>

The modal occupancy rate was 4 students to a room in most of the hostels with as many as 6 to a room. In some of the hostels, the rooms were intended to have 2 occupants per room originally. However, with the motivation to make profit on the part of hostel investors, they allowed 3 to
5 occupants in the midst of insufficient student accommodation on campus and a larger in-take of students at Bamahu campus of the UDS in Wa. The congestion could also be attributed to affordability as the rent per head decreases with increase in room occupancy. Some hostels in the neighbourhood charged rent per room per annum irrespective of the number of students who occupied the room. Hence as many students as possible could share the annual rent and occupy a room, and, the few wealthy ones could pay and live alone in a room (See Abugbila et al, 2013). This explains the responses under occupancy rate in Table 4. As a result, these hostels and their facilities were over-stressed and could experience high deterioration rate. Subsequently, the life span of these hostel investments could be shortened if they are not properly maintained. Again, the congestion could reduce the adequacy of these hostels and have negative impact on students’ performance. This could be why the respondents rated room space attribute to be only fairly adequate. A possible reduction in occupancy could improve the adequacy levels of these hostels.

Adequacy of the Hostel Attributes
Out of the 31 attributes, only 11 (mainly lighting and air quality attributes) were found to be adequate by the respondents. Sixteen (16) attributes were found fairly adequate; with the rest (4) rated inadequate. The attributes found to be fairly adequate were mainly ventilation, internal configuration as well as internal facilities attributes. Those found inadequate by the respondents were mainly services, security issues and external facilities. The hostels however provided adequate cleaning services and sanitary facilities and had adequate illumination in the rooms (Table 11). Fire safety measures (found inadequate) were generally lacking in these multi-tenanted facilities. It is a critical issue which requires immediate attention for both the safety of the students and the investors given the rampant fire outbreaks in recent times in Ghana. No attribute was found to be very adequate and very inadequate. Overall, the hostels were mainly rated by the respondents to be fairly adequate for their purposes. All the qualities that the respondents found adequate (or fairly adequate) were building components except cleaning services, which is a building service. This suggests that the respondents did not actually have problems with the architecture but the ancillary facilities that must complement the usage of the buildings. However, a “fairly adequate” overall index is unacceptable given that these are twenty-first century buildings.

Ancillary Facilities
The results show that the hostels do not adequately meet the needs of the post-modern students. Three out of the five hostels had no reading rooms; none had library and internet facilities. In addition, the hostels had modal room occupancy of 4 and as high as 6 (maximum) in some instances (Table 4). Without spacious library and/or reading rooms, how did the students study, given that students have variant reading hours? Without these key facilities, the students’ performance could be affected negatively. This is
because the Bamahu campus of the UDS in Wa has a very small library which closes very early (19:00 GMT). The lack of these facilities reduced the overall adequacy of these hostels. The provision of a basic facility as a reading room in each purpose-built hostel would do a great service to these students. Internet services have become an integral component of the needs of contemporary students. The lack of it could hamper the performance and development of students. And that means they have find another means of accessing the service which may often come at exorbitant cost. It is therefore not surprising to be among the least rated attributes of the hostels. Some services that are provided were found to be only fairly adequate (see table 11). Just a few (11) of the attributes used were found to be adequate.

Attributes that Need Improvement

From the results, it is clear that almost all the attributes need some improvements in the planning, design and construction of the hostels in this location to increase the adequacy levels of the hostels. All the first eleven (11) attributes found adequate can still be improved to be very adequate. About half (16) of the attributes were only fairly rated, suggesting that they need serious improvements. The bottom four (4) were found inadequate; warranting serious attention on the part of policy makers, building regulators, designers and developers. Among the bottom four, fire safety is the most important attribute that need urgent attention. Given the multitenant nature of hostels, the absence of fire safety measures endangers the lives and property of the residents; and puts the developers' investments at very high risk.

PRACTICAL IMPLICATIONS

The overall fairly adequacy index for the hostels show that there is more room for improvement in the design, construction and operation of hostel facilities in the study area. The Wa Municipal Assembly (WMA), the local authority in-charge of development, must enforce the national building codes regulating the design and construction of such facilities. The Ghana National Fire Service (GNFS) must first educate the operators of these facilities on fire safety measures and then enforce the fire safety requirements for such facilities. Both present and prospective hostel investors must endeavour to provide reading rooms, at least, in their facilities. These would not only help the students but would make such facilities more competitive in attracting students. The UDS, WMA and Government must facilitate and ensure the enactment and enforcement of regulations for the operation of these facilities. Such regulations must include, among others, a standard for room occupancy with respect to the total floor area. In addition, the regulations must provide for some basic external facilities required for the health, safety and the convenience of these vulnerable students.
CONCLUSION

The qualitative adequacy of five (5) purpose-built hostels has been assessed in Wa. The users of these facilities mainly found them fairly adequate. This is deemed unsatisfactory given that these are modern facilities. A number of these facilities keep springing up making the hostel market in the study area more competitive. It is therefore very imperative for both existing and prospective investors to feed their facilities or designs with lessons from POEs for stronger adequacy index to make their facilities more competitive in order to also stand the test of time. In the quest to respond to the growing demand for such spaces to meet the exponential growth in student numbers, it is also important for private investors to know that the quality of such facilities is more important than the quantity in the market. Technological advancement in the quality of labour, building materials, design and construction calls for quality in built facilities. There is therefore more room for improvement in the quality of all future projects. Quality is an important consideration as quantity. Therefore, qualitative adequacy of these hostels must equally be of concern to the University management, parents, government and all other stakeholders to ensure the health and safety of these vulnerable students in the pursuit of knowledge.

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REMEDIALLY APPROACH OF SECURING LAND-TITLE AND DEVELOPMENT PERMIT: CASE STUDY OF THE OGUN STATE HOME-OWNER CHARTER PROGRAMME

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Common knowledge assumes that most occupied residential property developed in Nigeria urban centres are faced with lack of or improper land-title and physical development documentation. This can also be said to have come with the problem of authenticity and acceptability of population census data. Consequent upon these and in the realization of likely loss of significant revenue accruable therefrom and perhaps because of the emerging sporadic yearning and aspiration of most property owners to have their respective properties properly and statutorily documented for one reason or the other, such as, for record purpose or for financial obligations or both, the government of Ogun State, Nigeria came up with a programme tagged "Home-Owner Charter (HOC) 2013". The programme provides window of opportunity for home-owners or property developers in respect of residential buildings for securing statutory land-title and development permit, with concession/waiver on some usual pre-requisites and financial obligations. The HOC is to stimulate voluntary compliance with the physical development requirements by homeowners for generating appropriate population data and improving upon the internally generated revenue base for developmental project planning and implementation. This paper therefore evaluated the level of achievement of the Government in this pursuit. Pertinent data were obtained through case study approach and field survey on randomly selected 304 respondents in Ogun state and data therefrom were subjected to descriptive statistical analysis. Findings reveal that Ogun State Government gave priority to revenue generation above other objectives set for the programme; and that the programme is generally not meeting up with the scheduled time for the exercise.

Keywords: compliance, development permits, home-owner charter, land-title, population data, remedial

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INTRODUCTION

Land is one of the most important resources available to mankind because all human activities take place on it. It is a factor of production as well as, factor of development. It is a wealth of the nation, if appropriately tapped, otherwise it remain a dead capital (Ukaejiofo, 2009). An official record of who owns a piece of land is simply termed land title. Land titling is the process of providing enforceable legal and secured rights to the possession and use of a given portion of land. Universally, land titling is a central concern, catalyst for national development and meaningful land reform programme.

Nigeria as a nation, is endowed with a vast land resource which is largely untapped because only 3% of land titling have so far been recorded, thereby retarding its physical development and full economic potential (Ukaejiofo, 2009). Similarly, Eleh, (2009) opined that, if truly land is an asset and a good store of wealth, it means that unleashing its potential and making it convertible to capital will serve to empower the populace and also foster national development. However, the full potentials of land as a factor of production can only be realized with appropriate documentation, titling and registration and human activity can become dynamic and more valuable only with secured or confirmed title. Next to land titling in property development is securing a planning and development permit. A planning permit is an entitlement given by law and as right to developer(s) or owner(s) to make particular use of piece of land owned by statutory right, in a specific manner which a designated area of land is to be developed and within a time limit and expires under specified circumstances. Development permit implies and means a permission to develop any piece of land or building granted by the statutory authority empowered to give such, in accordance to the planning laws and building regulations. This permit/approval must be obtained for new construction, renovations, businesses, and changes of use to existing buildings.

In some urban centres in Nigeria, it is required to have a valid planning or land use permit before applying for a development or building plan permit to construct the building or structure, or to apply for a business license/permit. In Lagos, Abeokuta, and their environs (Nigerian urban centres), requirements for securing development permit include: the Certificate of Occupancy (C of O), and/or Proof of Land ownership, receipts of payment of the prescribed statutory fees, evidence of Tax payment by applicant, sets of Architectural drawings, Structural Drawings and Engineering Services drawings, Original/Sun print copy of Survey Plan or Beacon Sheet among others (Lagos State Ministry of Physical Planning, 2011, Ogun State Urban and Regional Planning Law 2005 and Ogun State Building Planning Regulations 2010).

The statistical knowledge of people’s population is central and fundamental to its developmental plans, as it provides information for effective national planning, equitable governance and planning for the future. Census, i.e. the recording of human numbers using statistical
method is not a new development; it has in the past used for collection, analysing and interpretation of numerical data relating to a certain area of investigation as well as for drawing valid conclusions in situations of uncertainty and variability (Eniayejuni and Agoyi 2011). It also serves as a basis for resource distribution and/or revenue allocations, constituency representation, employment, the siting of industries and social amenities etc. The political and economic development would be easy if reliable population data were available because the absence of trustworthy or accurate population data directly affects the government’s inability to ensure balanced political representation and equal access to important governmental resources. Thus, when a society does not know the proportion and the total number of its citizens, its planning process is likely to be haphazard, difficult and ineffective.

Statistical records available in Ogun State, Nigeria indicates that many residential structures in the state are built illegally on both the Government and private parcel of land without building plan or development permit. Most of the buildings have no title documents on them because they do not possess C of O, probably due to the perceived high processing cost. Asides, majority of building owners have encroached on Government acquired lands without appropriate legal documentation from Government. In most situations it has been observed that population census was a subject of manipulation, ineffectiveness and falsification of figures (Eniayejuni and Agoyi 2011). The Ogun State Government has also noted this as a problem in the state. In solving these identified problems of land documentation, lack of planning and development permit, as well as, unreliable population data for proper planning, Government of the State came up with HOC programme. It is against this backdrop that the paper sets to study the level of achievements of Ogun State Government in line with its stated objectives for the HOC programme. Therefore the paper has been structured into seven sections, viz; introduction, the study area and the HOC programme, literature review, methodology, findings, discussions inferences and conclusion.

THE STUDY AREA AND HOME OWNERS CHARTER (HOC)

Ogun state otherwise called the Gateway State is one of the 36 states that make up the federal republic of Nigeria (figures 1 and 2 refer). It covers a land area of about 16,409.26km, made up of 10 zonal land areas, with 20 local government areas, 3 senatorial districts, 4 ethnic zones (Egba, Yewa, Ijebu and Remo) and having population of 3.751million comprising 49.71% male and 50.29% female see table 1. Ogun State is bounded in the west by the Republic of Benin, on the south by Lagos State and the Atlantic Ocean, on the east by Ondo State and in the north by Oyo State. Abeokuta is the capital and largest city in the state. Internally, the state is geographically adjacent to Lagos State hence it provides road and rail links, connecting Lagos with the rest of the country. Ogun State has the highest number of
registered universities in Nigeria (nine in all) Ogun state is one of Africa’s largest industrial centres, with significant industrial capacity for (especially medium and large scale), wholesale, retail, and financial activities. Ogun State's Gross State Product (GSP) was N128.92 Billion in 2008, accounting for 0.56 percent of Nigeria’s GDP. It is 100 percent Non-Oil, dominated by wholesale and retail trade, real estate and road transport, which jointly account for 60 percent of its GSP. Trading, Real Estate and Road transportation are predominant economic activities in Ogun State. Each of these generates about N25 billion worth of economic output annually to individually contribute about 20 percent of Ogun’s economic output and jointly account for about 60 percent of its GSP (Ogun State Website).

![Map of Nigeria Showing its 36 States](www.un.org/depts/cartographic/map/profile/Nigeria.pdf#page=1&zoom=auto,-270,612)

According to Ogun State Ministry of Urban and Physical Planning, the GIS Satellite mapping of the State revealed that there are significant numbers of unrecorded properties and thousands of houses in the state that have no building plan approval, certificate of occupancy and other title documents. This according to the Government is attributable to the perceived high cost of securing title to land and planning permit for development. This has made majority of property owners to avoid the payment of related property taxes and Government is therefore losing substantial sum from property related taxes. There is also lack of data in the areas of education, health and other essential infrastructures to guide Government in the provision of medium-term planning for provision of roads, schools, hospitals and other essential services. The population data released in 2006 by National Population Census in table 1 still remain a subject of doubt by the state Government and the people. This has negative impact on the effective planning of facilities in the state.
Table 1: The Population Structure of Ogun State by Local Governments

<table>
<thead>
<tr>
<th>Local Government</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abeokuta North</td>
<td>96,463</td>
<td>102,330</td>
<td>198,793</td>
</tr>
<tr>
<td>Abeokuta South</td>
<td>119,977</td>
<td>130,318</td>
<td>250,295</td>
</tr>
<tr>
<td>Ado- Odo/Ota</td>
<td>261,523</td>
<td>265,719</td>
<td>527,242</td>
</tr>
<tr>
<td>Egbado North</td>
<td>89,880</td>
<td>93,964</td>
<td>183,844</td>
</tr>
<tr>
<td>Egbado South</td>
<td>81,666</td>
<td>86,670</td>
<td>168,336</td>
</tr>
<tr>
<td>Ewekoro</td>
<td>28,212</td>
<td>26,881</td>
<td>55,093</td>
</tr>
<tr>
<td>Ifo</td>
<td>269,206</td>
<td>269,964</td>
<td>539,170</td>
</tr>
<tr>
<td>Ijebu East</td>
<td>56,981</td>
<td>52,340</td>
<td>109,321</td>
</tr>
<tr>
<td>Ijebu North</td>
<td>141,074</td>
<td>139,446</td>
<td>280,520</td>
</tr>
<tr>
<td>Ijebu North East</td>
<td>34,581</td>
<td>34,219</td>
<td>68,800</td>
</tr>
<tr>
<td>Ijebu Ode</td>
<td>76,466</td>
<td>80,695</td>
<td>157,161</td>
</tr>
<tr>
<td>Ikenne</td>
<td>60,607</td>
<td>58,510</td>
<td>119,117</td>
</tr>
<tr>
<td>Imeko Afon</td>
<td>41,850</td>
<td>41,102</td>
<td>82,952</td>
</tr>
<tr>
<td>Ipokia</td>
<td>74,649</td>
<td>75,738</td>
<td>150,387</td>
</tr>
<tr>
<td>Obaifemi- Owode</td>
<td>118,574</td>
<td>116,497</td>
<td>235,071</td>
</tr>
<tr>
<td>Odeda</td>
<td>55,200</td>
<td>54,322</td>
<td>109,522</td>
</tr>
<tr>
<td>Odogbolu</td>
<td>63,838</td>
<td>61,819</td>
<td>125,657</td>
</tr>
<tr>
<td>Ogun Waterside</td>
<td>37,412</td>
<td>36,810</td>
<td>74,222</td>
</tr>
<tr>
<td>Remo North</td>
<td>29,893</td>
<td>29,859</td>
<td>59,752</td>
</tr>
<tr>
<td>Sagamu</td>
<td>126,855</td>
<td>129,030</td>
<td>255,885</td>
</tr>
<tr>
<td>Total</td>
<td>1,864,907</td>
<td>1,886,233</td>
<td>3,751,140</td>
</tr>
</tbody>
</table>

Source: National Population Commission, 2006 National Census

Government’s urban renewal policy forming an integral part of the government’s mission to rebuild the state was seen by the Government to be un-achievable without reliable data. The state was also characterized by disputes of ownership of properties, while property related fraud and problems of land speculators have been noted to be rampant, which often manifest in the form of encroachment on land under Government acquisition and low value of the land-property in the State property market. In realising these, the Ogun State Government, on Monday, December 16, 2013, launched the “Home Owners Charter” (HOC) - a programme designed to enable property owners in the State to regularise their land and landed-property documents. Owners of properties who built without government approval/permit would not only have the opportunity to regularise its legal status and title documentation, but also obtain development (building) plan approval/permit and Certificate of Occupancy (C of O) at a huge discounted rate. Apart from being an integral part of the government’s mission to rebuild the State, the scheme will also provide data for the medium-term planning for provision of roads, schools,
hospitals and other essential services. In addition to this, the scheme will be extended to the owners of properties who built on land belonging to the State government. It is expected to unlock the latent potentials of property owners at creating wealth and enhancing the development of Ogun State’s housing market. It will perhaps, help to minimise disputes of ownership of properties while property related fraud and problems of land speculators will be reduced to the barest minimum. The scheme will ensure the waiver of all penalties and fines that are normally levied against those who build houses without permit or approval.

Figure 2: Map of Ogun State, Nigeria showing its 20 Local Government Areas. (Source: Ogun State Government Economic Plan Development ‘Mission to Rebuild’ 2012-2015)

Plate 1: HOC Programme Awareness Poster (HOC website 2014)
The HOC Programme relaxes the documentation requirements and fees are discounted so that many residents, especially those who would otherwise not be able to afford it, could benefit from the programme. Interested property owner are expected to make an initial deposit of N5, 000.00 and then submit documents that can be used to establish ownership of the property. These documents include land purchase agreements, deed of gift or sub-lease, receipts of payment of the prescribed fees and survey plan. To qualify for consideration under this programme, such property must be a functional and fully occupied/inhabited residential house on a plot or maximum of two plots of land. Building structures uninhabited and under construction at a level not beyond lintel are not eligible for consideration under this charter. Properties that are built under Power Holding Company of Nigeria (PHCN) high tension cables, those on Right-of-ways, on the ‘set-back’ of roads, and those on petroleum or gas pipelines, water ways, flood plain, gullies and areas those on government committed acquisitions are excluded under this charter. Other structures excluded are substandard or defective property and property under to legal dispute etc. Communities expected to benefit from the initiative under this phase of consideration are Abeokuta, Ijebu-Ode, Shagamu, Sango-Ota, Magboro, Ifo, Ogijo, Ojodu, Alagbole, Ado-Odo, Oke-Odan, Akute, Agbado, Agbara, and Ijoko-ota. The HOC programme provides simplified payment plan by allowing applicant’s instalment payment and facilitated payment through bank loans with re-payment plan not exceeding two-year tenure. The final cost payable by the applicant depends on property size and the area in which the property is located. A typical family bungalow (four-bedroom bungalow on a single plot of land) attracts a discounted sum of N95, 000.00 instead of the normal fees of N430, 000.00 and the maximum processing (moratorium) period of 9 months. The government agencies concerned with the HOC programme are the Ministry of Urban and Physical Planning, Ministry of Justice, Ministry of Finance and Bureau of Lands and Surveys.

LITERATURE REVIEW

Land titling is a policy intervention to recognize rights on land; to guarantee ownership of rights and recorded interests; to monitor and improve land market. It also provides support for government towards revenue drive through property taxation, as well as, encourage physical and economic development. The goals of ideal land policy according to Eleh (2009) are to confer title on the land owners and empower them economically. It creates a secured land registry system and helps to establish efficient, fast land transfer and administration system that will foster market fluidity, equitable distribution of land resources. It facilitates the development of land information systems and creation of database of addresses that could be used in the service and collection of bills in respect of levies, tenement rates, crime control etc. It therefore suggests that, land titling activities focuses on the improvement on land tenure security and the attendant promotion of its economic use. It
involves analysis of the existing legal framework of land administration, property adjudication and registration, mapping and land surveying as well as, the formalization of informal property rights. It is perhaps in this stead that Atilola (2013), posits that, the major objective of the land reform is to transform Nigeria into a land market economy by issuing land titles to all land owners especially the rural dwellers who cannot use their asset land to raise capital because they do not have titles. The pivot of the land reform agenda is the systematic land titling and registration of all land parcels in Nigeria with a view to creating a land market economy, towards empowering the owners whose land asset is currently locked up as “dead capital” due to lack of relevant titles. However, the need to involve relevant professionals and the adoption of best practices in the implementation of the land titling is underscored. Emerging Markets Group (2009) advocates that, land tenure regularization has generally failed where methodologies have not sufficiently taken into consideration the local reality of informal settlements and the importance of community-based dispute resolution and planning. It was further revealed that successful tenure formalization is directly linked with the upgrading of informal settlements and requires the participation of all stakeholders – the community residents, the public, and the government – in resolving disputes and formalizing settlements. Part of Government control over the use of land is by controlling the development on the land and curtail the excesses of people on the use of their land. Planning laws are meant to control the excesses of people concerning the use of land and the general environment and Government has a duty to enforcing these planning laws (Omole and Akinbamijo 2012). Part 2 Sections, 28-34 of Nigerian Urban and Regional Planning Law, (NURPL) Decree No. 88 of December 15, 1992 also made it clear that approval should be sought before any development can be carried out on land. The law makes it mandatory for Government and its agencies to obtain approval before commencing any development and planning bodies the power to approve with amendment, or delay approval of an application, or if circumstances so required, reject development permit completely. Section 60 provided that where a developer contravenes the provision of a planning law, the control department shall have the power requiring the developer to: (a) prepare and submit his building plan for approval or (b) to carry out such alteration to a building as may be necessary to ensure compliance or (c) to pull down the building or (d) to reinstate the piece of land to the state in which it was prior to the commencement of building. The HOC programme waived all these provisions/requirements in respect of the pre-conditions for granting planning and development permits. In the Afghanistan’s experience, an estimated 5.5 million Afghan citizens live in urban informal settlements throughout Afghanistan. These settlements do not conform to existing master plans and do not meet the formal requirements for access to land. The Kabul Master Plan of 1978 is over 30 years out of date and does not account for the recent population boom in returning refugees. Basic services such as power, sanitation, and potable water are either not provided or are insufficient. The government’s response historically has
been inadequate in terms of upgrading physical infrastructure and improving tenure security for the residents of informal settlements. USAID/LTERA has piloted tenure formalization methodologies in Kabul (Districts 6, 7 and 13), Kunduz, Taloqan and Mazar-i-Sharif to address tenure insecurity in informal settlements through an incremental, community-based methodology of upgrading and tenure regularization. The teams have developed a replicable and cost-effective process that integrates the upgrading of basic services with the regularization of tenure and formalization of informal settlements into the municipalities’ urban planning processes.

The project identified gaps in the legal framework affecting tenure regularization and provided advice to the Islamic Republic of Afghanistan to improve its urban land administration system. With the aid of reported judgements particularly in reference to judgement in Walker v. Burton 2012, Dixon (2013) analyse whether title to land is secure in England and Wales when registered under the Land Registration Act 2002, most especially when a title is registered without the proprietor being able to establish good title under pre-registration rules of property law, to discover an uncertainty at the heart of the registration system: the uncertainty as to the extent to which a registered title may be rectified to remove the proprietor. This is acute when it appears that the registered proprietor has no claim to the land other than by reason of his registration. There may be a difference in this regard between intangible property titles and tangible titles. The Land Registration Act 2002 is meant to replace registration of title with title by registration. The real force of this is only now being realised and there are few reported judgements, and less consistency, working out what this means in practice. Towards the same direction, Van Rij and Altes (2014) reviewed the rescaling of integrated planning policies for the built environment by the transposition of European directives on air quality in The Netherlands, examining European and Dutch policies, legislation, case law and reports by various Dutch Courts of Auditors and assessment agencies. They found combination of measures that prohibit practices and measures constituting new ways of working has facilitated environmental protection and integrated planning. The findings of this study of Dutch air quality regulation may contribute to other studies into the rescaling of environmental governance in relation to interactions between central norm-setting and integrated local policies. The paper of Lusiani and Zan (2013) aims at advancing knowledge about the variety of uses and meanings of planning tools and practices in the cultural heritage field, by bridging disciplines and by building on evidence from the studies to reflect that in the fields of both management and urban studies, a similar trajectory of “rise and fall” of rationalistic views of planning has taken place. Today’s discourse of planning in urban studies is strongly dominated by the issue of inclusiveness and participation. When looking at “who” really participates in these processes, it is clear that a vast array of public and private actors is involved, at least formally. When looking at “how” they are involved, a variety of possible approaches to participative
planning are in use, from more formal, to more informal and emergent ones. Whether these participative forms of planning in cultural heritage actually “work” remains in part an open question. Despite the increasing centrality of plans and planning in cultural heritage management, an investigation about the state-of-the-art of the debate on planning in this field and an exploration of how planning is done in practice are missing.

RESEARCH METHOD

Experimental research design may be impractical for social survey of this kind, because of variety in human behaviour; hence survey research design was adopted through the use of questionnaire which was administered through cross sectional survey. In this study, the target population is all applicants for the HOC programme from where the sample of 400 was chosen and the sampling technique adopted was simple random technique. The questionnaire was semi-structured questions to test the view of the respondents. Nominal and ordinal data types were collected therefrom. The questionnaires were administered through cross sectional survey. 400 Questionnaires were prepared and distributed to the participating home owners, out of which 304 were successfully administered representing 76% response rate. Data gathered from structured questionnaires were analysed and descriptively presented in tables and table’s interpretation. Also, survey of literature on the subject matter was fully explored through journals, textbooks and internet.

THE FINDINGS

The findings reveals that a total of 199,980 applications were submitted for processing; and that as at the end of January 2015, only 3850 certificate of occupancy have so far been issued to the applicants. It is confirmed that each and every applicant must have paid N15, 000.00, which comprises of N5000.00 for the application form and N10, 000.00 as initial assessment deposit. This amount is however deductible from the final assessment payable by the applicant. The payment options in this regard are:

Option one – 100% 9 months interest –free payment option for schedule instalment periods effective from the date on notice of assessment i.e. 40% of assessment payable in the first 4 months and remaining 60% payable before the remaining 5 months

Option two -For payment within 30 days of issue of the assessment a rebate of 5% of assessed value that is to say the applicant that wish to pay within 30 days of assessment date will only pay 95% of the assessed value.

Option three – For payment within 90 days of issue of the assessment a rebate of 2.5% of assessed value that is to say the applicant that wish to pay within 90 days of assessment date will only pay 97.5% of the assessed value.
There are 3 revenue codes, account names and payment plans for the programme and each of the accounts were operated in a sequential form. HOC registration form, HOC deposit on assessment and HOC final assessed value account. The detail of assessment of HOC program has indicated that as against the 100% usual charges, 92.7% was charged for building plan approval, 66.67% was charged for survey plan, 55.56% was charged for stamp duty and 30% was charged for certificate of occupancy. All the charges amount to 22.09% and having a rebate of 77.91% as indicated in table 2.

**Table 2: Details of Assessment Charges and Rebate for HOC**

<table>
<thead>
<tr>
<th>Charge Type</th>
<th>Normal charge</th>
<th>HOC Charge</th>
<th>Rebate Receivable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Plan Approval</td>
<td>100%</td>
<td>92.73%</td>
<td>7.27%</td>
</tr>
<tr>
<td>Survey Plan</td>
<td>100%</td>
<td>66.67%</td>
<td>33.33%</td>
</tr>
<tr>
<td>Stamp Duty</td>
<td>100%</td>
<td>55.56%</td>
<td>44.44%</td>
</tr>
<tr>
<td>Certificate Of Occupancy</td>
<td>100%</td>
<td>30.00%</td>
<td>70.00%</td>
</tr>
<tr>
<td>Total Charge</td>
<td>100%</td>
<td>22.09%</td>
<td>77.91%</td>
</tr>
</tbody>
</table>


For ratification of Government land, it was found out that 1/3 market price was expected to be paid as purchase price to the Government, indicating 66.67% HOC rebate. For the purpose of gathering population data for the state, the questions in the HOC application form was divided into 3 sections:

**Section A** was about the **owner of the property** (title, surname, other names, date of birth and gender, religion, GSM number, email, occupation, name of employer and address of employer).

**Section B** was about the **property itself** (date of construction, area of land, building type, number of property occupiers and their details, mode of acquisition of the property and attached documents with the property).

**Section C** was about the **residents of the property** (title, surname, other names, date of birth and gender, religion, gsm number, email, occupation, name of employer and address of employer).

All these information are expected to be supplied by the applicants of HOC programme. 233 (76.64%) of the respondents attribute their reason for not documenting the land title to affordability problem, but 28 (9.21%) respondents who can afford it thought it was not necessary. 29 respondents representing 9.54% were of the view that it requires long processing period, while the remaining 4 respondents representing 1.31% believed that since they don’t have land title problem, then there was no need for them to document anything about the land title. Majority of the respondents are aware of the importance of development permit before construction as revealed by 259 respondents representing 85.19%, 38
respondents representing 12.51% were not aware of the importance of development permit. 7 (2.30%) were undecided on this question.

It was revealed that the reason why 241 respondents representing 79.27% were unable to obtain the development permit was because they could not afford it, while 13 representing 4.27% considered it not necessary. 48 (15.79%) were of view that it is a waste of money and resources, while 2 respondents representing 0.65% responded that their property location is not noticed by town planning officers. 232 respondents representing 76.32% are not having development permit before constructing their property. 69 respondents (22.70%) secured development permit before they constructed their property, while 3 (0.98%) were undecided on whether they secured or not secured development permit on their properties. The reasons were given on why respondents apply for HOC programme in respect of their properties. 209 respondents (68.75%) were of the belief that HOC is affordable. 29 respondents representing 9.54% apply for HOC to secure their property against possible title problem. 11 respondents (3.62%) apply to secure certificate of occupancy as collateral security in bank, while 55 respondents representing 18.09% apply for the HOC programme to enhance the property value.

185 of the respondents representing 60.85% have received the HOC assessment notice and paid fully. However, 52 respondents (17.11%) have received their assessment notice, but prefer to pay in instalments, while 31 respondents representing 10.20% have not yet pay any of the assessment fee. 36 (11.84%) have not yet received assessment notice from the Government agency in charge. 32 of the respondents representing 10.53% prefer payment option one, 185(60.85%) prefer payment option two, 20 representing 6.58% prefer payment option three while 67 respondents representing 22.04% were undecided on this question. It was also revealed that 271 of the respondents representing 89.14% confirmed that population related data were filled in their HOC application form, while 14 representing 4.61% responded that they did not fill in population related data in their HOC application form.

However 19 of them representing 6.25% were undecided on this question. Only 9 of the respondents representing 2.96% have so far received the certificate of occupancy and/or development permit on their properties under the HOC programme. 293 representing 96.38% are yet to receive theirs, while 2 respondents (0.66%) were undecided on this question. The respondents were further asked to prioritise the objectives stated for the programme in the order of attention given to them by the Government. The ranking of the respondents in table 3 indicates that revenue generation is the major priority of Government in the HOC programme, as it is ranked first by relative importance index. Obtaining Certificate of Occupancy was ranked second, while, the assurance of development permit was ranked third. The fourth in the ranking was for the gathering population data. However, promptness of the Government to the schedule and stipulated time for the programme was ranked the lowest at the fifth position.
**Table 3: Respondents Perception about HOC level of achievement by Ranking**

<table>
<thead>
<tr>
<th>Respondents' perception Relative Importance Index</th>
<th>Very High (5)</th>
<th>High (4)</th>
<th>Average (3)</th>
<th>Low (2)</th>
<th>Very Low (1)</th>
<th>Sum of Weighted</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>About HOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOC assures development</td>
<td>5(25)</td>
<td>17(68)</td>
<td>188(564)</td>
<td>51(102)</td>
<td>43(43)</td>
<td>802</td>
<td>2.64</td>
</tr>
<tr>
<td>3rd permit/approval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOC is a means of Generating revenue For Government</td>
<td>289(1445)</td>
<td>9(36)</td>
<td>4(12)</td>
<td>2(4)</td>
<td>0(0)</td>
<td>1497</td>
<td>4.92</td>
</tr>
<tr>
<td>1st</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOC is a means of Gathering population Data by Government</td>
<td>13(65)</td>
<td>6(24)</td>
<td>19(57)</td>
<td>85(170)</td>
<td>181(181)</td>
<td>497</td>
<td>1.63</td>
</tr>
<tr>
<td>4th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOC is prompt to the Schedule/Stipulated time</td>
<td>1(5)</td>
<td>17(68)</td>
<td>28(84)</td>
<td>17(34)</td>
<td>241(241)</td>
<td>432</td>
<td>1.42</td>
</tr>
<tr>
<td>5th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOC is a means of getting Certificate of Occupancy</td>
<td>197(985)</td>
<td>66(264)</td>
<td>21(63)</td>
<td>15(30)</td>
<td>5(5)</td>
<td>1347</td>
<td>4.43</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Majority of the respondents are aware of the importance of documenting their land title and securing development permit on their properties before constructing them, but they are unable to do so because of their affordability problem then. Consequently, they now elected to apply for it under the HOC programme, as they found it affordable through that. They therefore paid their assessment fee in full once the assessment notice was issued to them. Those who could not pay in full prefer payment in instalments. In spite of people eagerness and responses to meeting their financial obligations, only 2.96% of them have been issued the C of C. and/or development permit as at the time of preparing this reporting.

In term of priority, Government’s most paramount priority in the order of objectives of the programme was noted to be on the revenue generation. This opinion has also been strengthened by the extension in the duration of HOC programme, which was initially scheduled for only nine (9) months period (April - December 2014). The duration for the window of grace appears to have become open-ended, because as at 31st January 2015, submission of completed application forms for consideration under the charter is still being collected with the concomitant revenue gains from the sales of about 199,980 application forms and the payment of initial deposit at N15,000.00/application. This translates into about N999,900,000,000.00 as proceed from the sales of application forms and N1,999,800,000.00 as deposit for assessment, excluding possible revenue from
the payments of a minimum of 80,000.00/application as assessment fees and other sources such as subsequent annual ground rent, fees for consent to transfer, mortgage, sublease, capital gain tax and levies, etc. all of these, has implications on the property market to the benefit of the Government.

It is noted that the initially stipulated time of 9 months was not realised due to logistic and other competing responsibilities by the civil servants saddled with the implementation of the programme. In realisation of this challenge, complementary services of 13 experienced and competent professional firms in the built environment were engaged as consultants for efficient and effective delivery. However, only 3,850 out of about 199,980 applicants representing 1.92% have so far been issued and received the Certificate of Occupancy, for over a period of ten (10) months, under the HOC Programme. Obtaining development permit under HOC is not applicable to all applicants but those who do not have prior development permit or approval. They are expected to submit the completed prescribed application form alongside with the sets of architectural and related engineering drawings, copy of survey plan, evidence of payment of prescribed discounted fees, upon which a decision on the approval or otherwise shall be made accordingly. On the objective of gathering population data for planning is seen to be a skeletal, because information that can possibly be gathered from the application form is only related to those who applied for the HOC programme, whereas, there are several other people whose data were not collected or captured. The percentage of the HOC applicants to that of the total residents’ population cannot give adequate information required for planning purposes for a whole State. From the interview session with the applicants, the fear of the people especially those who are waiting to be issued with the certificate of occupancy was that the programme may be truncated, whenever there is a change in government.

**INFERENCES FROM HOC PROGRAMME**

The benefits of the HOC programme mostly serve the Government, the property owners and property market. It is a viable source of revenue for the Government, especially from property owners’ default of property taxes to the previous administrations in the State. It is a means of accumulating the wealth missed by the previous Government administrations in the State. It provides platform for enhancing property value, where property owners will have their properties becoming more marketable and buyers can confidently buy when they know that title documentation is available. Property with correct legal status and documents can be used as collateral for bank loans and other business transactions. It helps in the control of disputes over ownership especially in the event of death of the original owner and the consequence of such in respect of heirs and inheritance issues. It helps in solving or reducing incidents of property related fraud, speculations and land grabbing. HOC programme stimulates voluntary
compliance with the physical development requirements by homeowners for generating appropriate population data and improving upon the internally generated revenue base for developmental project planning and implementation. The shortcomings arising from the programme are that, it provided an alibi or opportunity for people to abuse or *gate-crash* the process through manipulation of the property development and related documents to fall within the stipulated time of the programme and thus, encouraging mushroom development across the State. It also encourages pre-mature inhabitation of uncompleted buildings by people, in an attempt to surreptitiously meet up with one of the pre-requisites. There is a fear of the people that, the current elected Government is only raising revenue to finance its political campaign for second term re-election bid.

![Figure 3: The revenue generation by Ogun State (source: Ogun State official website)](image)

**CONCLUSION**

It is deemed to be normal in land documentation and property development to acquire land with good documentation and also secure planning and other development permit before embarking on building construction. When this is not done at their appropriate time any attempt to do them later is a remedial measure. Ogun state Government recognising that majority of home owners in the state have defaulted in taking this step attempted to remedy in favour of the concerned home owners, but the objectives were not fully achieved, although revenue generation was not indicated as one of the objectives of HOC programme, but this was given priority over the other vital stated objectives. By the HOC programme the Government was able to create a considerable revenue share from property market in primary form and secondary form and this is line with the state Government economic plan of ‘enhancing Internally Generated Revenue (IGR) by movement of the large informal
sector of the economy into structured trade groups to enable taxation’ Ogun State Government economic plan (n.d). By this revenue generation from HOC programme, it is expected that the IGR of Ogun state will substantially increase upward from N16.1 billion (29%) indicated in Fig.3

REFERENCES


Lagos State Ministry of Physical Planning (2011) Requirements for the grant of Planning Permit in Lagos June 2011


## APPENDICES: QUESTIONNAIRE ANALYSES TABLES

### Respondents’ reasons for not documenting the land

<table>
<thead>
<tr>
<th>Why have you not documented your title before the HOC Programme?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I cannot afford it because i have no fund to finance it</td>
<td>233</td>
<td>76.64</td>
</tr>
<tr>
<td>I can afford it but i don’t think it is necessary</td>
<td>28</td>
<td>9.21</td>
</tr>
<tr>
<td>It requires long period to process</td>
<td>29</td>
<td>9.54</td>
</tr>
<tr>
<td>I don’t have title problem with my land then</td>
<td>4</td>
<td>1.31</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Respondents’ awareness about importance of obtaining planning permit

<table>
<thead>
<tr>
<th>Are you aware of the importance of obtaining Development permit before the HOC programme?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>259</td>
<td>85.19</td>
</tr>
<tr>
<td>No</td>
<td>38</td>
<td>12.51</td>
</tr>
<tr>
<td>Undecided</td>
<td>7</td>
<td>2.30</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Respondents’ reasons for not obtaining planning permit

<table>
<thead>
<tr>
<th>Why have you not obtain Development permit before the HOC Programme?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I cannot afford it because I have no fund to finance it</td>
<td>241</td>
<td>79.27</td>
</tr>
<tr>
<td>I can afford it but i don’t think it is necessary</td>
<td>13</td>
<td>4.27</td>
</tr>
<tr>
<td>It is a waste of money/resources</td>
<td>48</td>
<td>15.79</td>
</tr>
<tr>
<td>My property location is noticed by Town Planning Officers</td>
<td>2</td>
<td>0.65</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Respondents has Development permit on the property

<table>
<thead>
<tr>
<th>Are you having Development permit on your property before the HOC programme?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>69</td>
<td>22.70</td>
</tr>
<tr>
<td>No</td>
<td>232</td>
<td>76.32</td>
</tr>
<tr>
<td>Undecided</td>
<td>3</td>
<td>0.98</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>
### Respondents’ reasons for applying for HOC programme

<table>
<thead>
<tr>
<th>Why do you apply for the HOC Programme in respect of your property?</th>
<th>Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I discovered that it affordable</td>
<td>209</td>
<td>68.75</td>
</tr>
<tr>
<td>I have title problem to solve and need to secure title to my land</td>
<td>29</td>
<td>9.54</td>
</tr>
<tr>
<td>I need certificate of occupancy on my property to take loan from bank</td>
<td>11</td>
<td>3.62</td>
</tr>
<tr>
<td>I want to enhance the value of my property</td>
<td>55</td>
<td>18.09</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Has the respondents paid the HOC final assessment fee?

<table>
<thead>
<tr>
<th>Have you paid the HOC final assessment fee on your property?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have paid in full</td>
<td>185</td>
<td>60.85</td>
</tr>
<tr>
<td>I am paying in instalments</td>
<td>52</td>
<td>17.11</td>
</tr>
<tr>
<td>I have not paid any final assessment</td>
<td>31</td>
<td>10.20</td>
</tr>
<tr>
<td>I am ready to pay but i have not yet being given assessment notice</td>
<td>36</td>
<td>11.84</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Which of the options of payment do you subscribe to?

<table>
<thead>
<tr>
<th>Which of the payment options do you adopt for your assessment fee?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option one</td>
<td>32</td>
<td>10.53</td>
</tr>
<tr>
<td>Option two</td>
<td>185</td>
<td>60.85</td>
</tr>
<tr>
<td>Option three</td>
<td>20</td>
<td>6.58</td>
</tr>
<tr>
<td>Undecided</td>
<td>67</td>
<td>22.04</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>

### Do you fill any data relating to population in your application form?

<table>
<thead>
<tr>
<th>Do you fill any population related data in the HOC application form?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>271</td>
<td>89.14</td>
</tr>
<tr>
<td>No</td>
<td>14</td>
<td>4.61</td>
</tr>
<tr>
<td>Undecided</td>
<td>19</td>
<td>6.25</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>
Have you now been issued certificate of occupancy and or planning permit?

<table>
<thead>
<tr>
<th>Have you now been issued certificate of occupancy and or Development permit?</th>
<th>Response Frequency</th>
<th>Percentage of Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>2.96</td>
</tr>
<tr>
<td>No</td>
<td>293</td>
<td>96.38</td>
</tr>
<tr>
<td>Undecided</td>
<td>2</td>
<td>0.66</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>100</td>
</tr>
</tbody>
</table>
ROLE OF BUILT ENVIRONMENT PROFESSIONALS IN ACHIEVING SUSTAINABLE BUILT ENVIRONMENT

Dahiru Dauda¹, AbdulAzeez Abubakar Darda’u² and Bala Kabir³
Department of Building, Ahmadu Bello University, Zaria, Nigeria

Construction industry across the globe is making concerted effort to mitigate the negative side effects of its activities. This paper examines the role of Built Environment, BE, professionals in the attainment of sustainable built environment in the West African sub-region. Through wide review of literature such as publications, research works, on line materials, etc. The concepts of sustainability and sustainable development were discussed. This was followed by an exposition on sustainable construction and challenges faced by the BE, professionals due to the influence of technological development. The role of BE, professionals in achieving sustainability in design, construction and operation of building were examined. In addition, their function towards the creation of an enabling environment for the sustainable construction practice was discussed. Also, close study of the effort made by the BE professionals in West Africa, reveal that very little effort was made towards achieving sustainability. This is particularly true, when such effort is compared with that of the developed nations. It was concluded that the BE, professionals can only avoid putting themselves in disadvantaged position if they make concerted effort to put themselves and the industry at par with their counterparts across the globe – in terms of training, skills, exposure, etc. taking responsibility for the negative side effects of their activities on the environment as well as the creation of sustainable built environment. Part of the recommendation made are: BE, Professionals should make sincere effort to improve themselves, Government policy that will assist construction firms to be at same level with their counterparts across the globe should be put in place and close collaboration among the BE professionals in the West African sub-region should be encouraged.

Keywords: built environment, built environment professional, sustainability, sustainable construction, West Africa

INTRODUCTION

Construction industry is the heart of economy of any nation. It is one of the biggest industries in the world; constituting around one – tenth of the

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gross domestic product, GDP, (Pearce et al, 2012). According to Russel et al. (2007), construction industry accounts for more than 12% of the GDP in the United States of America. Besides that, it is a significant employment generator and it provides work to almost 7% of the total employed population globally (Pearce et al 2013). It acts as vehicle for the realization of the necessary infrastructural facilities that enhances productivity and human prosperity. The flexibility, mobility and effectiveness of the workforce and the productivity of firms, depends on the availability of approximately configured and located house and premises – all these are provided by the construction industry (SSC 2008). The development projects provided by the industry, ranges from the homes we live in, to the highway we drive on, rail, the power plants that provide energy for our daily activities life, other infrastructures like harbours and sea defences and host of other very important developmental projects that meet human needs and realize the aspiration of nations.

However, the provision of these facilities, consumes large amount of natural non-renewable resources. According to Sev (2009) in Windapo and Omeife (2012) building consume around 50% of the materials and resources entering the global economy, representing 6 billion tons of industrial raw materials each year. They account for one-fourth of the world's wood harvest, two-fifths of its material and energy usage and one-sixth of its fresh water usage (Bokinni 2008). Besides, 45% of energy generated is used to power and maintain buildings and 5% to construct them. This leads to serious side effects. For instance 50% of all global warming gas emissions are related to buildings Construction industry is also regarded as a polluter of the environment as it emits approximately 50% of the waste generated in the world. Harman and Benjamin (2004) in Dania et al (2007) noted that building industry is responsible for some of the most serious local and global environmental changes. According Pearce et al (2012) Construction activities including the construction, operation, maintenance and demolition of built facilities are also connected to the broader problems and issues affecting the environment, including global warming, climate change, ozone depletion, soil erosion, desertification, deforestation, eutrophication, acidification, loss of diversity, land pollution, water pollution, air pollution, depletion of fisheries, and consumption of valuable resources such as fossil fuels, minerals and gravels. Besides that, built facilities significantly impact human health, comfort and productivity. Thus it is not surprising that construction activities are responsible for around one third of ecological disasters (Schmidt 2000). That is why Crossely (2002) noted that construction industry is one of the most resource intensive and environmentally damaging industries in the world. That is why Kolawole & Anigbogu (2005) opined that it may seem that one of the friendliest ways to handle the environment is not to build, because building activities will invariably and adversely affect the environment. However, shelter, as one of the basic human needs, is desirable.
Thus humanity faces an overwhelming challenge to reverse these unsustainable trends. Construction industry has a big role to play. According to Halliday (2008) many are trying to move in appropriate direction, but unsustainable building clearly dominates. This brings to mind the role of a BE, professionals. As academically trained specialist, and statutorily registered professionals, responsible for the design, construction and operation/management of the built environment, they have the responsibility of adopting new technologies, processes, products, and systems that guarantee the achievement of sustainable construction. In other words, the BE professionals should ensure that construction is undertaken in an environmentally sound manner. Also, the structure produced should be attentive to the environment as well as meeting the increasingly common social expectation. So that such effort leads to the delivery of buildings/infrastructural facilities that are functional, efficient, joyous and healthy building.

In view of the fact that “ecological interactions do not respect the individual ownership and political jurisdiction,” and that the local nature of human interaction with environment is not confined to local environmental effects (WCED 1987 in Suliman & Abdelnaser, 2009); achieving sustainable built environment requires collaborative effort. The Economic Community of West African States, ECOWAS, as a regional group, need to extend its sphere of influence from the “economic” to “environmental”, hence sustainability.

METHODOLOGY

A wide review of literature from textual materials, like books, journal publications, conference proceedings, on line materials, etc was undertaken; so as to articulate prevailing knowledge on the concept of sustainability, with special emphasis on the roles of BE professionals, effort made by the national and international communities towards the attainment of sustainable built environment. This was followed by an evaluation of the role of BE professionals in achieving sustainable built environment in the West African sub region.

Sustainability and Sustainable Development

Excessive consumption of resources, at rates beyond the ability to regenerate, results to, among others, ecosystem problems, resource depletion and escalating pollution. This has led to the implementation of precautionary approach that emphasizes the need to configure development and mode of exploitation of natural resources. This is in order to maintain balance in the ecosystem, sustain global resource base and to ensure that developmental activities are undertaken within the earth carrying capacity, for the overall benefit of the present and future generation. This justified restraint on ‘inappropriate’ development and a primary driver of improving quality of life for all is referred as sustainable development (Halliday 2008). According to Moles and Kelly (2000) in Makama (2012), currently, there are over 300 published definitions of
sustainable development. While Shah (2007) noted that there are over 500 definitions of sustainability and sustainable development. However, the most widely accepted definition of sustainable is one given by the Brundtland report (1987) which defines sustainable development (SD) as “Development that meets the needs of present generations without compromising the ability of future generations to meet their needs and aspirations” (UN World Commission on Environment and Development, WCED, 1987). Glasson et al (1999) described SD as handing down to future generations not only, “man-made capital”, such as roads, schools and historic buildings, and “human capital”, such as knowledge and skills, but also “natural environmental capital”, such as clean air, fresh water, rain forests, the ozone layer and biological diversity. It is also viewed as the potential for long term maintenance of wellbeing, which has environmental, economic and social dimensions. It is intended as a means of configuring civilization and human activity so that society and its members are able to meet their needs and express their greatest potential in present, while preserving biodiversity and natural ecosystems, and planning and acting for the ability to maintain these ideas indefinitely (Mbamali, 2005).

The concept of sustainability has evolved to reflect perspectives of both the public and private sectors. A public policy perspective would define sustainability as the satisfaction of basic economic, social and security needs now and in the future without undermining the natural resource base and environmental quality on which life depends. However from a business perspective, the goal of sustainability is to increase long term shareholder and social value while decreasing industry’s use of materials and reducing negative impacts on the environment (Magaji 2015). Thus common to both the public and business perspectives, is the recognition of the need to support a growing economy while reducing the social and economic costs of economic growth. The goals of sustainability are to enable all people to meet their basic needs and improve their quality of life, while ensuring that the natural systems, resources and diversity upon which they depend are maintained and enhanced, for both their benefit and that of future generations.

There is no doubt that there are a lot of benefits associated with the attainment of sustainable development. That is why experts have enunciated ways and means of achieving sustainability. Brundtland Report highlighted three important components for sustainable development. These are: environmental protection, social equity and economic growth. Thus sustainable development should reduce environmental problems such as global climate change, depletion of fossil fuel resources, pollution, as well as social development like poverty reduction, equity and well – being. In addition, there should be economic growth and prosperity (WCED, 1987). Shah (2007) was of the view that achieving sustainability entails taking set of actions by the present generations that will not diminish the prospects of future persons to enjoy levels of consumption, wealth, utility, or welfare comparable to those
enjoyed by present persons. Moving towards sustainability is also a social challenge that entails international and national law, urban planning and transport, local and individual lifestyles and ethical consumerism. Ways of living sustainably can take many forms from reorganizing living conditions (e.g., Eco-villages, eco-municipalities and sustainable cities), reappraising economic sectors (permaculture, green building, sustainable agriculture), or work practices (sustainable architecture), using science to develop new technologies (green technologies, renewable energy), to adjustments in individual lifestyles that conserve natural resources (Wikipedia 2014). While Bourdages (1997) in Dahiru and AbdulAzeez (2012) put forward five important factors that are necessary for the attainment of sustainable development. These are: democracy, fairness, interdependence, responsibility and accountability. There are, also five principles of implementation. This includes: Environmental and Economic integration, Maintenance of Biodiversity and conservation of natural resources, Precaution, Prevention and Evaluation, Cooperation, Partnership and Participation and Education, Training and Awareness.

Sustainable Construction
In view of the significant impacts construction activities have on ecological and human health, the construction industry has a growing interest in the concept of sustainability. Halliday (2008) observed that there can be few within the professions involved in the built environment for whom sustainability is a new idea. While Pearce et al. (2012) noted that the construction industry is beginning to adopt the concept of sustainability in all construction activities in order to mitigate problems associated with construction activities while contributing to high quality of life for its clients. According to Taylor (2002) there can be few aspects of construction which has attracted greater attention than sustainability and this trend is expected to gather momentum as general awareness of matters relating to the environment increases. This explain the reason why the entire modern green building movement has shifted to a strong focus on building sustainability (Yudelson 2012).

Adebayo (2000) in Dahiru (2005) noted that sustainable construction is the way the building industry responds to achieve sustainable development. Adebayo (2002) further described construction sustainability as building practices that can be utilized in the long term, without causing damage to the environment. While Bourdeau (1999) noted that it is the creation and responsible management of a healthy built environment based on resource efficient and ecological principles. It is a process which starts well before construction in the planning, design stages and continues after the construction team has left the site. It also includes managing the serviceability of a building during its lifetime and extends to its eventual deconstruction and the recycling of resources to reduce waste stream usually associated with demolition (Wyatt, 1994). Thus, it is an integrative and holistic process of construction which aims to restore harmony between the natural and the built environment (CIB Publication 237, 2007). Kibert (1994) defined sustainable construction as creating a healthy
built environment using resource efficient and ecological based principles. Watuka (2002) described sustainable construction as the set of process by which a profitable and competitive industry delivers built assets building structures, supporting infrastructure and their immediate surrounding which:

- Enhance the quality of life and other customer satisfaction in the future.
- Provide and support desirable natural and built environments.
- Maximize the efficient use of resources while minimizing waste.

Thus sustainable construction is mainly concerned with the process of creating building and infrastructural facilities with the aim of restoring harmony between the natural and the built environment and creating settlement that affirm human dignity and encourage economic quality. It entails procurement (new construction, refurbishment work and maintenance) as well as operation and demolition of construction work (Magaji 2015).

There are six principles applied in all the phases of the construction process in order to achieve sustainable construction. These are:

- Minimization of resource consumption.
- Maximation of available resource reuse
- Use of renewable and recyclable resource.
- Protect the natural environment.
- Pursue quality in creating the built environment.
- Create healthy and non-toxic waste (Mbamali 2005).

That is why Halliday (2008) describes sustainable construction as built development projects that are simultaneously more efficient and profitable, much more socially accountable, and less damaging to the environment. According Suliman & Abdelnaser (2009) sustainable construction is the set of processes by which a profitable and competitive industry delivers built assets (buildings, structures, supporting infrastructures, and their immediate surroundings) that:

- Enhance the quality of life and offer customer satisfaction.
- Offer flexibility and the potential to cater for user changes in the future.
- Provide and support desirable natural and social environments; and
- Maximize the efficient use of resources.

Thus sustainable construction considers materials, energy, design and construction. In addition, evaluation and remediation of contaminated land, minimizing waste, pollution, noise and traffic. Provision of safer working environment for workers involved in the construction, maintenance, operation/management and deconstruction of buildings or
structures (Suliman & Abdelnaser 2009) However, it was noted by Ofori (1998) that there is no agreement regarding what sustainable design and construction really means.

**Challenges faced by the BE, professionals due to the influence of technological development**

Recent development in almost all spheres of human endeavor has led to the transformation of the building practice. First, construction advertisement, marketing and tendering are carried out electronically via the internet and cable networks. Thus with this development, construction firms and professionals in the West African sub-region, may have to compete for projects with their counterparts across the globe. Besides that, the project team for a building may involve partners from different countries, sometimes in different continents (Madigan, 1993). While the clients to projects are well – informed. They have innovative ideas that they want to implement on their projects. Also client’s requirements are becoming less country specific (CIB 2004). In other words, they require the same standards of quality and uniformity as it is obtained in other part of the world. Additionally, there are various components with different attributes and sources with growing regularity in, not only the building materials but also the process – the design, procurement and techniques. Similarly, the role of organizations is increasingly coming under the scrutiny of investors, analysts and pressure groups. On the other hand construction firms have a formal environmental policy typically entailing a commitment to limiting environmental impact to a practical minimum (Alexander, 2005).

This means that BE professionals in West Africa should not lose sight of the fact that just like the progress of science and technology has transform the building practice, raised competitive forces and pose big challenge, there is the dire need for a positive change of attitude on the part of the BE professionals so that they will be at par with their counterparts all over the world. This is particularly important in view of the fact that the construction industries across the globe have, for long, recognized the fact their actions is leading to a very serious and far reaching changes on a global scale – in terms of depletion of natural resources, negative changes of the ecological and socio-political conditions. As such, it is the responsibility of the construction industry to fix it. They have therefore, put in place measures that will, not only mitigate the negative side effects of building construction and other developmental activities, but also create sustainable built environment.

**Role of BE professionals in achieving sustainable built environment**

Achieving sustainable built environment is not only desirable, but necessary (Glasson et al 1999, Adebayo 2002, Kolaowole & Anigbogu 2005, Shah 2007 and Halliday 2008). However it is generally believed to be very difficult due to the fact that it is expected to achieve many things. Alexander (2005) asserted that there exists conflict of interest in dealing with environmental issues. According to Adebayo (2001) in Dahiru and
Abdul-Azeez (2012) sustainable construction in developing countries like the ones in the West African sub-region, is faced with many problems. This is because of the fact that such nations are faced with the extreme survival issues due to poverty, war and economic problems, as such; it is difficult to establish the environment as a priority. The major challenge for sustainable construction would be, to get sustainability on the agenda of industry, educational institutions, financial institutions, national governments, local authorities and on the public/consumer (Adebayo (2001) in Dahiru (2005). Izam and Ameh (2012) observed that there exist significant gaps in the current university education and professional training on sustainable construction. In addition, familiarity with sustainability among BE professionals is quite low (Magaji 2015). Nevertheless, Halliday (2008) and Pearce et al (2012) are of the view that it is possible to achieve sustainable built environment.

VITAL AREAS WHERE BE, PROFESSIONALS CAN CONTRIBUTE TO THE REALIZATION OF SUSTAINABLE BUILT ENVIRONMENT

Despite the aforementioned problems there are important areas that BE professionals can assist in the attainment of sustainable built environment. These are as follows:

**Recognition of Environmental Issues**

- At corporate Level

One of the important ways that a BE professionals can contribute towards the achievement of sustainable construction is the recognition of environmental issues at both individual and corporate level. According to Alexander (2005), this requires the development of an understanding of the techniques and systems for environmental and energy management. At corporate level, building construction firms should undertake a systematic, objective and independent analysis of the environmental impact of their activities (building construction) and adopt an approach that seeks to respect the environmental consequences of such action, with a view to conserving the ecology of the planet as a whole.

Thus building construction companies should introduce environmental policy – processes and practices for reducing, eliminating and preventing negative environmental impacts arising from their activities. This can be done at two levels. Firstly, the working conditions for personnel should be taken care of – in terms of remunerations, health, safety and welfare. Secondly, the overall impact of all its activities on the environment should be considered. This means that construction work should be carried out according the appropriate environmental legislations and construction works are carried out in ways that will not harm the environment as well as the general public. To achieve the desired objective, attention should be paid to construction techniques and the selection of materials. An important measure that can assist is making sure that materials are
ethically and responsibly sourced, is the use of the concept of Responsible Sourcing (RS); which is described as the management of sustainable development in the provision or procurement of a product. It requires the entire procurement process to be independently verifiable throughout its various supply chains. Thus construction firms in the West African sub-region should consider Ethical Purchasing (EP) as a necessary and important requirement of sustainable construction. According to Mathenge (2012) EP is a generic term that includes: sourcing, purchasing and procurement. Mamic (2005) noted that EP is the acquisition of goods and services through supply chains and subcontractors in a responsible manner, with consideration of conditions under which goods and services made and delivered and a strategy that promotes improvements. Closely related to RS and EP concepts is environmental management, EM. According to BS 7750 (1992), EM requires that all technical factors affecting environmental impacts are under control and the organization’s administrative and human factors are well managed. In order to achieve the desired objective, it is recommended that organizations should:

- Identify the key elements affecting environmental performance
- Develop an integrated management system for regulating them.
- Define a policy containing a set of objectives for managing these effectively.
- Introduce a method for reviewing how effectively the policy and objectives are being met (Alexander 2005).

Another important tool that will assist in the achievement of sustainable built environment is Life –cycle assessment, LCA. It is a tool applicable to waste management. Life-cycle assessment also known as life-cycle analysis, Eco balance, and cradle-to-grave analysis is a technique to assess environmental impacts associated with all the stages of a product’s life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling). LCAs can help avoid a narrow outlook on environmental concerns. Besides that there is the need for construction firms to undertake detailed preconstruction planning. According to Pearce et al (2012) construction firms are involved in the integrated design process from the very beginning, and could be employed only to carry out preconstruction services in a project with sustainable goals but may later be permitted to bid on the project.

Another very important area where construction firms can promote sustainable built environment is through the discharge of corporate social responsibilities (CSR). According to Dahiru and Abdul-Azeez (2012) CSR is a concept in which business organizations takes into account the interest of society by taking responsibility for the impact of their actions on the clients, workers, shareholders, communities and other interest groups and the environment. There are diverse forms of CSR which can be provided by the construction companies such as: provision of voluntary services beyond the standards set by law, employing the physically handicapped, and
refusal to invest in businesses that may be harmful to the society/individuals. Provision of health facilities/services like hospitals or clinics, educational institutions like universities, secondary or primary schools, tree planting, provision of infrastructural facilities, etc. According to Ojonugwa (2009) in Dahiru and Abdul-Azeez (2012) CSR can be responsibility to the customers, employees, stakeholders or society.

Major areas where CSR can be used in the construction industry are generally any activity that can remedy the side effects of construction activities such as: afforestation programme, improvement on the visual pollution caused by quarries and mining used to gain raw materials for concrete production (gypsum, limestone, aggregates etc) and raw materials for the production of steel reinforcement (such as iron ore), aluminium, copper, etc., sponsoring researches on sustainable construction like development of green building materials, rehabilitation of abandon sites, provision of infrastructural facilities such as roads, dams etc.

- At the individual level

BE Professionals have very important role to play in order to realize sustainable construction practice hence sustainable built environment. Prominent among these areas are as follows:

Assisting in the development and implementation of environmental legislation relating to construction works

Griffith (1999) in Gandu (2005) noted that mitigating the effects of construction in the future will be fundamentally determined by two major influences namely legislation (standards for environmental management at project and organization levels appropriate to need and procedures in order to ensure compliance with the standards) and conformance (to environmental management by employers and all those organizations who participate in the construction process). The BE professionals can assist in the promotion of sustainable construction by ensuring that the management of building production or construction of any structure, is carried out in accordance to the relevant provisions of the existing legislations on measures that will ensure sustainable built environment. According to Gandu (2005), there are legislations on measures on the protection of environment in Nigeria. These include among others the following:

- Decree 58 of 1988 on the establishment of Federal Environmental Protection Agency, FEPA, for environmental planning, review and control in Nigeria.
- Decree no. 86 of 1992 meant for organizations to develop a management systems for their anticipated environmental problems in any new development project
- Sectorial guidelines to cover several areas of Nigerian economy. It provides guiding principle for carrying out Environmental Impact Assessment, EIA among others.
There are similar legislations in other countries in the West Africa. Close study of such legislations shows that they are inadequate and there is no much effort to establish common legislation among countries in the sub-region. The BE professionals should also highlight any loop hole in the relevant laws with a view to calling attention for essential improvements. In addition, there is still some very important legislation that needs to be put in place in order to achieve sustainable built environment. For instance two of the important measures that are put in place all over the world in order to realize sustainable construction, hence sustainable built environment, are responsible sourcing and environmental policy. There is also, the need for construction specific policies to realize the goals of sustainability – including the decrease of greenhouse gas emission and energy consumption in the building sector. Many countries have sustainable construction policies and programmes.

Meaningful contribution to the design:

Another way in which the BE professionals can make significant contribution towards the attainment of sustainable built environment is through synergistic design. BE Professionals should emulate their counterparts in the car manufacturing industry in which right from the onset, design engineer, production engineer, the technician and marketers put their heads together during design of a car. According to Ferguson (1989) in Bamisile (2004) a builder has been described as a “practical man” in view of the vast experience he has on building production; as such, engaging him right from design stage will undoubtedly assist the designers in the production of a buildable design. That is why an important criterion in the construction of green building is the use of integrated approach in the design of such building. In which all the stakeholders are brought at the design stage so as to achieve synergistic design. It should be noted however, that the BE professionals cannot discharge their duties without knowledge of, not only construction work but also design – as such, they must understand and appreciate the procedures and implications of the design, construction and even operation of sustainable building. Thus a BE professionals should know the goals of sustainable design. They are as follows:

**Integrated Site Design:** Promote development of the built environment that reduces its impacts on the natural systems and processes of the site or restores and improves sites that have been poised or altered greatly over time. Strategies include minimizing site disruption, increasing development density, minimizing the building’s footprint, using pedestrian-friendly neighborhoods, developing links to public transportation, landscaping that conserve water and reduces the heat island effect and so on.

**Water Conservation:** Use water conservation strategies that reduce storm water runoff and introduce water harvesting techniques to increase local aquifer recharge; reduce or limit the use of portable water for landscaping;
use low-flow plumbing fixtures, water-efficient appliances and heating, ventilations and air conditioning (HVAC) equipment, and so on.

Energy Conservation and Atmospheric protection: Minimize energy use through energy efficient Heating, Ventilation and Air Conditioning, HVAC, lighting, and other equipment, increase the use of renewable energy sources, reduce atmospheric ozone depletion and so on.

Resource Efficiency: Reuse existing building design, long lasting buildings that can be adopted for changing uses over time, reduce construction waste and implement construction waste management; increase the use of durable and reusable materials; use materials with greater recycled content; use of locally or regionally produced product; and so on.

Indoor Environment: Maintain good indoor air quality; increase ventilation effectiveness, reduce the emission of volatile organic compounds (VOCs) and other contaminants by interior materials; increase the use of day lighting of interiors, and so on (Mehta, Scarborough and ArmPriest 2009).

However, Pearce et al (2012) have proposed best practices for sustainable design in six major categories. These are: sustainable sites, energy optimization, water and waste water performance, materials optimization, indoor environment quality and integrated strategies – which consist of making effort to find solution integrated green solutions that meet the client’s needs for a facility and, at the same time do not spoil the natural ecosystems or deplete resource base nor go beyond the budget. Thus sustainable building requires taking a whole life cycle approach to building planning, design, construction and use.

Materials Selection
In view of fact that building materials constitute a large part of the environmental burden, BE professionals should be able to select building materials whose general environmental burden is low. Halliday (2008) stressed the use of natural materials with minimum processing and transportation. Also, they should be healthy, non-toxic and contribute to passive forms of environmental control. During the selection of materials, there are some important questions that should be asked. These are:

1. What is the Resource Base? - Where is it from and how much is left?
2. What is the Embodied Pollution? - What has been done to it and by – there is often an ethical component.
3. What is its impact in use? – What effects does it have on people and the wider environment?
4. What is its final destination? – What will happen to it at the end of its life? (Halliday 2008)

Materials used for the construction of environmentally friendly buildings are called green materials. Mehta et al (2009) noted that the greenness of materials depends on the following:

- Renewability
Dahiru, AbdulAzeez and Bala

- Recovery and reusability
- Recyclability and recycled content
- Biodegradability
- Resource (energy and water) consumption
- Impact on occupants’ health
- Durability and lifecycle assessment of greenness

For the fact that material's durability is directly associated to its sustainability, conservation of natural resources by making the construction materials last longer is therefore an ecological step. That is why currently designers of concrete structures, evaluate the durability characteristics of construction materials as carefully as other aspects like mechanical properties and first cost (Shetty 2009; Mehta & Monteiro 2007 and Gupta & Gupta 2006). Euro code 7 (1995) requires structures and their foundations to have adequate durability to resist attack by substances in the ground or in the environment which could cause weakening and the risk of exceeding the ultimate and serviceability limit states (Tomlinson, 2001).

Other factors considered are sustainability of grounds such as landscaping, sitting and planting of trees and flowers, etc calculation of energy use and analysis of life cycle energy use; consideration of innovative sources of power like co-generation or solar energy. In nutshell, all professionals should undertake analysis and design within the scope of their field of specialization. Since the most popular contract procurement method used in the West African sub-region, is the traditional contract procurement system, which separates design phase from the construction phase, in such situations, the professional builder should undertake buildability and maintainability analysis. According to Bamisile (2004) Buildability has been defined as the ability to construct building efficiently, economically and to agreed or specific quality standards from its constituent’s materials, components and sub-assemblies. While Maintainability is defined as the degree to which ease of maintenance has been designed into a proposed building to optimize access and cost effectiveness during the use of the building (Bamisile 2004). This entails detailed study of building design to determine the extent to which it is construction (and maintenance) friendly. The basic function of buildability and maintainability analysis is to determine and minimize or remove waste and wasted efforts before work starts on site.

After the completion of design of building, depending on the nature and complexity of structure, there may be need to carry out Environmental Impact Assessment, EIA. According to Glasson et al (1999) EIA is a systematic process that examines the environmental consequences of development action, in advance. In other words it is a process of identifying, communicating, predicting and interpreting information on the potential impacts of a proposed action or development on the
environment, including humans and to propose measures to address and mitigate these impacts (Munn 1979 in Dahiru 2009)

**During construction**
Pearce *et al* (2012) noted that a new role of preconstruction manager has emerged among construction management firms, as distinct function separate from the traditional construction project manager. Presently, construction manager plays the primary role of managing a project right from planning and design phase and assisting in evaluating the implications of potential decisions at every point along the way. The project manager provides a complete picture of both the budget and schedule, including relevant contingencies and qualifications. He also systematically works with the design team and client’s team to reduce the need for such contingencies and qualifications. In addition, he is in charge of packaging work and communicating its scope to bidders. Additionally, he undertakes constructability review and value engineering/analysis.

In order to achieve sustainability of project, BE professionals should pay attention to construction operations and put in place measures that will reduce to the barest minimum, or eliminate noise, disturbance, dust pollutions and any form of interruption that can affect the smooth and successful execution of works on site. Also, activities should be made sustainable in such a way that it will be easier to restore the site to good condition after the completion of work. As such, effective management techniques should be introduced to erosion, sedimentation and any form of damage that construction activities may cause in, and around the construction site. Measures should also be adapted to guides against or reduce disturbance of site, most especially Greenfield that is hitherto undeveloped and undisturbed and sites with important habitat or vital environmental features. According to Pearce *et al* (2012) common methods of reducing disturbance are erection of construction fence and proper selection of construction equipment. In order to make the work more sustainable, contractual penalties and incentives can be used to encourage more sustainable behavior on site. For instance, where preservation of existing on site is vital, fines may be imposed on defaulters. BE Professionals should always remember that one very important measure that can greatly assist him is to undertake an in-depth analysis of the prevailing condition at site so as to adequately organize the site (Site design).

**High Performance/Green Buildings**
Another important step that should be taken by BE professionals is to incorporate high performance or green buildings features in buildings to be designed and constructed by them. Ogunlana (2006) identified five objectives of sustainable buildings. These are as follows:

- Resource efficiency
- Energy efficiency (including greenhouse gas emissions reduction)
- Pollution prevention (including indoor air quality and noise abatement)
Harmonization with the environment

After the building is erected, the building should be commissioned. Commissioning is a systematic and objective evaluation to verify that the basic building components and systems have installed and calibrated to function as intended. There are standards that guide the design and construction for sustainability which assist in undertaking objective, practical and fair assessment of various sustainable buildings. One of the popular rating systems is “Leadership in Energy and Environmental Design (LEED) developed by the US Green Building Council, United States Green Building Council, (USGBC). The rating system has gone through a number of updates. The current one is LEEDS 3.0 or LEED 2009. In view of the fact that challenges posed by building depends on the type of building, there are several variations in the rating system. The LEED rating system is based on the performance of the building under the following five topical categories. The maximum possible point score in each category is:

- Sustainable Site (SS) – maximum 26 points.
- Water Efficiency (WE) – maximum 10 points.
- Energy and Atmosphere (EA) – maximum 35 points
- Materials and Resources (MR) – maximum 14 points
- Indoor Environment quality (EQ) – maximum 15 points

The measure of a building’s sustainability is determined by the sum of all points it scores, and the total score determines LEED certification level as shown in Table 1.

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Points Scored by Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certified</td>
<td>40 - 49</td>
</tr>
<tr>
<td>Silver</td>
<td>50 – 59</td>
</tr>
<tr>
<td>Gold</td>
<td>60 – 69</td>
</tr>
<tr>
<td>Platinum</td>
<td>80 – 100</td>
</tr>
</tbody>
</table>


When the building is put under use, an important incorporation of sustainable criteria entails reducing the use of energy, water usage, waste minimization, procurement control and putting in place measures that would ensure the health, safety and welfare of the users of such building. In order to achieve the desired objective, there is the need to provide Building Operation and Maintenance Manual. It is detailed guide for the use and maintenance of building. There is also, the need for periodic condition survey, depending on the nature and complexity of building. For instance the Nigeria, National Building Code, NBC (2006) requires building survey to be carried out for building of five floors and above, every ten years by registered professionals involved in the initial design and
construction stages of the building. Countries in the West African sub-region have similar regulations.

In recent times Facilities Management, FM; approach is used in the management of buildings. FM encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process and technology. According to Cotts (1992: 3) “FM is the practice of coordinating the physical workplace with the people and work of the organisation; integrates the principles of business administration, architecture, and the behavioural and engineering sciences” In view of the fact that the operational phases of buildings have the most injurious effect, on the environment, the Facilities Manager is tasked with mitigating climate changes by delivering sustainable facilities management in the built environment. Sustainable FM was described by Nielsen et al (2009) as an “umbrella” for various ways of minimizing flows of energy, water and waste in the operation of buildings and waste generated from the daily operations and management of buildings which invariably, lead to reduced operational cost of the buildings. According to Abigo et al (2012) in Faith (2015) some of the various systems of sustainable practices used in the management and operation of buildings, in order to reduce their carbon emissions, and energy usage, includes: Building Information Modeling (BIM), audits – energy and water and waste audits, sustainable cleaning products, adequate metering and monitoring. PA (2007) identified five principles of sustainable FM; these are as follows:

- Energy and Environment
- Conservation of Materials and Resources
- Water Conservation and Quality.
- Indoor Environment Quality.
- Sustainable Site Design.

Generally, buildings and the built environment will be required to meet a number of standards which include, among others, the following: Enhance biodiversity, identify and meet the real needs, requirements and aspirations of communities, use of resources effectively- buildings should be affordable, manageable and maintainable, minimize pollution, create healthy environment and effectively manage the delivery of sustainable projects – by identifying right targets, tools and standards, and manage their delivery (Halliday 2008).

**ANALYSIS OF DATA**

Thus there is, indeed, wide range of actions required to achieve sustainable built environment. However, close study of the efforts made by governments, private organizations and BE professionals in West Africa, it can be said that very little or no serious effort was made towards achieving sustainability. This is particularly true, when such effort is compared with that of the developed nations like the United Kingdom, United States of
America, Australia, Japan, etc. There is no serious commitment by
countries like Nigeria, Ghana, Mali, Niger, etc. to develop strategies to
achieve sustainable built environment. As matter of fact there are salient
issues that were neglected which can actually go along towards
achieving sustainable built environment. Firstly, failure to use school
curriculum as agent of change. In view of the fact that Professional bodies
have the legal right to accredit professional courses in higher institutions,
from time to time, in their own area of specialization, they should ensure
that sustainable construction forms part of the curriculum. This is
important because recent study by Ibrahim (2015) shows that there is low
level of awareness of sustainable construction, among students of faculty
of environmental design, at Ahmadu Bello University, Zaria, Nigeria. This
result is, most likely not going to be different with the rest of educational
institutions in West Africa. Besides that, not much attention is given to
sustainability in mandatory training workshops, seminars or professional
examinations organized by the professional bodies. There is also lack of
collaboration among the BE professionals in West Africa, in general,
particularly on issues relating to sustainable construction. It was only in
2013 that the Nigerian Institute of Building, NIOB, invited the president
of a similar body in Ghana to attend its Conference and Annual General
Meeting, AGM, in Abuja – as part of effort to cooperate. However, in other
parts of the world, especially in developed nations, many countries and
economic groupings have developed sustainable design and construction
assessment tools. They have set target for maximum carbon emission.
Another important fact that is often ignored is the recognition of the
unique features of our own setting, in any effort towards achieving
sustainable built environment. For instance countries in the West African
sub region are blessed with renewable construction materials such as
timber and there is also abundant supply of solar energy. However, there
is no much coordinated and wide-ranging study of these materials that will
assist in making optimum use of such materials. At the other end of the
scale, there are problems such as exponential increase in population and
the value of land, as fixed asset, is always increasing.

Little is done to solve this problem, such as the construction of high rise
buildings and provision of underground infrastructural facilities such as
underground railway, tunnels, BE professionals did not benefit from the
experience of the developed nations and International organizations. For
instance most developed nations make sure that when construction
companies are carrying out construction work, they follow set standard. In
addition, when International organization like the World Bank or World
Health Organization, WHO, is to execute any construction project, in any
part of West Africa, they make sure that the construction firm follow set
standard. For example if there is need for EIA, they ensure that it is
carried accordingly. Sometimes the nature of the contract or project may
require certain procurement method to be used or certain procedures to be
followed so as to achieve the desired objective. Construction industry in
West Africa fails to emulate such effort. Also, sustainable construction
encourages synergistic approach to the design and construction of buildings.

Currently, the Traditional contract procurement method is the most widely used in the whole West African sub region. This separates design and construction phases, leading to, among other problems, buildability and maintainability problems. BE professionals should put their heads together and discuss issues of common interest to them in the region. One important area that can assist, greatly, in the achievement of sustainable built environment, is promulgation of environmental legislations for the entire West African region. In view of the fact that most, if not all, of the countries in the West African sub – region, were either colonized by the British or French, many of the legislations, standards, code of practice etc, were either carbon copy of United Kingdom or France – including environmental legislation. Effort towards achieving sustainable built environment require the BE professionals to remember the statement made by the Brundtland report, which was mentioned earlier, that “the local nature of human interaction with environment is not confined to local environmental effects” as such there should be collaboration between countries in the West African sub region, on various issues, - foremost among them is environmental legislations.

CONCLUSION

1. The BE professionals in the West African sub-region are faced with big challenge to put themselves and the industry at par with rest of industries across globe.

2. There is no much effort on the part of BE professionals to take responsibility for the negative side effects of their activities on the environment and the creation of a sustainable built environment; through the adoption of sustainable construction practice in West Africa.

3. The level of cooperation and awareness of sustainable construction among the BE professionals in the region is very low.

RECOMMENDATION

1. There is the need for BE professionals to improve on their area of professional calling as they are no longer confined to small area in their professional practice.

2. There should be deliberate government policy across the West African sub region that will assist building construction firms to be at same level with their counterparts across the globe

3. Efforts made by construction companies internationally to take responsibility of their activities, should be adopted by BE professionals and construction firms in the West African sub-region.
4. Government and professionals should work together to create an enabling environment for the realization of sustainable built environment. To that end, governments in West Africa should promulgate environmental legislations, sustainable construction policy and programmes. While professionals and professional bodies, should assist in supporting the government towards successful implementation of such laws, policy and programmes in the entire region.

5. The implementation of the various provisions of the Building regulation is one of the significant way of solving the various problem facing the building industry and a viable method of achieving sustainable built environment.

6. BE professionals, and construction firms, in West Africa should study ways and means of enhancing their competitive position.

7. The Professional bodies in each country in West Africa should put sustainable building construction among the important subjects that professionals will be taught during the mandatory training workshop they organize from time to time.

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Watuka, I. (2002). *Sustainable construction: An investigation into the awareness and implementation of sustainable construction practice in the Kenyan Construction Industry* University of Nairobi, Kenya


STAFF PERCEPTION OF RELAXATION SPACES IN OFFICES OF TERTIARY INSTITUTIONS OF NIGER STATE

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As humans engage in daily activities in order to make ends meet, they go through the hustling of working environment of their work places. This in the long run builds up stress in their system. Stress which is unavoidable is in most cases accumulated most times and definitely leads to ill physical conditions, mental illnesses or poor/reduced staff output. Relaxation, is the most recommended cure by medical practioners for treating stress related cases. Since stress builds up over time, it is then necessary to regulate its build up in one’s system. In the academic system, staff of tertiary institutions undergo much more pressure than staff in primary and secondary institutions. The faculty offices in tertiary institutions, such as any work place, are a bee hive of activities. There is therefore a die need to address how to control the stress levels in staff by providing relaxation spaces in faculty offices. This paper examined the availability and functionality of relaxation spaces provided in faculty offices of tertiary institutions from the view of direct users. This study was carried out on faculty offices of tertiary institutions in Niger state. Data is generated by the use of questionnaire and data collated and analyzed using SPSS 17 and graphic illustrations generated using Microsoft excel. The paper shows that the relaxation spaces so provided in faculty offices in tertiary institutions are inadequate hence there would be need for the remodeling of the office facilities and new facilities designed would need to take into cognizance relaxation spaces.

Keywords: faculty offices, space, stress, relaxation space

INTRODUCTION

Relaxation to humans is one important activity which should be observed as a daily routine. Relaxation can basically be understood as a state of relieving oneself of stress. Relaxation does not literally mean lying on the couch, sleeping and being lazy. (Williams and Carey 2008) or as a state of being free both psychologically and physically. It is broadly studied by medical practitioners, psychologists and social analysts. Therefore a proper understanding of relaxation is very important to further understand the scope of this paper. The causes, responses and method of

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approach are very delicate aspects of relaxation to consider. Relaxation on the other hand could be practiced on a personal level where the individual knows best how he would want to relax. This paper relates the acknowledgement of relaxation spaces provided in offices of tertiary institutions with the view of the users of such spaces where they exists. This has been an aspect of staff welfare in tertiary institutions that has been neglected for too long. Spaces when designing are intricate decisions by the architect, spaces are allocated to accommodate a particular function or activity giving the complete design a perfect harmony. An individual or user of a space as expatiated earlier could choose to adopt his personal space such as his work desk or total private office to carry out his relaxation activity based on what is made available to him and his choice or relaxation. This shows that in some ways it is an individual experience. People tend to find themselves consciously and unconsciously. There are various types of relaxations, such as;

**Physical aspect** - physical aspect of relaxation involves taking a deep breath or static stretching. It also is the conscious body movement or activity that aids in relaxing, such as body exercise.

**Spiritual aspect** - this aspect of relaxation involves meditation, yoga and praying. Relaxation by concentrating on your inner peace and letting it dominate, by doing this the physical self is shut down, this gives a relaxing effect.

**Intellectual aspect** - imagination and use of the mind is implemented in this aspect of relaxation. It is mostly used for those who are hyper active.

**Social aspect** - this aspect of relaxation gives more attention interactions with the public such as going out, a stroll in the park, and other activities that keeps one excited and happy.

**Types of Relaxation Techniques**
There three basic categories of relaxation as described by Jonathan (2007), which are considered for this study. They are:

**Progressive Muscle Relaxation**
This type of relaxation technique is practiced by tightening or putting the muscles under tension for about 10seconds and then released for 30seconds to relax. This technique is not recommended for individuals with heart issues and high blood pressure.

**Passive Muscle Relaxation**
This does not involve putting the muscle groups under tension instead the individual thinks and imagines he is actually relaxing his muscles. This technique has shown that by mere thinking of your muscles relaxing they actually relax. Thinking about it sends signals to the brain to relax the muscles. It is good for those with high blood pressure and other chronic pain as this technique does not involve muscle tension.
Meditation
This is a long used technique that has been in existence for thousands of years. It’s widely adopted all over the world today. There are many research on relaxation and different techniques, there are two main ways in which people relax, sports and leisure or recreation. In most cases people tend to go for the latter because it is less vigorous and tiring. On the other hand there are also two forms of relaxing either assisted or induced or self-assisted.

Health Awareness in Academic Staff in Nigeria
The lack of knowledge concerning the health among staff of tertiary institution is alarming, this is because, and most staff go through the stressful educational system for 35 years without paying much attention to their health. As a result of this, they are diagnosed with different stress related ailments without knowing the cause of it. Poor health is usually an attribute of stress accumulated over time due to poor working conditions. The excessive workload, job insecurity, domestic/work imbalance and office relationship are among the many stressors indicated to cause sudden ill health among staff (Ukwayi, Uko and Udida 2013). With the rapid increase in the establishment of tertiary institutions all over the country by federal, state, private and religious entities have brought about the craze of trying to maintain standards and these can only be done by pushing the staff to over work to hit the goal. In this working environment, staff tend to work themselves out to avoid being replaced. (Omoniyi 2013).

In the bid to trying to curb stress among staff of tertiary institutions, it is important that the management of the institution or for the purpose of this research, the union bodies and the government are best to be inculcated in any course of managing stress among staff this is because where the upper bodies are not involved or interested in the course then the whole program and restructuring is null. Staff of tertiary institutions try to manage this stress on their own in their own way. They do this by adapting to what has been made available to them, getting used to the stress overtime and by whatever they have decide to do to relieve stress. Many researchers has studied the behavioral attitude of lecturers in tertiary institutions and have come to a conclusion that there is stress among staff in the academic institution. (Salami 2006).

Architecture and Relaxation
Architecture has been able to contribute immensely to the management and relieve of stress in work places. The use and addition of building elements to a space help to transform a space and thereby making it relaxing for users, the use of day lighting, colors and finishing can put used to achieve this. (Edward and Torcellini 2002). The orientation of the building plays a significant role in making interior and exterior spaces adequate enough for relaxation. Where there is too much of sunlight into a space, the micro climate of that space usually tends to be most times at certain period of the day to be very uncomfortable to the users of that space. Another aspect is building maintenance, which is very necessary in
buildings. In the case of tertiary institutions which is an institutional building and also a public building, there is high requirement for a tidy environment and adequate planning of exterior spaces which can be used for relaxation (Akinsola, Hussaini, Oyenuga, Fatokun 2012).

Space Designation for Relaxation
Space in architectural design is very crucial in terms of designation of functions. In this regard many considerations are put in place to suit the users. For the purpose of this paper, considering spaces suitable for relaxation is important to note. Function of a space should be easily related to the users of the space. Humans are affected physically and mentally by the space provided (Shafaq 2010). For a stressful environment such as in a tertiary institution, it is necessary to focus on making spaces feel more relaxing to the users (Shafaq 2010).

While maximizing office spaces during planning to provide fundamental relaxation spaces for a better working environment for staff, roof tops could be designated for lounges, general grounds for common lounges and seating areas. In this way wasted spaced are minimized and well utilized. (Facilities Management Good Practice 2012)

Relaxation and Office Spaces
The rapid change and expansion in the working environment has pulled workers away from pausing for a second and refreshing themselves. On the other hand, most workers have learnt to combine both work and relaxation together. To curb this issue is to bring within reach relaxation provisions. (Schmidt 2009). It is then necessary to note the working environment provided for workers is made conducive by involving the end users in the design stage. Office spaces planned without considering the users of the space would result to oversights causing inconveniences to the user (Zubairu and Olagungu 2003).

RESEARCH METHOD
This paper evaluates the research done in the assessment of staff perception on relaxation spaces in offices of tertiary institutions of Niger state. The research was set out to study the views and wellbeing of staff in tertiary institutions with relation to how comfortable they are in spaces made available for them to relax in. A Post Occupancy Evaluation (POE) was carried out using observation schedule and questionnaire. The questionnaire contained questions aiming at the factors surrounding the condition of the working environment provided at each of the universities studied. It also drew more insight on the staff adaptation to relaxation while at work. Using these tools of data collection were deemed most appropriate as it produce data gotten directly from the staff of these tertiary institutions studied. This brought up helpful insights when data was collated and combined from the questionnaire and from the observation schedule. Some limitations were experienced in the course of gathering data as staff of the tertiary institutions was mostly busy with
examinations to fill out the questionnaires, also experienced was that some senior staff such as professors and head of departments gave out their copies of questionnaires to their secretaries or assistants to fill out on their behalf. Questionnaires filled in such way were rejected and considered void. In total 15 copies of questionnaires were distributed in each of the 5 institutions visited making a total of 75 copies which were administered, filled and returned. SPSS 17 was used to compare data and generate results in tables and pie charts.

DISCUSSION OF RESULTS

Table 1. Distribution of Studied Tertiary Institutions

<table>
<thead>
<tr>
<th>Tertiary institutions</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBB LAPAI</td>
<td>15</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>COE MINNA</td>
<td>15</td>
<td>20.0</td>
<td>20.0</td>
<td>40.0</td>
</tr>
<tr>
<td>FED POLY BIDA</td>
<td>15</td>
<td>20.0</td>
<td>20.0</td>
<td>60.0</td>
</tr>
<tr>
<td>STATE POLY ZUNGERU</td>
<td>15</td>
<td>20.0</td>
<td>20.0</td>
<td>80.0</td>
</tr>
<tr>
<td>COLLEGE OF NURSING BIDA</td>
<td>15</td>
<td>20.0</td>
<td>20.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s fieldwork (2015)

Discussed in this section are results gotten after collating the different parameters considered in relation to spaces within faculty offices in tertiary institutions with other variables which at the end generated relevant information that supported the assessment of staff perception on relaxation spaces in faculty offices in the tertiary institutions studied. The table above is detailed to show the distribution of questionnaires administered to the five different tertiary institutions. It also illustrates other information in percentages. Table 1.0 shows how institutions studied are selected across Niger state with equal amount of offices visited carefully representing the different staff cadre in tertiary institutions.

Space definition in Office Spaces

Space allocated for offices in faculty buildings is one important factor in designing. Faculty offices are meant to be designed putting into consideration the functions of the space, the users’ preferences and his cadre or rank. The planning of educational institutes which includes faculty buildings, school secretariat and hostel accommodation are key requirements. Where buildings built for other or initial purposes without adequate restructuring to suit its new use, brings about high level of inconveniences to the users and the building. Disregarding the initial frame work of the building, partition walls are formed or existing walls are broken down or no change is made totally on the building to suit its new purpose.
Federal Poly Bida and IBB Lappai University were built purposely for use, while College of Nursing Bida, COE Minna and State Poly Zungeru had buildings that were initially for other purposes until it was named an educational institute as shown in Fig 1.

The poor consideration for relaxation spaces in faculty offices and within or around the building is alarming. This is due to inadequate planning and building customization. Where existing buildings or spaces are adopted to accommodate faculty offices, there is little or no luxury to consider extra spaces such as relaxation spaces. But in faculty buildings which were purpose built such as IBB University Lappai as shown in fig 2. were built mainly for the purpose of its use.
Space Preference

Working space flexibility in offices is particular to its users, everyone naturally would prefer his own space to relax. Most lecturers are stressed in the course of the day, taking lectures, departmental responsibilities and his own personal self-development. All these squeezed together in a day within 8am to 5pm. In this light, it is deemed to understand the standard space allowance for shared offices and private offices to enable one accommodate adequately the appropriate amount of staff to fit in a space.
Fig 4 shows that over 60% of academic staff take up to 2-3 lectures in a day. This is an addition to the need for relaxation spaces for staff to wind down in the middle of the busy day. Where adequate spaces are provided for staff to relax either within or outside faculty building or even relaxing right in their office spaces it is necessary to ensure that the overall area of the office is adequate enough. Due to improper planning and disregard for the well-being of staff of tertiary institutions fig 5 shows that 72% of faculty offices are less than 12msq and still accommodate more than 2 staff therefore making the space congested and increases stress level among staff.

**Office Comfort**

Designation of space while at the design stage or in the case of an adopted building, the comfort of the users is very necessary in the sense that most staff of tertiary institutions do not feel comfortable in their offices due to factors such as size of the offices, and number of staff in the office. The feeling of staff pertaining to the structure of arrangement of his office goes a long way in boosting the productivity level of where offices provided are spacious and well planned. Where staff feel relaxed in their offices, a reasonable increase in performance would be experienced. Privacy level in offices of faculty buildings is as important as other factors in assessing the office comfort in faculty offices.

Elements that can be included in office to aid relaxation are balconies (private balconies or public balconies), couches, staff lounge and open cafeteria. In figure 6 78% of staff who are the academic staff who are also the highest in terms of staff category in tertiary institutions do not find their office comfortable enough to be called a good working environment. This in the long run shows how unhappy they feel about their working environment.
Relationship between Users and Spaces
Understanding the users and the space made available is an interesting factor as the two must have to be balanced solely done by the architect. Just as humans naturally inhabit his space and make it comfortable for him so are offices too. There has to be a balance and a relationship between users and the space provided for him to feel comfortable to work in. This is why there is need for staff of tertiary institutions to relate and relax in their offices whether private or shared. This involves the size of furniture, office arrangement/orientation and finishing.

The space provided must suit the category of staff. This means that there are different offices spaces for different cadre of staff. For most senior lecturers which include doctors, head of departments and professors, they tend to receive visitors in their offices. According to Fig 7 space adequacy is considered to be cut short. Also 0% of staff at IBB Lappai found their office space conducive enough for relaxation although it is one of the tertiary institutions that was designed and built.
User’s Preference for Relaxation Space
Knowing the perception of staff of tertiary institutions in relation to how they would want to relax when they are presented with options has produced results as shown in charts below. In the course of collating data it was observed that the different cadres in the tertiary institutions have different views on how their day goes at work. This is due to the different responsibilities and categories they have been classified into and this has affected how they prefer to relax. Figure 8-11 shows that where lounges are more preferred among junior staff because this is where they can relax freely, discuss, chat and can also meet with senior colleagues in a more informal avenue. Also students on the other hand tend to relate more with junior staff, so the lounge is often their best option. It can clearly be seen that as the cadre gets higher there is more preference of private spaces, quiet environment and lounges too. With 57% of academic staff preferring lounge and 32%, 345, and 31% among senior academic staff spread almost evenly among quiet environment, personal relaxation space and lounge. Senior staff who are basically of the older age have preferred personal and quiet spaces to relax read write without打扰s.

![Pie chart for junior staff preference for relaxation space](image1)

**Fig 8. Preference for relaxation space type (Junior Staff)**

![Pie chart for senior staff preference for relaxation space](image2)

**Fig 9. Preference for relaxation space type (Senior Staff)**
CONCLUSION
The conclusive part of this research shows that staff of tertiary institutions, regardless of the cadre or level at one point in time relaxes both consciously and unconsciously. In this vein, relaxation cannot be achieved if there are no spaces allocated for such exercise. It is therefore known that allowances for relaxation are not created in the construction of faculty offices. There are also no provisions of additional furniture such as couch in faculty offices to support relaxation when staff isn’t working. Office spaces in faculty buildings are obviously too small for comfort, and with that it is difficult to add furniture to aid relaxation. Office comfort which is to be the prime goal in making a relaxing working environment for staff is not considered in all the tertiary institutions studied.
RECOMMENDATION

The summary to the discussion of results indicates the need to have more appropriate design that actually suits its users. The development and introduction of new tertiary institutions should be accompanied by buildings with adequate facilities for the benefit of the staff. The health and well-being of staff should be put into high consideration by providing them with good working environment, this would help reduce stress and increase productivity. Spaces such as lounges should be provided for informal interactions among colleagues and students if need be, outdoor relaxation spaces such as a garden library, outdoor cafeteria should be provided for private relaxation. As different as individuals are so are his preferences, this is why it is necessary to provide diverse options of relaxation for staff.

REFERENCE


STRATEGIES TO FACILITATE BUILDING INFORMATION MODELLING ADOPTION IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

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Building Information Modelling (BIM) is a concept that has been defined as a technology that digitally constructs an accurate virtual model of a building. BIM can be defined as an IT enabled approach that involves the application and maintenance of a fundamental digital representation of a building and all its information throughout the different stages of the project. This study assesses the ways to overcome the barriers hindering the adoption and implementation of BIM in the South African construction industry. The data used in this paper were derived from primary and secondary sources. The primary data tool (questionnaires), was designed based on the related literature that was reviewed. The questionnaire was distributed to construction professionals in the South Africa construction industry, facility managers, and academics who have been, or are scholars (researchers) on BIM in the South African construction industry. The questionnaires were analysed using descriptive statistical procedures. The findings revealed that a lack of skills, education, and knowledge of BIM are the biggest barriers to the adaptation and implementation of BIM in South Africa. Furthermore, the results also show that educational and skill development initiatives are widely considered to be the answer to the existing barriers to BIM adoption. Lastly, the study makes some recommendation on feasible ways of moving away from the common practice of construction process and to the adoption of BIM on construction projects in South Africa.

Keywords: building information modelling, construction industry, South Africa

INTRODUCTION

BIM produces a model known as the building information model, which according to Ahazar (2011) and Bryde et al., (2012), can be used throughout all the project stages to, and including the operation and maintenance of the facility. According to Riddel (n.d.), BIM represents the design of the building as objects that carry their geometry and full

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attributes. This is achieved because the model will depict how the building will look once all the components have been inserted or built into the data. According to Ashraf and Esquire (2008), some of the other possible uses for BIM in the construction industry include it being used solely for design purposes, for coordination and clash detection, estimating material prices, construction simulation, and the creation of shop drawings and for review of submittals, amongst others. Although BIM is perceived to being able to eradicate almost all the inadequacies that arise in the process of construction, it is not the solution to all the problems in construction (Davidson, 2009). Eastman et al., (2008) further states that BIM is a modeling technology, which has an associated set of process that produce, communicate and analyze building models. The authors further identify the characteristics of these models by the building components that are digitally represented, the different components of the data, and the data, which produces the different views of the model.

The communicated views are 3D representations which is something that cannot be achieved without the usage of BIM. However; even with the documented benefits of using BIM, it has certain barriers that make potential users reluctant to its full adoption and implementation in the construction industry. Davdson (2009) attributes some of these barriers to issues such as workflow disruption, staff and training, legal and contractual issues and interoperability. Some of these attributions are echoed by Ku and Taiebat (2011) and Takim et al., (2013). These barriers are universal because of the professionals’ reluctance to move away from their usual methods of managing and carrying out projects.

Furthermore, Cidik et al., (2014), with aid from Bank et al., (2010) identify other abilities of the BIM technology, including those before mentioned, to help professionals in carrying such performance assessments at earlier design stages of the projects as a benefit of using BIM. Although BIM is proving to be the answer to a lot of construction related problems, it has also been widely noted by authors such as Brewer et al., (2012) and Ashcraft and Esquire (2008) that BIM doesn’t come without its challenges. From the literature that was reviewed, the researcher found that there were two major issues which were turning out to being barriers to the adoption and implementation of BIM in construction industries across the world. These barriers could be divided into two groups namely contractual issues as explained by Ashcraft and Esquire (2008), and personnel issues as explained by Ku and Taiebat (2011).

Ashraf and Esquire (2008) have identified certain legal issues that that stand in the way of the full adoption and implementation of BIM. These issues provide headaches with regards to who should be taking responsibility for which parts of the model, as well as the distribution of risk amongst all the professionals within the project team. Because of the above-mentioned challenges, the main research question is to see whether or not BIM’s full integration in the South African construction industry can work in favour of bettering the building practice in South Africa. Therefore, in this research study, the researchers have looked at what
BIM is, the critical barriers to its adoption, and how these barriers can be successfully overcome in the South African construction industry.

**BARRIERS TO THE IMPLEMENTATION OF BIM**

Ashraf and Esquire (2008) have done a lot of research on the barriers to the full adoption and implementation of BIM in construction. And they have listed the following as some of the existing barriers:

**Standard of care of using BIM**
This looks at the inability of the professionals to identify and rectify any physical conflicts (clash detection) that may occur during the project life using BIM. The resulting consequences of such ‘negligence’ may include delays and cost overruns due to reworks that will be required once clashes are detected.

**Design delegation and professional responsibility**
This clause looks to define and identify the roles and responsibilities of the parties involved in the project. The process between design, construct and ownership of the building normally puts the architect and/or engineer as the person with the most responsibility for the model. Alternatively, a new position such as a BIM-modeller can be created (Brewer et al., 2012) to carry out the same responsibilities.

**Intellectual property**
This refers to the challenges that will arise in terms of what is the design and who owns it amongst others. Such problems are only resolved by contractual agreements at the commencement of the design process. Failure to do so may lead to violations because the model holds the parts of the design.

**Insurability**
This relates to who has rights in the model of the project at hand. Hence the rights to the models have to be insured. Insurance brokers involved in the construction industries are yet to allow stable and assured policies with regards to these issues.

**Data translation**
This relates to the sharing/feeding and/or transferring of information into the model. The appropriate interoperability of the information is a fundamental aspect of BIM. The ability for different tools in the model to adequately send and receive information is of utmost importance. The ethics of the professionals plays a role in ensuring the smooth-running of this part of the model.

**METHODOLOGY**

The data used for this paper was derived from both primary, and secondary sources. The primary data was obtained through a structured close-ended questionnaire, and the secondary data was obtained from the
relevant literature that was reviewed by the researchers. A total number of 65 structured questionnaires were self-administered by the researchers directly to individuals in the municipalities of Tshwane, City of Johannesburg, and Ekhuruleni (all in Gauteng, South Africa) who are practicing as Quantity Surveyors, Construction Managers, Architects, Facility Managers, Project Managers, or Academics. The questionnaire was designed based on the information that was gathered during the literature review. A 5-point likert type scale was used for the questionnaires. This scale measured the extent to which the respondents agreed or disagreed with the factors presented to them. A random sampling method was adopted for the purposes of this research. This method was preferred because it gave all the targeted respondents an equal chance and opportunity of being selected.

From all the questionnaires that were sent out; 50 usable questionnaires were returned. This meant that the response rate was at 77%. The data were then analyzed using the Statistical Package for the Social Sciences (SPSS); with the frequencies and mean item scores (MIS), and the standard deviations (SD) of the rated factors being considered. This research was conducted between the months of May and September 2014; with the data collection done between June and August 2014.

The Likert scales were transformed to an MIS for each of the research objectives as applicable. The indices were then further used to determine the rank of each item according the results obtained from the respondents. These rankings made it possible to cross compare the importance of each item to the respondents. The MIS was based on previous studies as conducted by Mukuka et al., (2013) where the ‘MIS’ rating was used. This method was also used for this study to analyze the data collected through the distributed questionnaire. The MIS was calculated from the total of all weighted responses and then it was related to the total responses on a particular option/item on the questionnaire. This was based on the principle that respondents’ scores on all the selected options, considered together, are indices of the relative importance of each of the options. The index of MIS of a particular factor is the sum of the scores that were received from the respondents (on the particular Likert scale of that question) as just a proportion the overall score that all respondents could give to that factor (one to five), which, for the two main questions for this study, mean “Not a barrier (NB)-Extreme barrier (EB)” and “Strongly Disagree (SD)-Strongly Agree (SA)”. The relative index for each item was calculated for each item as follows, after Aigbavboa et al (2013).

Following the mathematical computations, the criteria’s were then ranked in descending order of their relative importance index (from the highest to the lowest). The next section of the article presents the findings of the survey and some discussions.
FINDINGS AND DISCUSSIONS

Biographical data results
Findings from the respondents revealed that 64% of the 50 respondents were male; while 36% were female. Furthermore, 36% were between 20 years and 25 years of age, 28% were between 26 years and 30 years of age, 18% were between 31 years and 35 years of age, 10% were between 36 years and 40 years of age, 4% were between 41 years and 45 years of age, and 4% were between 46 years and 50 years old. Results also showed that none of the respondents were above the age of 55 years old. The results further showed that 42% of the respondents had obtained a Bachelor’s Degree, 38% had a Diploma, 14% had a Master’s Degree, and only 6% had a Matric certificate as their highest educational qualification, 32% were working as Quantity Surveyors, 32% were Architects, 18% were Construction Managers, 12% were Project Managers, 4% were Construction Project Managers, and only 2% were working as Facility Managers. When asked about their years of experience in their field of work, 52% had between 1 year and 5 years, 30% had between 6 years and 7 years, 12% had between 11 years and 15 years, 4% had between 16 years and 20 years, and only 2% had above 20 years of experience; while 32.7% worked for contractors, 28.6% worked for/as consultants, 20.4% represented a client in the private sector, 12.2% represented the government as a client, 2% worked for higher learning institutions, and 4.1% worked for organisations that weren’t listed as one of the available options. All these biographical information were obtained within the three main municipalities of Gauteng; namely Ekurhuleni, Tshwane, and the City of Johannesburg.

Critical barriers to the adoption of Building Information Modelling
When the respondents were asked what they thought were the barriers to the adoption of BIM in the South African construction industry, they identified and ranked a lack of BIM skills development as the main barrier (MIS=3.56, SD=0.675). The results, shown in Table 1 also show that lack of training on BIM (MIS=3.53, SD=0.892, Rank (R) =2), lack of education on BIM (MIS=3.52, SD=0.909, R=3), the unavailability of qualified personnel (MIS=3.42, SD=0.785, R=4), and the lack of expertise on BIM (MIS=3.32, SD=0.768, R=5) are amongst the major barriers to the full adoption and implementation of BIM in the South African construction industry. This is in full agreement with what Ku and Taiebat (2011), Aouad et al (2006), and Arayici et al (2009) who identified personnel problems as the biggest hindrances and barriers to the full adoption of BIM in organisations. The results show that problems arising from contractual issues (MIS=2.74, SD=0.922, R=16), licensing procedures (MIS=2.68, SD=0.935, R=17), and insurance issues (MIS=2.65, SD=0.830, R=18) were the lowest ranked in relation to them being factors inhibiting the full adoption and implementation of BIM in the South African construction industry. The lower ranked factors are also in agreement with Eadie et al (2014) and Ashcraft and Esquire (2008) who said contractual
issues were also barriers in the adoption of BIM globally. However, the results contradict Ashcraft and Esquire’s (2008) conclusion that the contractual issues are among the main barriers.

**Table 1: Shows the potential barriers to the adoption of BIM in the South African construction industry.**

<table>
<thead>
<tr>
<th>BARRIERS TO ADOPTION OF BIM</th>
<th>MIS</th>
<th>SD</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of BIM skills development</td>
<td>3.56</td>
<td>0.675</td>
<td>1</td>
</tr>
<tr>
<td>Lack of training on BIM</td>
<td>3.53</td>
<td>0.892</td>
<td>2</td>
</tr>
<tr>
<td>Lack of education on BIM</td>
<td>3.52</td>
<td>0.909</td>
<td>3</td>
</tr>
<tr>
<td>Unavailability of qualified personnel</td>
<td>3.42</td>
<td>0.785</td>
<td>4</td>
</tr>
<tr>
<td>Lack of expertise on BIM tools</td>
<td>3.32</td>
<td>0.768</td>
<td>5</td>
</tr>
<tr>
<td>Lack of information on BIM</td>
<td>3.20</td>
<td>0.948</td>
<td>6</td>
</tr>
<tr>
<td>Lack of resources needed for BIM</td>
<td>3.14</td>
<td>0.948</td>
<td>7</td>
</tr>
<tr>
<td>Unwillingness to change the traditional way of practice</td>
<td>3.04</td>
<td>0.989</td>
<td>8</td>
</tr>
<tr>
<td>No software interoperability</td>
<td>3.04</td>
<td>0.901</td>
<td>9</td>
</tr>
<tr>
<td>Current contractual systems which do not adequately address</td>
<td>2.96</td>
<td>0.781</td>
<td>10</td>
</tr>
<tr>
<td>issues of control of entry of data to BIM model</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequacies in the standardization of BIM processes</td>
<td>2.94</td>
<td>0.767</td>
<td>11</td>
</tr>
<tr>
<td>Hesitation to learn new technology</td>
<td>2.92</td>
<td>0.932</td>
<td>12</td>
</tr>
<tr>
<td>Culture shock (Contrary to common practice)</td>
<td>2.92</td>
<td>1.057</td>
<td>12</td>
</tr>
<tr>
<td>The common practice of design and drafting separately</td>
<td>2.86</td>
<td>0.756</td>
<td>13</td>
</tr>
<tr>
<td>Current contractual systems which do not adequately address</td>
<td>2.86</td>
<td>0.833</td>
<td>13</td>
</tr>
<tr>
<td>issues regarding model ownership</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of software interoperability</td>
<td>2.86</td>
<td>0.857</td>
<td>13</td>
</tr>
<tr>
<td>Lack of software standardization</td>
<td>2.84</td>
<td>0.817</td>
<td>14</td>
</tr>
<tr>
<td>Current contractual systems which do not adequately address</td>
<td>2.84</td>
<td>0.866</td>
<td>14</td>
</tr>
<tr>
<td>issues regarding the liability for errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of support for BIM from clients</td>
<td>2.80</td>
<td>1.161</td>
<td>15</td>
</tr>
<tr>
<td>Problems arising from contractual issues</td>
<td>2.74</td>
<td>0.922</td>
<td>16</td>
</tr>
<tr>
<td>Current contractual systems which do not adequately address</td>
<td>2.74</td>
<td>0.965</td>
<td>16</td>
</tr>
<tr>
<td>issues regarding omissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problems arising from copyright procedures</td>
<td>2.74</td>
<td>0.986</td>
<td>16</td>
</tr>
<tr>
<td>Problems arising from licensing procedures</td>
<td>2.68</td>
<td>0.935</td>
<td>17</td>
</tr>
<tr>
<td>Problems arising from insurance issues</td>
<td>2.65</td>
<td>0.830</td>
<td>18</td>
</tr>
</tbody>
</table>

**Ways of overcoming the barriers to BIM adoption**

In addition, when the respondents were asked to rate their agreement with the researcher as to which ways would work best in eradicating these barriers, education on BIM came out on top. The result, also shown in Table 2, show that the respondents believe that BIM should be integrated into education courses across all built environment disciplines (MIS=4.52), that BIM skills development programmes should be conducted in the construction industry (MIS=4.32), and that the availability of BIM technology be increased (MIS=4.28).
Table 2: Shows the identified ways of overcoming barriers to BIM adoption in the South African construction industry

<table>
<thead>
<tr>
<th>Ways of overcoming barriers to BIM adoption in South Africa</th>
<th>MIS</th>
<th>SD</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrate BIM into education courses across all built environment disciplines</td>
<td>4.52</td>
<td>0.707</td>
<td>1</td>
</tr>
<tr>
<td>Conduct BIM skills development programmes in the construction industry</td>
<td>4.32</td>
<td>0.844</td>
<td>2</td>
</tr>
<tr>
<td>Establish feasible ways of moving from common practice into BIM</td>
<td>4.28</td>
<td>0.784</td>
<td>3</td>
</tr>
<tr>
<td>Increase the availability of BIM technology</td>
<td>4.28</td>
<td>0.927</td>
<td>3</td>
</tr>
<tr>
<td>Conduct workshops on BIM benefits to create awareness among all the stakeholders</td>
<td>4.24</td>
<td>0.797</td>
<td>4</td>
</tr>
<tr>
<td>Undertake pilot projects to validate and demonstrate the BIM outcomes</td>
<td>4.10</td>
<td>0.839</td>
<td>5</td>
</tr>
<tr>
<td>Improve interoperability of the BIM software with existing applications</td>
<td>4.08</td>
<td>0.922</td>
<td>6</td>
</tr>
<tr>
<td>Communicate lessons learned from the pilot projects to all stakeholders</td>
<td>4.08</td>
<td>0.944</td>
<td>6</td>
</tr>
<tr>
<td>Develop forms of contracts for stakeholders for the use of BIM technology</td>
<td>4.04</td>
<td>0.947</td>
<td>7</td>
</tr>
<tr>
<td>Develop forms of contracts for stakeholders for intellectual property of BIM</td>
<td>4.02</td>
<td>0.958</td>
<td>8</td>
</tr>
<tr>
<td>Improve on BIM software standardization</td>
<td>3.94</td>
<td>0.843</td>
<td>9</td>
</tr>
<tr>
<td>Develop forms of contracts for stakeholders for warranty requirements of BIM</td>
<td>3.94</td>
<td>0.956</td>
<td>9</td>
</tr>
<tr>
<td>Educate government departments on ‘model-based’ deliverables and its benefits</td>
<td>3.94</td>
<td>1.038</td>
<td>9</td>
</tr>
<tr>
<td>Develop forms of contracts for the insurance of BIM</td>
<td>3.84</td>
<td>0.934</td>
<td>10</td>
</tr>
<tr>
<td>Have government enforce the usage of BIM as a primary requirement in the built environment sector</td>
<td>3.72</td>
<td>1.230</td>
<td>11</td>
</tr>
</tbody>
</table>

The results have also shown that the respondents consider the improving of BIM software standardization (MIS=3.94), the developing of forms of contracts for the insurance of BIM (MIS=3.84), and having the government enforce the usage of BIM as a primary requirement in the built environment sector (MIS=3.72) as the lowest ranked. However, it must be noted that although these three are at the bottom of the list, the MIS’s are not too far from those at the top. This explains that any, if not all, these suggested ways to overcoming the identified barriers could have a major impact if they were taken forward and enforced.

CONCLUSIONS

The study has assessed the critical barriers to the adoption and implementation strategies of BIM in the South African construction industry. The findings of the study suggest that the barriers to the adoption in South Africa are similar to those of the first world countries.
The findings reveal that BIM and its tools are used in South Africa, however it has not been exposed to enough people for it to be considered on construction projects in the local industry, with only 38% of the organisations using BIM on often and/or all their projects. The findings further reveal that a lack of skills, education, and knowledge on BIM are the biggest barriers to the full implementation of BIM in the South African construction industry, in addition to that, the results also show that educational and skill development initiatives are widely considered to be the answer to the existing barriers to BIM adoption. Also, increasing the availability of BIM technology to all organisations, and establishing feasible ways of moving away from the common practice (way of doing business) into using BIM on all construction projects have been ranked highly as possible ways of overcoming the identified barriers to the full implementation and adoption of BIM in the local South African construction industry. Therefore, the study's objectives of assessing the critical barriers to the adoption of BIM in the South African construction industry, and to suggest feasible ways of overcoming the berries have been met.

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THEMATIC ANALYSIS OF CHALLENGES FACED BY SMALL AND MEDIUM CONSTRUCTION COMPANIES IN ACCESSING CREDIT IN SOUTH AFRICA

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University of Johannesburg, South Africa

Small- and medium-sized enterprises (SMEs) are considered the engines of growth in developing countries. In developed countries, SMEs have historically played a vital role in creating jobs, spurring innovations, and creating new products, and thus contributed to economic vitality and growth. However, it has been indicated that SMEs faces challenges in accessing credit. The purpose of the study was to provide an overview of the challenges small and medium contractors in South Africa construction industry are facing in accessing credit facilities. The method of the research is based on literature review. A thematic analysis was used to analyse both quantitative and qualitative research projects between 1995 and 2015. The literature revealed that lack of business management skills leads to difficulty in accessing credit, lack of collateral etc……The findings were based on literature review of relevant articles between 1995 and 2015, hence might be biased. The paper suggests that small and medium sized contractors in South Africa are subject to challenges in accessing credit making their growth and being innovative almost impossible. Conclusion: The study sought to explore the challenges and barriers in accessing credit by Construction SMEs in South Africa.

Keywords: small and medium construction company, South Africa, thematic analysis

INTRODUCTION

The objective of this paper is to thematically analyse and present the constraints of accessing credit by the construction small and medium construction enterprises (SMEs) in South Africa. A survey conducted by Financial Service Board (FSB 2012) reported, that 36.2 % of the construction SMEs in South Africa reported that their business closed down due to shortage of working capital. Despite the fact that some of the construction SMEs had operated for some years. Furthermore, the survey also established a meagre, i.e. 5.8 % of the construction SMEs applied for credit.
credit. This suggests that construction SMEs are stifled in accessing bank credit. This gap poses a problem and triggers the need to conduct a review on the challenges of construction SMEs in South Africa in accessing credit. A literature review was administered. The review established the challenges affecting the construction SME accessing credit to be; creditworthiness of the borrower, collateral requirement by the banks, risk default and lack of business plan.

The capacity for SMEs to fulfil their potential in an economy depends on the availability of finance or credit, Turner et al., (2008). Finance in general and credit in particular is especially important for SMEs, since they are unable to finance themselves through retained earnings or equity financing. Despite the fact that credit or financing is a major factors for growth of construction SMEs, a number of studies and government enquiries have mentioned that construction SMEs face problems when accessing credit from financial institutions.

One of the significant characteristics of a flourishing and growing economy is a vibrant and blooming SME sector. Turner et al. (2008) propounds that most of the current multi-million dollar enterprises have their origin in SMEs. Despite the importance of construction SMEs, they are faced with different challenges. SMEs in developed and less developed countries (LDCs), as in other countries, are still facing a number of difficulties and obstacles that are impeding and complicating their operations and growth.. In South Africa access to credit by the construction SMEs is still one of the major challenges, despite the emphasis which is made to increase the availability of credits to the construction SMEs. A report by Fin-Mark (2010) found that up to 32.7% of the construction SMEs mentioned that they lack capital, which is the main problem, while only 10% of the contractors had ever received loans. The main credit source in South Africa is the informal credit market, which provides easier access to credit for construction SMEs, rather than in the formal credit market which have the lending terms and conditions, such as collateral, application procedures as well as the repayments periods (Fin-Mark 2010).

The main objective of this paper is to determine the credit accessibility challenges of small and medium construction enterprises in South Africa.

**PROBLEM STATEMENT**

Small and medium scale enterprises in South Africa have been acknowledged to face many problems in their operations and this was often limited to the absence of a clear vision of the role they played in development of the economy of South Africa and the lack of credible policy framework and distinct interventions to promote the growth and expansion of construction SMEs (Aryeetey et al 1994). Coupled with the absence of clear vision for SMEs, they are further disadvantaged in accessing credit in formal financial institutions. This study seeks to answer three research questions, namely:
Research questions
- What are the sources of credit for the construction SMEs companies in South Africa?
- What are types of sources of credit available to construction SMEs from financial institution?
- What are the financial challenges of accessing credit facilities from the financial institution in South Africa?

Objectives of the study
The specific objectives of the study were;
- To identify the sources of funds/credit for the construction SMEs
- To identify the types of source of credit available to construction SMEs
- To identify the financial constraints faced by construction SMEs in accessing bank credit facilities.

RESEARCH METHODOLOGY
The literature review of scholarly work spanned the period September 1995 to 2015 and was based on a systematic Keyword combination search on the following debasees: UJDigispace/Multidisciplinary, Sabinet/Multidisciplinary, ProQuest MTD, Emerald on Business studies and Entrepreneurship, Scopus/Economics Engineering and Technology, OECDilibray, Oxford journals online and Socio-logical Abstracts.

SEARCH METHOD
The search was conducted by deducing the main keywords and the keyword variables based on the aim of this paper and above stated background. From here the search was continuously expanded with new keyword variables as they appeared throughout the search in the specific databases. Following this, the search was conducted in every single database by searching the main keywords in combination with every single keyword variable. Where the results exceeded 30 hits yet another and keyword variable was added to the search. The review established the challenges affecting the construction SME accessing credit to be; creditworthiness of the borrower, collateral requirement by the banks, risk default and lack of business plan.

Criteria for inclusion
The article had to:
- Be peer reviewed;
- Be written in English
• State an aim, method, results and a conclusion;

Report, investigate or contain results relating to the aim of this literature relating to the aim of this literature review.

LITERATURE REVIEW

Definition of Small and Medium Construction Firm in South Africa
The definitions for the various enterprise categories are given as follows (Republic of South Africa - White paper on national strategy for the development and promotion of small business in South Africa, 1995) and the National Small Business Act (amended 2003).

According to Berry et al., (2009) when defining SMEs it is important to differentiate it from small, micro and medium- sized enterprises (SMME’s). Although both terms are used to refer to small businesses, SMME’s comprises of a wider range of firms, from “established businesses employing over one hundred employees to self- employed owners of informal micro- enterprises”. SMEs form an upper end of the ranges contained by SMME’s; these are larger in size compared to the micro and very small medium sized enterprises.

The definition of small and medium sized contractors can vary from one country to the other. However, the definition used for this research study will be largely based on turnover and the number of permanent employees. Dlungwana et.al. (2002) defines small construction companies in South Africa as those companies with an annual turnover of less than ten million rands (R10 million), while medium contractors have a turnover ranging between ten million rands (R10 million) up to fifty million rands (R50 million). The National Small Business Act No 102, 27 November 1996 (1996) defines small contractors as firms that employ between five (5) and fifty (50) permanent employees, while medium contractors employ between fifty (50) and two hundred (200) permanent employees.

SOURCES AND TYPES OF CREDIT FOR CONSTRUCTION SMES
The sources of finance available to SMEs could be from a variety of sources. These sources can be classified based on a number of factors which includes internal and external, formal and informal. It is also crucial for construction firms to choose the most appropriate source of finance for their several needs as different sources have their own benefits and costs.

There are many ways in which SMEs can be finance which include: Equity Financing method, family and friends, business angels, venture capital, capital markets. This is the act of raising money for company activities by selling common or preferred stock to individual or institutional
investors. In return for the money paid, shareholders receive ownership interests in the corporation. (Schmid, 2001). Equity finance can sometimes be more appropriate than other sources of finance, for example bank loans. In this type of finance there is less cost which means interest is not paid on it. Raising finance through equity require much harder effort as investors need to be convinced of the market potential and of the business and good returns expectations. Equity financing can serve as a powerful tool for small-firm development when used for the true reasons. When a company does not hold a sufficient record of achievement or the collateral needed for a bank loan, and if the owners do not have adequate personal savings, equity financing may be an option when cash is required though a percentage of the ownership and profits is given up. Equity financing is used not only to secure cash, but as well to make key persons committed to the company’s success.

Debt based finance method are those of microfinance banks, Commercial banks, non-bank Intermediaries, Non-Governmental Organizations (NGOs). Debt financing is a loan or direct obligation to pay back to a financial institution of what the firm borrowed. Debt finance exists in various forms and the tenure can be arranged in three principal terms thus, short term, medium term, and long-term debt.

Most traditional lenders prefer manufacturing or industrial operations where funds will be used to purchase fixed assets, like land, buildings or production equipment than construction sector. The benefit of debt financing is that it is finite and the debt is paid over time to a zero sum balance without any further obligation to the lender. The biggest advantage of debt financing is that it allows the firm owner to retain control of his or her company, also interest payments are tax deductible; there is no dilution to existing equity holders. Others are Quasi finance method includes guarantees, performance bonds, tax savings, trade credit finance, factoring and invoice discounting; business angels financing; venture capital funding; and leasing and hire purchase.

**CHALLENGES FACED BY CONSTRUCTION SMES IN ACCESSING CREDIT FROM FINANCIAL INSTITUTIONS**

The challenges that Small and Medium Construction SMEs encounter when trying to access credit can be due to an incomplete range of financial products and services, regulatory rigidities or gaps in the legal framework, lack of information on both the banks and the construction SMEs side, (Ackah and Sylvester 2011). Financial Institution may avoid providing finance to certain types of SMEs, in particular, new business entrants and very young firms that typically lack sufficient collateral, or firms whose activities offer the possibilities of high returns but at a substantial risk of loss. (Uriyo 2004). Kayanula and Quartey (2000) argued that factor like availability and cost of finance are the most common constraints faced.
Other are lack of collateral requirement, Informational barriers, Regulations and rules that impede construction firms access to credit. The legal framework and policies around investment and financial institutions lending are fundamental, lack of access to appropriate technology, weak institutional capacity, lack of management skills and training in the construction firms, lack of proper book keeping etc. The legal and regulatory frameworks that exist in South Africa also fail to provide the right support infrastructure to facilitate construction SMEs lending by the financial institutions. The lack of collateral, lack of proper financial management, lack of fiscal incentives for Construction SMEs, strict prudential regulations which restrict flexibility of financial institutions, unduly complex or onerous administrative procedures and even simply the lack of a consistent definition or enabling law for SMEs are some of the impediments to construction SMEs financing. A large majority of SMEs do not employ a qualified individual to manage their finances and that, compared to other aspects of running the firms, confidence in dealing with financial issues was not high. Lack of adequate management skills, strategic and operational factors further exacerbate the failure of SMEs in accessing credit. Even though construction SMEs tend to attract motivated managers, they can hardly compete with larger firms (Ofori, 2009).

According to studies done by Foxcroft et al. (2002), W, K, Herrington et al. (2008) reported that significantly large numbers of SMEs fail to gain access to credit from financial institution Wood kew, Herrington et al. further explained that bank credit are the most preferred source of external finance by entrepreneurs and a significant proportion of applicants to banks failed to get financed. Another study done by Angela and Motsa Associates (2004) reviewed that entrepreneurs face several problems in their efforts to access credit, particularly from banks. These are lack of collateral security, lack of owner contribution/ owner’s equity, lack of good business plan, high interest rate, location of the business, lack of managerial ability, lack of cash flow statement, lack of information on the cost obtaining the credit, lack of good reference on the integrity, lack of experience and exposure on construction project also cited the firm characteristic was measured by looking at the risk profile of either the business or the individuals who borrowed loan. The loan characteristics was measured by the interest rate and collateral provided by the client.

The observable characteristics were measured by the age of the individual or the business and the credit history of the loan applicants, (Angela et.al 2004).
Discussion on sources of credit for construction SMEs

Friends and Relatives

According to Kuriloff et al. (1993) reported that contributions from friends and relatives are common source of credit, especially for new business since the financial institutions are reluctant to providing funding for start-up business because of the risk involve. This source of funds, however, bears a potentially dangerous price. Many friends’ relatives find it very difficult to stay as passive creditors or investors. They usually try to interfere with policy and operational issues (Kuriloff et al.1993; Longenecker et al. 1994). As a remedy to this problem, Kuriloff et al. (1993) recommended the treatment of such credit like bank loans by putting in writing all the terms including interest rates and payment schedule.

Commercial Bank

According to Hisrich and Peters (1995) make an assertion that commercial banks constitute the most widely used source of debt financing for small companies. This assertion is also supported by longenecker et al. (1994). Again Longenecker et al. (1994) claim that commercial banks loans to small companies are mostly short-term loans, though some do offer long-term loans to small and medium size companies. According to Kuriloff et al. (1993), commercial banks usually provide loans for working capital or for the purchase of fixed assets. They demand evidence of a company’s ability to pay the interest and principal as scheduled. This evidence is usually in the form of cash flows statements. They also demand some form of security. Collaterals are the most widely used form of security demanded by commercial banks. Longnecker et al. (1994) classify commercial bank loans as line of credit and term loans. Longnecker et al further reported that companies can enjoy some form of credit from their business suppliers. This is a very important source of credit, especially for construction SMEs. The suppliers allow the company some time to pay for the supplies. The credit periods varies from a few days to several years according to Broom et al. (1983). Credit from business suppliers may be trade credit or equipment loans and leases. Broom et.al. Further cited trade Credit, saying it basically involves the purchase of goods and services from a supplier on credit. The purchasing firm is given a few days,
usually between 30 and 120 days, to settle the debt (Broom et al. 1983). This type of credit is very important to construction SMEs.

**Types of credit for construction SMEs**
Trade credit, however, is not cost-free. The cost associated with trade credit may not be explicit as interest on bank loans, for instance. Suppliers incur costs by supplying goods on credit and they must recover cost. They usually pass the costs on implicitly as part of the purchase price of the merchandise.

Trade credit may come with an offer of cash discount. A cash discount may be quoted as 3/12 net 40. This means that SMEs has 40 days to pay the full amount but can enjoy a 3 percent discount if payment is done within 12 days. Failing to take cash discount may constitute an opportunity cost of trade. In the above quote, for example, failing to utilize such discount implies borrowing the amount for 28 days (i.e. 40-12) days at 3 percent. Therefore it is important to compare the cost of forgoing a trade discount and the cost of other available short-term credit facilities before decision is made (Moyer et al., 1992; Brealey et al., 2001)

**Personal Resources**
According to Longenecker et al. (1994) observe that personal savings of the owners and partners of businesses constitutes an important source of funds, particularly in the formative stages of a firm. Personal contributions also help to raise additional funds from other sources.

Significant financial commitments made by owners of a company tend to build a lot of confidence among potential investors. Kuriloff et al. (1993) also note other personal resources apart from personal savings. These include borrowing using one’s personal assets such as house and bonds as collateral.

There is a category of private individuals who invest in business ventures. These individuals are referred to as ‘business angels’. Many of such individual investors tend to have some experience in business and/or are affluent professionals, who may have a lot of money to invest. Business angels constitute the informal capital source. They are said to represent the informal capital because there is no formal market place where their investment transactions are carried out. They are usually contacted through dealmakers such as business associates, accountants and lawyers (Longenecker et al. 1994).

**Venture Capital**
According to Stevenson et al., (1999), is a pool of equity capital contributed by wealthy individuals, as limited partners, and professionally managed by general partners for a fee and a percentage of the gain on investments. Thus venture capital firms are investment firms. Owing to the highly risky nature of the investments they undertake, venture capitalists demand very high returns on their investments, with target returns of about 50 percent or 60 percent being considered normal (Stevenson et al. 1999). Tuller (1994) notes that owing to their high expected returns, venture capital companies usually target companies that have prospects of rapid
growth and above average profitability. The targeted companies must also have the prospect of going public in the foreseeable future – usually within five to seven years. Venture capital firms aim to capitalize on initial public offerings (IPOs) and cash in on their investments if prices are substantially above their initial investments in the respective companies. Apart from the provision of capital for very promising business ventures, venture capital firms also provide useful advice to these young enterprises, having acquired much more experience in business. They also provide additional financial assistance in the future if a firm they have invested in runs into financial difficulties. It will not be considered prudent to stand aside and watch their investments go to waste with a firm for lack of cash provided throwing in more cash will not amount to reckless investment (Tuller, 1994; Longenecker et al. 1994). Tuller (1994) summarizes this as future availability of funds can be an enormous boost to achieving long-term strategic goals.

Discussion on factors affecting construction SMEs of credit inaccessibility

Project proposal: For the construction SMEs to qualify for a business loan, financial institutions require detailed information about the business including revenue, profit and expenses. Most of the construction SMEs, lack the ability to formulate a proper project proposal. The literature reviews showed that requirement of project proposal is considered by bank before they can have access to bank loan.

Collateral requirements: Securing borrowers’ property rights to assets they can pledge as collateral particularly help small and medium company to access finance and obtain cheaper and longer-term loans. The use of appropriate collateral is the most common mechanism which is used by the financial institutions so as to reduce the informational problems in financing the construction SMEs. Lending to construction SMEs is backed by collateral so as to reduce moral hazard and adverse selection. Collateral requirements for construction SME loans are higher than for consumer loans, because construction SMEs’ credit risk is usually more difficult to evaluate. The literature review showed that requirement of collateral is generally more stringent and therefore discourages them from borrowing. This is confirms the work by Beck et al. (2004) who found that better protection of property rights increases external financing of small companies significantly more than it does for large companies, particularly due to the differential impact it has on bank and supplier finance.

Bank charges: When banks lend to construction SMEs, they tend to charge them a commission for assuming risk and apply tougher screening measures which drive up cost on all sides. The literature review revealed that financial institutions charge higher interest rates to construction SMEs companies in order to compensate for the higher costs of information collection, the smaller volume of external financing and the greater risk of failure. Construction SMEs are more likely to pay higher interest rates to reflect their comparatively higher risk profile. The study also revealed that
the high bank charges and fees discouraged the construction SMEs from borrowing.

**Savings:** Saving is important for households to weather difficult times, like drought, damage and fire and to plan for the future. The commercial banks are gradually moving away from the highly risky mass markets to individual account holders, whose balance could act as collateral in the event the borrower loses his or her job. Amount of savings usually determines how much is advanced as bank loan. It is important to note that financial lenders perceive that the higher the saving ability, the higher the ability of the customer to repay a bigger bank loan.

**Risk default:** It refers to the failure of the borrowers to repay the loans advanced to them by commercial banks. Commercial banks regard the construction SMEs as high risk borrowers due to perception of a high risk of business failure, their insufficient assets and low capitalizations and vulnerability to market fluctuations. Majority of commercial banks denied construction SMEs credits because of a higher defaulting rate. The banks therefore consider risk default as a major determinant.

**Business plan:** Based on the literature review showed that banks are much more likely to approve a loan when they can see a clear and defined plan for how a business intends to make profit. If an entrepreneur develops a comprehensive business plan at an early stage in the project, the risk perception is reduced and their likelihood of obtaining capital is increased. Plan which is not well thought out will likely be rejected. Based on the literature review at least 85% of the bank considered the factor as major challenges affecting construction SMEs.

**Managerial skills:** Quality of management determines the success or failure of any business. Better management enables businesses to command respect and trust from commercial banks because of their better chances of success and higher profitability for the banks. Studies by Shane and Stuart (2002) and Rudez and Mihalic (2007) positively associate managerial competencies with new venture performance. The higher the level of managerial competency exhibited by the owners of a new firm, the greater the viability and survival of the construction SMEs, the more successful they are in accessing credit. Commercial banks the literature review reported that they considered the quality of management of the construction SMEs before advancing bank loan. This is because constructions SMEs without quality management do not command their respect and trust as they are perceived to have limited chances of success.

**CONCLUSION**

The study sought to explore the challenges and barriers in accessing credit by CSMEs in South Africa. The challenges revealed by the study includes: Inability of CSMEs to provide collateral and other information needed by financial institutions such as audited financial statement couple with the high cost of credit in terms of high interest rates makes it extremely
difficult to access finance. In the light of the key findings, policy actions should include better information provision regarding the various sources of finance. The results of this study revealed low awareness and usage levels of the various financing initiatives among CSMEs. Most of the schemes are perceived as difficult to access. The difficulties CSMEs often face in accessing these credit include: lack of securable assets, lack of knowledge by finance providers about the nature of respondents business, stringent eligibility criteria, lack of knowledge about lending criteria, difficulty in finding out about available finance, and bureaucracy. These really limit CSMEs’ ability to access credit from these initiatives. Suggestions and recommendations for overcoming these challenges and barriers have been provided to management, government and other stakeholders in the built environment and financial sector.

DISCUSSION OF FINDINGS/RESULTS

Based on the findings of the present study, the following recommendations are made:

- To improve easy access to credit, construction SMEs (CSMEs) should endeavour to form strong associations to champion their course since financial institutions (FIs) believe that being in association can help them to get the right information about the firms towards gaining financial assistant, to reduce FIs inability to trace some CSMEs to recover their loans, thereby increasing the risk of defaulting by the firms. This might go a long way to reduce any bad image of CSMEs in credit default.

- The government through innovative initiatives should encourage specific training institutions and NGOs to provide training to CSMEs on entrepreneurial, management skills in areas like negotiation skills, writing good business plans and proposal, effective records keeping, having managerial ability, basic legal training in law of the country, among others.

- Government should institute some form of tax incentives to FIs involved in CSMEs lending. This will encourage other FIs to consider the option of lending to CSMEs.

- CSMEs should also reduce the reliance on banks and take advantage of institutions such as Venture Capital Trust Fund (VCTF) and Micro-Finance and Small Loans Centre (MASLOC) set up by the province to assist them in terms of finance.

- CSMEs are encouraged to adopt sound and rigorous financial management practices in order to reduce loan defaults, financial loss and mismanagement of financial resources that characterize small and medium scale enterprises in general.
• There should be dialogue between CSMEs and the FIs through trade fairs, open days, financial forums that are capable of bring to light the challenges of CSMEs and how they could be addressed effectively.

• Stakeholders in the construction industry should embark on strategic programmes to promote the development of skills in areas of management, technical, book-keeping, advisory to enable the CSMEs run their firms profitably to be able to repay loans.

• Financial Institutions in South Africa are encouraged to rethink and develop more innovative approaches to their requirement for granting financial facilities to CSMEs. Eligibility criteria and accessing credit should be made a bit more flexible to enable more CSMEs to qualify for these credits.

• Establishing of revolving credit by banks and non-bank financial services. Revolving credit is a lending product which enables a company to collect money on credit sales (Ackah at al., 2011). Revolving credit as it is well known will help CSMEs breathe in some air when it comes to the management of their account receivable because it has numerous benefits.

RECOMMENDATIONS

The study has important theoretical and managerial implications. Theoretically, the study provides preliminary evidence on the challenges faced by Construction SMEs in accessing credit from financial Institutions in developing country contexts. It is recommended that government should partner with some of the SMEs in forming public companies. Government could also take over some of these companies and develop them into a full fledged construction firm to boost the construction based of the economy. Also, since the study found that most construction SMEs use their personal savings in establishing their construction firms, which in some cases are inadequate to finance the start-up of the firm, it is recommended that government and other stakeholders should keep developing innovative ways of meeting the problem of inadequate sources of funds for SMEs start-ups.

LIMITATIONS OF THE RESEARCH AND FUTURE RESEARCH

One limitation of this paper is that it uses a relatively literature reviews of CSMEs. It is recommended that future studies should improve upon the literature and use a combination of qualitative and quantitative approach to provide more evidence to support the findings of this study. Future studies could attempt to measure the extent of the accessibility in obtaining credit by CSMEs in South Africa.
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THEORETICAL LINK BETWEEN ORGANIZATIONAL BEHAVIOUR AND COST ADVICE FUNCTION OF QUANTITY SURVEYORS VIA PROJECT TEAMS

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Over the past decades, researches on the accuracy of cost advice have emphasized the technical aspects of early cost advice while focusing on factors that affect the accuracy of the cost advice. However, the softer issues for example, behaviours, which plays significant role in all aspect of human endeavour receives less attention. Organizational behaviour research has established that in today’s competitive and demanding workplace, managers cannot succeed on their technical skills alone. They also need to have good people skill. This paper takes a cue from the fact that the outcome of any endeavour is dependent on the behaviour inherent in an organization. This point to the fact that the outcome of quantity surveyors cost advice is dependent on project team’s effectiveness, rather than on the direct influences of factors that affect accuracy. This work is based on the review of literature and is aimed at establishing a theoretical link to the effectiveness of project teams within client organizations and the cost advice function of Quantity Surveying firms.

Keywords: cost advice, effectiveness, organizational behaviour, quantity surveyor, team behaviour

INTRODUCTION

Potential clients need reliable cost advice (CA) for the evaluation of projects viability as soon as possible, Ashworth (2010) emphasized that Quantity Surveyors (QS) are widely recognised as the most appropriate cost advisers. The CA is primarily crucial at the early stages of project inception. It is at this time that major decisions, often affecting the size and quality of the work, are determined. It is important that the cost advice given be as realistic as possible, so that clients can proceed with the greatest amount of confidence. Akintoye and Fitzgerald (2000) points out that project cost estimating is a multi-disciplinary function, the QS should

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be aware that striving to achieve optimization in cost is a key objective. While all consultants would like to achieve optimization in their own subsystem of activity, it is the performance of all systems acting together that will determine the degree of client’s satisfaction (Ferry, Brandon and Ferry, 1999). This implies that the purpose of the design team cannot be achieved by individual professionals working on their own. Organizational behaviour (OB) is a discipline aimed at improving organizations effectiveness. Kondalkar (2007) defines OB as “a field of study that investigates the impact that individuals, groups and organizational structure have on behaviour within the organization, for the purpose of applying such knowledge towards improving an organizational effectiveness”. OB studies three determinants of behaviour in organizations which includes; individuals, teams, and organizations (structure). To be effective is to produce result that are wanted or intended; producing a successful result; Robins and Judge (2011) affirm that an organization is effective when it successfully meets the needs of its clientele.

Cost is the universal and most highly visible performance metric for indicating project success (Tichacet, 2006). Seeley (1996) makes it clear that it is vital to operate an effective cost control procedure during the design stage of a project in order to keep total cost of the scheme within the building client’s budget. The client expects professional cost advisers to be experts, and will judge them accordingly. Recent organizational theories have attributed performance to organizational behaviour, thus, the outcome expected of any endeavour is dependent on the behaviours inherent in an organization. It has been established that OB studies three determinants of behaviour in organizations which includes; individuals, teams, and organizations (structure). Since QS provide cost advice to organizations while participating in teams i.e. the project team, this paper is limited to OB at the group (team) level. The effectiveness of the cost advice provided by the QS is highly dependent on OB (at team level) within which the QS is engaged. This paper focuses on developing a theoretical link between OB and CA function of the QS via project teams i.e. effectiveness of the project team in providing cost advice.

**COST ADVICE: A TEAM DEPENDENT FUNCTION**

Throughout the developmental cycle the QS will be called on to advice the client on matters of cost, Ashworth (2010) reasons that the CA given should be as reliable as possible, so that clients can proceed with the greatest amount of confidence. Kim (1998) points out that cost of planning which entails the use of cost models not only determines the probable cost of a building, but also helps to control design development thus Cost planning, therefore, should be a process of 'designing to a cost' rather than 'costing a design'. This process of 'designing to a cost' is particularly critical during the briefing stage. It is at this point that probable solutions are identified.
Accurate estimates optimize good contracting as well as the process of calculating and analysing all the costs that will go into a particular job to arrive at a set total. The success or failure of a project is dependent on the accuracy of several estimates done throughout the course of the project (Ahuja, Dozzi and AbouRizk (1994) in Abdal-Hadi and Enshassi (2010). Studies have been undertaken, with a focus on identifying the factors that influence the accuracy of estimating the costs of construction work. Odusami et al. (2008) studied Factors Affecting the Accuracy of a Pre-Tender Cost Estimate in Nigeria and revealed six important factors, based on the construction industry’s experience of the quantity surveyors, which affect the accuracy of a pretender cost estimate. Ashworth (2004) in Kolo (2011) points to the fact that the eventual outcome of the CA function is a reflection of individual circumstance, nature, design and the information available; this Kolo (2011) termed as behavioural variables and further established that evidence does exist in literature that the success of the QS CA function is largely dependent on the behaviours of clients and designers particularly during early stages of construction projects, and considers the success of any cost advice (CA) as the function of the QS to depend on the inputs and reactions of both clients and the design team.

Over the past decades, researchers on the accuracy of cost advice have emphasized the technical aspects of early cost advice, focusing on factors that affect cost advice. Whereas, research in human behaviour and people skills has received relatively less attention. Robins and Judge (2011) points out that over the past three decades, business faculties have come to realize the role that understanding human behaviour plays in determining a manager’s effectiveness, and required courses on people skills have added to many curricula. To this extent, organizational behaviour researchers have come to establish that in today’s competitive and demanding workplace, managers cannot succeed on their technical skills alone. They also need to have good people skills. This paper takes a cue from the fact that the outcome expected of any endeavour is dependent on the behaviours inherent in an organization. Therefore, it argues that the outcome of cost advice is dependent on the effectiveness of the project team rather than on the direct influences of factors that affect accuracy.

**OB AND ITS ATTRIBUTES AT TEAM LEVELS**

The Concept of ‘team’ came in existence along with division of work; a team is an interdependent collection of two or more individuals working for a common goal. To achieve organizational objective the team has to accomplish its objective so that the ‘whole’ is achieved. The same can be achieved by coordinating team activities (Kondalkar, 2007). The Study of human behaviour is very complex. It is affected by various environmental factors. It is based on various cultural factors in which an individual is brought up and various social systems in which he is working. Every individual behaves in a different manner, his behaviour is individualistic in nature, and therefore cannot be changed easily without any strong
stimuli. There exists a cause and effect relationship in individual behaviour (Kondalkar, 2007). Robin and Judge (2013), taking a systematic approach to uncover important facts and relationships and provide a base from which to make more accurate predictions of behaviour. Underlying this systematic approach is the belief that behaviour is not random. Rather, we can identify fundamental consistencies underlying the behaviour of all individuals and modify them to reflect individual differences. These fundamental consistencies are very important because they allow predictability; Behavior is generally predictable, and the systematic study of behaviour is a means to making reasonably accurate predictions. The contribution of people in a team is more than the sum total of individual contribution made to the organization. Study of team behaviour is carried out under several concepts like: group dynamics, group decision making, power politics, leadership inter-group and intra-group behaviour, conflict management. All these variables are studied so that the energies and skills are diverted towards enhancing effectiveness in the organization (Kondalkar, 2007).

FACTORS AFFECTING TEAM BEHAVIOR

Researching on factors affecting multifunctional teams in innovation processes, Shen (2002), established the following as the characteristics of effective teams: Inspired leadership, Specific, quantifiable goals, Commitment and loyalty, Effective communications, Achieve small victories along the way, Think competitively, Open minded and progressive thinking, Recognize superior performance. In the Creation of Effective teams, Chow, Then and Skitmore (2004), came to a conclusion that the most common underlying features for successful implementation of teamwork are: Keep focus, commitment to team objectives or shared common goals, respect and consideration of others, interdependence or diverse individual concentrating on common effort, the ‘We’ mentality, cohesiveness or unified commitment, trust among team members, mutual understanding or mutual trust, a positive ‘can do’ attitude, enthusiasm or strong member participation. Khalid (2011), in considering Factors affecting group effectiveness agrees that there are many factors which influence the group performance and organizational goals. These factors can easily affect the functioning of the group whether these are formal or informal group.

The most important factors in the behaviour of groups as indicated by Cole (2005), includes; nature of task, size, leadership, environment, individual roles, cohesiveness, group norms, nature/motivation. Pulling our attention to Meetings, Gorse et al (2006), points out that meetings are used to bring together key individuals to exchange information and possibly make decisions. It is generally accepted that for a meeting to realize its potential members must be willing to express their views and opinions in an open environment. Yet, interaction is rarely open and evenly distributed and members may unknowingly present barriers that prevent their colleagues’
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effective contribution. In the Creation of Effective Teams Robins and Judge (2013), draws attention to the fact that many have tried to identify factors related to team effectiveness. However, some studies have organized what was once a “veritable laundry list of characteristics” into a relatively focused model. Figure 1 below summarizes what is currently known about what makes teams effective.

In the study of this model, two points should be noted. First, teams differ in form and structure. The model attempts to generalize across all varieties of teams, but avoid rigidly applying its predictions to all teams. Second, the model assumes teamwork is preferable to individual work. Creating “effective” teams when individuals can do the job better is like perfectly solving the wrong problem. The key points of effective teams can be organized into three categories: context, composition and process (Robins and Judge, 2013).

![Figure 1 Team effectiveness model](Source: Robin and Judge (2013))

**RELATIONSHIP BETWEEN QS ADVICE AND TEAM BEHAVIOR**

On factors affecting Team Behavior, it has been established through literature that there are several factors that affect Team Behavior. For the purpose of this paper, and in other to draw a conclusion and narrow down these reviewed factors, Robins and Judge’s (2013) model on team effectiveness as shown in the figure 1.0 has been adopted.
A dependent variable is the key factor that you want to explain or predict and that is affected by some other factor. Team outcomes are the key variables that you want to explain or predict, and that are affected by some other variables. Scholars have emphasized outcomes at team-level to include team cohesion and functioning as the dependent variables (Robins and Judge, 2013), this in turn, influences the effectiveness of teams at providing QS CA; these outcomes are affected by factors. The model below, gives a summary of the OB at team level and its link to team effectiveness.

Ashworth (2008) in Kolo (2011) have pointed out that the construction industry is made up of complex links of relationships and interaction in order to meet up the requirement of its clients to employ a range of different professional advisers to advice on funding, design, cost, construction, letting. Ferry, Brandon, & Ferry (1999) affirms that in the formulation of the brief, the QS should be co-operating, preferably on a team basis, with:

- Those professionals concerned with the actual building design
- Representative of the client’s organization or the client’s project managers
- Valuation surveyors, accountants, and possibly planners

As the design team work towards getting a satisfactory design, the QS becomes more involved with the designer and the design consultants, including perhaps a construction planner (Ferry, Brandon, & Ferry, 1999). In this light, this paper categorizes team level behaviour into client’s organizational related behavioural factors which is the factors that affect the support the design team gets from the client organization, and design team behavioural factors. These two categories, determine team cohesion and functioning. Kolo (2011) opined that the success of cost advice (CA) a
function of the QS depends on the inputs and reactions of both clients and members of the design team.

TEAM SUPPORT FROM THE CLIENT ORGANIZATION

Whether public or private, the client organization is the prompting stakeholder that gets the project financed, designed and built. In line with the organizational behaviour research and models, the support the client organization renders the team i.e. the extent to which the leadership of the client organization enables the team to perform effectively, includes four contextual factors comprising; adequate resources, effective leadership, a climate of trust, and a performance evaluation and reward system that reflects team contributions. These contextual variables influence the team’s behaviour (team cohesion and team functioning) are discussed below:

**Adequate Resources**

Teams working on construction projects are part of the larger client organization system; every work team relies on resources outside the group to sustain it (it becomes the responsibility of the client organization to ensure that these resources are adequately provided). A scarcity of resources directly reduces the ability of a team to perform its job effectively and achieve its goals (Robins and Judge, 2013). We must recollect that the client is the key member of any team engaged in a construction project and will need to establish means of acting efficiently within the team to ensure the success of the project. It is his responsibility to ensure that timely and adequate information needed, proper and adequate equipment, adequate staff, encouragement, and administrative assistance is provided to the team of professionals, which is required to carry out its functions in line with laid down goals and objectives upon which they are commissioned.

**Leadership and Structure**

Agreeing on the specifics of work and how they fit together to integrate individual skills require leadership and structure. According to Robins and Judge (2011) reliable leaders (the client organization i.e. within the construction context) share information, encourage open communication, and stick to their ideals, if this is done, Robins and Judge (2011) apply that the team come to have faith in the leader. Thus on construction projects, it is paramount for the design team to get strong leadership from the client organization for optimal effectiveness. This is achieved by ensuring; clear outline of work specifics, effective leadership delegation were appropriate, review and clarifications on project deliverables, effective facilitation, policy direction, support for the development and review of critical decision, support for the development of appropriate and adequate scope, schedule, and budget parameters, the meeting of deadlines, exercise of mutual trust, respect for ideas and regard for professionals' feeling, expression of appreciation. However, Alexander (1985) believes that no one person can be expected to perform all these
required leadership functions effectively all the time. And has emphasized that teams perform better when all members perform and accept responsibility for both task and maintenance functions. Task functions includes; initiating discussions or actions, clarifying issues and goals, summarizing points, testing for consensus, and seeking or giving information. Alexander (1985) believes these are things necessary to do the job, and maintenance functions includes; encouraging involvement and participation, sensing and expressing group feelings, harmonizing and facilitating reconciliation of disagreements, setting standards for the group, and “gatekeeping” or bringing people into discussions, these he believes are things necessary to keep the team together and interacting effectively.

**Climate of Trust**
Alexander (1985) has pointed out that people do not automatically work well together just because they happen to belong to the same work group or share the same job function. Members of effective teams trust each other, they also exhibit trust in their leaders. Robin and Judge (2013) have emphasized trust as the foundation of leadership with the consequences of trust being; to encourage risk taking, facilitate information sharing, develop added team effectiveness, and enhance productivity. For a client organization to exhibit trust, it is expected for it to exercise; Integrity which entails Honesty and truthfulness; having consistency between what he says and does, Benevolence which is the display of caring and supportive behaviour and ability which proves the client organization to have technical and interpersonal knowledge and skills.

**Performance Evaluation and Reward System**
Individual performance evaluation may interfere with the development of high performance teams (Robins and Judge, 2013). It important for client organizations to put in place measures to get design teams individually and collectively accountable so as to reinforce team effort and commitment.

**PROJECT TEAM COMPOSITION AND PROCESSES**
The team must in composition and processes ensure excellent behaviour that would ensure team functionality and cohesion leading to an effective outcome, in line with this, some of the variables at this level include:

**Ability of members**
Part of a project team’s performance depends on the knowledge, skills and abilities of its individual members. Robins and Judge (2013) brings to light three different types of skills including; technical expertise which is ability to apply specialized knowledge or expertise, problem solving and decision making skills which deals with identifying problems, generating and evaluating alternatives and making competent choice and interpersonal skills which involves; good listening, feedback and conflict resolution. To ensure effectiveness, the ability of the team leader matters, smart team
leaders help less-intelligent members when they are struggling on a task, but less intelligent team leaders can neutralize the effect of high ability team.

**Personality of Members**

Personality significantly influences individual team member’s effectiveness (Robins and Judge, 2013). Each individual brings to the team a unique personality and position which reciprocally affects team function (Mapel, 1987) in (Mickan and Rodger, 2000). From the big five personality model; literature identified three significant dimensions which were adopted for this paper, firstly, conscientiousness which entails that each project team member should be responsible, dependable, persistent and organized in behaviour, secondly, openness to experience signifies being imaginative, sensitive and curious in behaviour and thirdly, agreeableness finally involves being good natured, cooperative, and of a trusting behaviour (Robins and Judge, 2013).

**Allocation of Roles**

Teams have different needs, and members are selected to ensure all the various roles are filled. There are two identified dimensions under allocation of roles to influence design team effectiveness. The first conveys that the work assigned to each professional, fits preferred style, and that each member of the team proves to be able, experienced, and conscientious in assigned role. Mickan and Rodger (2000) point out that although individual contributions are not normally considered antecedent conditions, they can be perceived as per-requisite characteristics of effective teamwork.

**Diversity of Members**

Several researchers hold the view that that diversity should be a good thing, the idea is that diverse teams should benefit from deferring perspective and do better (Robins and Judge, 2011). He further exerts that one of the pervasive challenges with teams is that while diversity may have real potential benefits, a team should be deeply focused on commonly held information, to realize their creative potential, diverse teams need to focus not on their similarities but on their differences.

**Size of Teams**

When teams have excess members, more people communicate less. Members will have trouble coordinating with one another especially under time pressure. Robins and Judge (2013) suggest that the smallest number of people who can do the task should be used on teams.

**Member Preferences**

Not every professional is a team player, some professionals, if given an option, would prefer to opt themselves out of team participation and work alone. Robins and Judge (2013) suggests that, when selecting teams, members making up the team should be people who prefer to work as part of the group.
**Common Plan and Purpose**
Commitment to a unified set of team goals and values provide direction and motivation for individual members (Mickan and Rodger, 2000). Effective teams begin by analyzing the team’s mission, developing goals to achieve that mission and creating strategies. Teams that establish clear sense of what needs to be done and how, consistently perform better (Robins and Judge, 2013).

**Team Efficacy**
Effective teams exercise confidence in themselves; they believe they can succeed; the team should share a common belief that it is the best to deliver the given coordinated service to the client organization. Bassoff (1983) in Mickan and Rodger (2000) asserts that committed individuals should be more willing to invest personally in the team, contribute to the decision making and respect the balance of interdependence and collaboration.

**Mental Models**
Effective teams share accurate mental models, knowledge and beliefs about how the work gets done (Robins and Judge, 2013). If team members have different ideas about how to do things, the team will fight over how to do things rather than focus on what needs to be done. Teams need to harness the variety and minimize the differences of members, to ensure that expert skills and knowledge are utilized (Mickan and Rodger, 2000).

**Conflict Levels**
Team conflict can be both creative and destructive. There are two levels of conflict first there is the relationship conflict and task conflicts (Robins and Judge, 2013). Conflicts on teams are not necessarily bad, teams completely devoid of conflicts are likely to become apathetic and stagnant but this depends on the kind of conflict. Task conflicts, can stimulate discussions, promote critical assessment of problems and options, and can lead to better team decisions but relationship conflicts which is based on interpersonal incompatibilities, tension, and animosity towards others area almost always dysfunctional (Robins and Judge, 2013). Thus it is important that the client organization and professionals proffer ways of resolving conflicts as this alone can create the difference between effective and ineffective teams.

**Social Loafing**
Robins and Judge (2011) have proffered that individuals can engage in social loafing because their particular contribution cannot be identified. Effective teams can undermine this tendency by making members individually and collectively accountable for the teams’ purpose, goals, and approach. Consequently team members should be clear on what they are individually responsible for and what they are jointly responsible for on the team (Robins and Judge, 2013).
DISCUSSION

The two behavioural outcomes (dependent Factors) as shown by the figure 2 include team functioning and team cohesion, Dudovskiy (2013), has asserted that team cohesion can be explained as the level of attractiveness of the team to its members and is a major factor impacting team functioning. It has been established by Egbu and Gorse in Gorse et al (2006) that cohesive teams, with strong social relationships, are more effective than teams that do not have such interpersonal ties; yet if teams become too close, their task-based interaction may be hindered by social distraction. Teams can benefit from the collective abilities of different perspective offered by its members, but only if members are allowed to express their ideas and concerns. A team is said to be effective only to the degree to which it is able to use its individual and collective resources. The measure of a teams’ effectiveness is its ability to achieve its objectives and satisfy the needs of the individuals on the team.

The building design process is a complex interaction of skills, judgment, knowledge, information and time, which has its objective the satisfaction of the client’s demands for shelter, within the overall needs of society. Clients must be concerned with developing a more cohesive and cooperative relationships between professionals and the team within which they are appointed to function. It is not possible to place all the responsibility for establishing a successful cost solution on the shoulders of the Quantity Surveyor, other members of the design team must cooperate in, and contribute to, the cost planning process. Thus, the figure 3 above provides a summary of the link that exists between organizational behavior, the client organization, the design team and the cost advice service of the QS.
CONCLUSION

Effective teamwork is essential for the successful accomplishment of any construction project. The team objectives being to effectively deliver on terms assigned by the client organization which usually includes; to deliver a project on time, on or under budget, profitable to all team members, void of claims and results in a satisfied client.

Cost advice has been considered as both an art and science and with project cost estimation process being a multi-disciplinary function. It is required that Quantity Surveying firms provide cost advice to client organization(s) while participating in teams. The effectiveness and the eventual outcome of the team process leading to the cost advice provided by the Quantity Surveyor to clients is a reflection of individual circumstance, nature and design information etc.

Robins and Judge (2013) team effectiveness model which gives a focused summary of factors that influence team effectiveness and organizes the key components of effective teams into three categories of; contextual factors (team support from the client organization) that make teams effective (adequate resources, effective leadership, climate of trust, and performance evaluation and reward system, team’s composition (ability of members, personality of members, allocation of roles, diversity of members, size of teams member preferences) and team’s process (common plan and purpose, specific goals, mental models, conflict levels, and social loafing).

The review of literature has attempted to establish that effective team work and team building are crucial to the success of the cost advice function of the Quantity Surveyor to client organization. The team’s support from the client organization; provides that the client organization needs to play a leadership role in fostering and maintaining the team environment, since building and maintaining the team is in each member’s best interest. Methods of team building begin with the provision of adequate resources, leadership and structure, climate of trust, and a performance evaluation and reward system.

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USE OF COCOA BEAN SHELLS ASH AS A STABILIZER IN SOIL BRICKS PRODUCTION

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Over the years, soil bricks have been stabilized to improve its properties for masonry purposes. Most of these stabilization methods have been regarded as unsustainable as the stabilizers are uneconomical. A study was conducted to determine the suitability of using Cocoa bean shells ash (CBSA) as a stabilizer in soil bricks production. Seven levels of stabilization were adopted which ranged from 0% to 30% at intervals of 5%. A total of 126 bricks were produced with dimensions; 210mm × 105mm × 75mm. Soil bricks were tested for their compressive strength, abrasion resistance and water absorption property alongside density after 28 days curing age. Data from the study showed that the cocoa bean shell ash had a significant effect on the properties of the bricks. The compressive strength of the soil bricks ranged between 4.084N/mm² and 6.506N/mm² above the BSI 1985 minimum requirement for masonry units of 2.8N/mm² with the optimum strength obtained with 20% CBSA. The ability of the bricks to absorb water (water exclusion coefficient) and wear (abrasion coefficient) both showed significant improvements as the quantity of Cocoa beans shell ash increased. Although Soil bricks stabilized with CBSA were recommended for use as interior partition units where it is protected from moisture, bricks performed satisfactorily as masonry units especially when stabilization quantity does not exceed 20% by weight.

Keywords: cocoa bean shell ash, soil bricks, stabiliser, water absorption

INTRODUCTION

Adequate shelter is one of the most important basic human needs, yet 25 percent of the world’s population does not have any fixed abode (International Labour Organisation, 1987). In Ghana, and most Sub-Saharan countries, housing is one of the most cherished properties to

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acquire. Even though most individuals would prefer to own a house, this dream has always been hindered predominately due to the high cost of building materials as most of the conventional building materials are imported coupled with scarcity of these materials. This has necessitated the need to research into the use of alternative indigenous materials suitable for the construction of functional but also low-cost dwellings both in the urban and rural areas of Ghana. One way of ensuring a sustainable environment and efficient use of resources is the promotion and subsequent use of locally available building materials like earth bricks although it has been used in the construction of different magnitude of structures since pre-colonial days. These earth bricks are simply soil moulded in the form of bricks. Soils according to Walker (1997) is rich in iron oxide and is usually derived from rock weathering under strongly oxidising and leaching conditions. It forms in tropical and sub-tropical regions where the climate is humid.

The use of soil bricks for building purposes have been with us for long although its engineering properties have been criticized as being deficient. According to Ghomari (1989) researchers are constantly studying how the life span of soils bricks could be judiciously improved for economic reasons as it is readily available with an incredibly low procurement cost. Rigassi (1995) reiterated that, different stabilisation techniques could be used to improve the engineering properties of soil for building applications. Furthermore, Adam and Agib (2001) pointed out that stabilisation of soil can improve the compressive strength of a soil by as much as 500% with other supplementary characteristics such as; increased cohesion, reduced permeability, improved water repellent, increased durability, and minimal shrinkage and expansion of soil during dry and wet conditions. As a result, various materials have been used as stabilisers including cement (Alayaki and Bajomo, 2011), lime (Mtalib and Bankole, 2011), Bitumen (Adam and Agib 2001) among others. In recent times, there has been a shift in the materials used as stabilisers as researchers have developed interest in agricultural wastes and by products such as rice husk ash (Alhassan, 2008), corn husk ash, sugar cane bagasse ash, wheat husk ask as these materials are believed to contain pozzolanic properties due to the presences of the silica, iron, aluminium or calcium oxides in substantial quantities.

One agricultural by-product found to exhibit such cementitious properties due to the presences of iron compounds is the ash of cocoa bean shells residues, which are used as fuel for the boiler as an alternative energy source (Amankwah, 2013). Cocoa bean shell (CBS) is an industrial lignocellulosic waste material produced at cocoa and chocolate factories which forms 12-14% of the roasted cocoa bean (Aina, 1998). According to Olupona et al. (2003) the dried CBS contains 13.12% crude protein; 13.00% crude fibre; 8.71% ether extract and 9.15% ash. Over the years, these residues are produced in large quantities by the cocoa and chocolate processing industry in Ghana with dying consequence as their improper disposals which are mainly dumping or burning have led to environmental pollution.
This study sort to examine the suitability of using cocoa beans shell ash obtained from a local cocoa processing factory as a stabiliser in the production of compressed stabilised earth bricks for masonry purposes.

EXPERIMENTAL STUDIES

The materials used in the production of the bricks in this study consisted of earth, water and the ash of cocoa beans shells which has been described below.

Cocoa beans shell
The cocoa bean shell ash used as a stabilizer in this study was sourced from Real Product Ghana Limited in Apowa, Takoradi a cocoa processing factory. The cocoa beans shells which is the residue after the extracting the cocoa products (cocoa butter and powder) are used to fuel the boiler as an alternative energy source thereby yielding the ash (shown in Figure 1) which was naturally fine necessitating no sieving.

Soil
The soil used was obtained from Whindy-Ridge in Takoradi. Scraping the topsoil which harboured plants before digging the sample. The soil sample was then sieved through a 10mm sieve mesh which ensured the removal of cobbler and stones from the soil before classification tests were conducted as per BS 1377 (1990). Sample of the soil were randomly selected to determine its engineering characteristics as per BS 1377 (1990). The results of these tests have been presented in Table 1.

Water
Drinkable tap water devoid of contaminants was used in this study.

Moulding and Curing of Soil bricks
Using moulds dimensions of 200mm × 100mm × 75mm, a total 126 bricks were produced. The cocoa bean shells ash was added by weight of the soil in variations from 0% to a maximum of 30% in steps of 5%. These were
designated as $A_0$, being the control, $A_5$, $A_{10}$, $A_{15}$, $A_{20}$, $A_{25}$ and $A_{30}$ which represent soil with 5%, 10%, 15%, 20%, 25% and 30% cocoa bean shells ash addition respectively. Sample specimen were compacted using a hand-made bricks moulding machine such that it could be easily replicated by the indigenous people. Moulded soil bricks were stored in the laboratory with a temperature ranging between 25°C and 30°C and a minimum humidity of 70% but covered with polyethylene sheets for 28 days. This was done to prevent rapid evaporation of moisture which causes dry shrinkage and undesirable cracks on the bricks due to the harsh weather conditions at the time of production.

Figure 2. Soil

Tests on Soil bricks

The properties of the compressed stabilized soil bricks were studied after 28 days. Randomly selected soil bricks were oven-dried at 40°C until a constant mass were obtained after weighing. The mass of a brick was considered constant when the difference in mass between two (2) weighing at a 24 hours interval were < 0.1 % of the initial mass. Soil bricks were then left in the open to ambient air to cool down before investigating their properties. The properties of the soil bricks studied were dry density, compressive strength, water absorption and abrasion coefficients. These properties according to Yalley and Asiedu (2013) give substantial data on the performance of compressed stabilised bricks whilsts affecting other properties. Experimental studies were done in accordance to Centre for Development of Enterprise Guides (2000).

The compression test was done using an ADR 2000 Compressive strength machine. The abrasion resistance was determined by subjecting the selected bricks to mechanical erosion by brushing with a stiff wire brush. Bricks were initially weighed ($M_1$) before being brushed at a constant pressure in turns with wire brush at one forward and backward motion for 60 cycles on the face of the bricks using a setup as shown in Figure 3.
Figure 3. Set up for determining the Abrasion Resistance of the Soil Bricks

The coefficient of water abrasion resistance was determined using the formulae in Equation 1 below.

\[ C_a \text{(cm}^2/\text{g}) = \frac{S}{M_1 - M_2}, \quad \text{(Equation 1)} \]

Where; \(S\) is the bushed area, whiles \(M_1 - M_2\) is the mass (in grams) of abraded materials.

The coefficient of water absorption by capillarity rise on the other hand was measured by the increase in weight of soil bricks when immersed in 5mm depth of water for 10 minutes as shown in Figure 3 below and deduced from the formulae in Equation 2.

\[ C_b \text{(g/cm}^2/\text{min}) = \frac{100 \times (M_1 - M_2)}{S \sqrt{t}}, \quad \text{(Equation 2)} \]

where; \(M_1 - M_2\) is the mass of water, in grams (g), absorbed by the brick, \(S\) is Surface area of the submerged face, in square centimetres (cm\(^2\)) and \(t\) is duration of time of the immersion of the brick, in minutes (min).
RESULTS AND DISCUSSIONS

The Natural Properties of the Soil
The soil was found to have an appreciable mixture of clay, silt and sand and gravels as proposed by Minke (2006) as presented in Table 1 and Figure 5 below. The clay particles which act as the binder was found as 24.21% consistent with a recommendation proposed by Aysen (2005) that the minimum clay content of 10% which is suitable for stabilised bricks. The silt content of 22.32% and a sand and gravel content of 53.47% also fell within the criteria suitable for rammed earth given by Norton (1997).

<table>
<thead>
<tr>
<th>Soil Properties</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle size</td>
<td>( C_c = 0.714; C_u = 17.173 )</td>
</tr>
<tr>
<td>Soil description</td>
<td>Coarse-grained soil with little fines</td>
</tr>
<tr>
<td>Natural moisture content</td>
<td>10.9%</td>
</tr>
<tr>
<td>Organic matter content</td>
<td>1.7%</td>
</tr>
<tr>
<td>Specify gravity</td>
<td>2.76%</td>
</tr>
<tr>
<td>Free swell index</td>
<td>3.44%</td>
</tr>
<tr>
<td>Shrinkage limit</td>
<td>6.96%</td>
</tr>
<tr>
<td>Clay content</td>
<td>24.21%</td>
</tr>
<tr>
<td>Silt content</td>
<td>22.32%</td>
</tr>
<tr>
<td>Sand/Gravel content</td>
<td>53.47%</td>
</tr>
<tr>
<td>Liquid limit</td>
<td>56.60%</td>
</tr>
<tr>
<td>Plastic limit</td>
<td>26.6%</td>
</tr>
<tr>
<td>Plasticity index</td>
<td>30%</td>
</tr>
<tr>
<td>Optimum moisture content</td>
<td>19.80%</td>
</tr>
</tbody>
</table>

The specific gravity of the soil which was 2.76 was found to be in the range of 2.55 and 4.6 as recommended by Magnien (1966) for lateritic soils as suitable for the production of soil bricks for masonry wall units. The particle size distribution on the natural soil revealed a uniformity
coefficient (Cu) and coefficient of curvature (Cc) of 17.17 and 0.71 respectively which Viswanadham (2003) described such soils as a coarsely-grained soil with little fines. The organic matter content was 1.7% which according to Houben and Guillaud (1984) would not have any effect on the characteristics of the natural soil as it is below 2%. With a shrinkage limit of 6.96%, the soil used in this study was suitable for the production of compressed stabilized bricks.

![Plasticity Chart of Natural Soil](image)

**Figure 5 Plasticity Chart of Natural Soil**

**Results on Cocoa Bean Shell Ash**

The chemical composition of the cocoa bean shells ash was carried out using an energy-dispersive polarizing X-ray fluorescence (XRF) spectrometer (SPECTRO X-LAB 2000). This analysis was performed at the Ghana Geological Service. The result of the chemical composition on the cocoa bean shells ash is shown in Table 2.

<table>
<thead>
<tr>
<th>Oxides Present</th>
<th>Quantity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica Content as (SiO₂)</td>
<td>2.88</td>
</tr>
<tr>
<td>Magnesium as (MgO)</td>
<td>15.20</td>
</tr>
<tr>
<td>Aluminium as (Al₂O₃)</td>
<td>1.50</td>
</tr>
<tr>
<td>Calcium as (CaO)</td>
<td>3.57</td>
</tr>
<tr>
<td>Iron as (Fe₂O₃)</td>
<td>0.35</td>
</tr>
<tr>
<td>Sulphate as (SO₃)</td>
<td>3.83</td>
</tr>
<tr>
<td>Potassium as (K₂O)</td>
<td>44.45</td>
</tr>
<tr>
<td>Phosphorus as (P₂O₅)</td>
<td>14.05</td>
</tr>
<tr>
<td>Chlorine as (Cl)</td>
<td>0.10</td>
</tr>
<tr>
<td>Manganese as (MnO)</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Tests on Stabilised Bricks
The properties studied were; density, compressive strength, abrasion coefficient, and water capillarity rise for each batch after 28-days of curing age.

Density
The average compressive strength of the soil bricks ranged between 2167kg/m$^3$ and 1889kg/m$^3$ as depicted in Figure 6. The dry densities of the soil bricks were within the range of 1200kg/m$^3$ and 2400kg/m$^3$ posited by Morton (2007) as suitable for masonry units. With an F-value of 24.56, the data showed variability between the different levels of stabilization indicating influences caused as a result of the stabiliser (cocoa bean shell ash) at 5% significant level.

![Figure 6 Relationship between the Density and CBSA](image)

A regression analysis conducted on the data gave the model; \( Y = 950.02X + 1877.9 \), where \( Y \) represent the mean density whiles \( X \) represents the cocoa bean shell ash (CBSA) as shown by an R-Squared of 0.729. This indicate that the CBSA had a relatively strong positive influence on the densities of the soil bricks.

Compressive Strength of the Soil Bricks
Considered as one of the most essential property of masonry units the compressive strength of the compressed stabilised bricks ranged between 4.084N/mm$^2$ and 6.506N/mm$^2$ as shown in Figure 7 below. Generally, the compressive strength of the bricks were above the minimum strength of 1.4N/mm$^2$ and 2.8N/mm$^2$ required for the construction of load bearing walls for one and two-storeys respectively according to Martirena et al. (1998).
Soil bricks with no cocoa bean shell ash had the least average strength of 4.08 N/mm² whiles bricks stabilized with 20% cocoa bean shell ash had the highest average compressive strength of 6.51 N/mm².

Data analysis showed an increase in the strength as the cocoa bean shell ash increased from 0% to 20% where it reached its peak of 6.51 N/mm² after which the compressive strength of the stabilised soil bricks declined to 5.15 for soil bricks with 25% stabilisation and a further dip to 4.83 N/mm² for soil bricks stabilised 30% cocoa bean shell ash.

As a strong indicator of the compressive strength of masonry units, the dry densities of the soil bricks positively correlated with the compressive strengths of the soil bricks as a Pearson correlation of \((r = 0.877, p = 0.01)\). In other words, as the quantity of the CBSA increases there was an increase in both the compressive strengths and the densities of the soil bricks affirming prepositions by Walker (1997) and Bahar et al. (2004) that the density have a tremendous effect on other masonry properties.

![Figure 7 Relationship between Compressive Strength and CBSA](image)

The increasing compressive strengths as the CBSA increases was consistent with studies (Yalley and Asiedu, 2013; Okoli and Zubairu, 2002) conducted on some agricultural wastes ash used as stabilisers. This occurs due to the presence of silica and other crucial compounds present in the CBSA and the natural soil which improves the bonds existing between the soil particles confirming studies conducted on stabilising materials (Olaoye and Anigbogu, 2000; Ogunbode and Apeh, 2012).

**Water Absorption by Capillarity**

With an absorption coefficient of 19.61 g/cm² mins soil bricks with no stabilisation recorded the highest absorption capabilities. The water absorption capabilities of the soil bricks reduced to 15.59 g/cm² min for soil
bricks stabilised with 10% of cocoa bean shell ash before declining drastically to 6.01 g/cm²min when the ash content was increased to 15%. A further reduction was found as the absorption coefficient of 3.79g/cm²min was recorded for bricks with 30% addition of the stabiliser as depicted in Figure 8 below.

The results obtained also showed a high variability between the individual groups than within groups showing that the significant differences found in the results were as a result of the effects of the stabiliser (CBSA) with an F-value of 71.87. A regression analysis gave the model; $Y = -59.25x + 19.088$, with an R-Squared of 0.8744, where Y represent the absorption coefficient whiles X represents the cocoa bean shell ash (CBSA). Deduction shows that the CBSA had significant effects on the soil bricks as it was able to predict 87.44 of the variations in the absorption coefficients of the bricks.

![Figure 8 Relationship between Water Absorption Coefficient and CBSA](image)

The inclusion of the cocoa shell ash had significantly influenced the water absorption property of the soil bricks confirming an earlier preposition made by Adam and Agib (2001) that, the amount of stabilisers influences the water absorption properties of soil bricks. This decrease in permeability according to Yalley and Asiedu (2013) is as a result of the reduction of pore spaces as the finer particles of the cocoa shells ash fill the voids thereby drastically reducing the flow of water within the soil bricks. This property of the CBSA according to Adam and Agib (2001) creates a compacted matrix; thereby inhibiting the free movement of the water molecules is considered an important criterion in the properties of soil bricks. Deducing from the results, soil bricks with low water absorption coefficients could be achieved with high amounts of the cocoa shells ash.
Abrasional Resistance
The average abrasion coefficients of the soil bricks was analysed as described in above. Soil bricks stabilised with 20% cocoa shell ash recorded the highest abrasion coefficient of 1.333cm$^2$/g, whiles bricks with the least abrasion resistance occurred at 0% level of stabilisation with an abrasion coefficient of 0.332cm$^2$/g. In general, there was a gradual increase in the abrasion coefficient as the quantity of stabiliser increases. After attaining its highest coefficient after 20% addition of the stabiliser, the abrasion coefficient started declining (as shown in Figure 9).

It was also deduced that, there were variations between the different batches compared to the variations within the individual batches indicating the effect of the ash: F-value = 11.883, P=0.0<0.05 which confirms that, the inclusion of the CBSA influences the abrasion resistance of the soil bricks. More precisely, the addition of cocoa shells ash improves the ability of the soil bricks to resist deterioration or wear which was found to be in an agreement with other studies conducted on agricultural wastes ashes and other stabilising agents (Maniatidis and Walker, 2003; Kamang, 1998).

![Figure 9 Relationship between the Mean Abrasion resistance coefficient and CBSA](image)

This phenomenon exhibited by the soil bricks as the CBSA increases was attributed to the improved cementitious action between the compounds present in the ash of the Cocoa beans shell and the soil resulting in increased bond strength between the particles in the matrix as explained in Yalley and Asiedu (2013).
CONCLUSIONS AND RECOMMENDATIONS

Deducing from the data in this study, it is worth noting that inclusion of cocoa beans shells ash as a stabiliser in the production of soil bricks influenced the density, compressive strength and the durability properties after curing for 28 days. The cocoa bean shell ash after analysis did not qualify satisfactorily as a Pozzolana as the quantities of Silica, Iron and Alumina were present in small quantities.

The densities the compressive strengths and abrasion resistance of the compressed stabilised blocks after 28 days gradually increased as the ash content increased until it got to its optimum after 20% ash addition. Further increase in the ash content saw a decline in the densities and compressive strengths.

The water absorption characteristics of the compressed stabilised blocks showed an improvement as the ash content increases. Based on the results, compressed stabilised bricks can effectively perform satisfactorily as a walling unit especially as an interior partition units where bricks could be protected from moisture.

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USE OF COMPUTER TOMOGRAPHY SCAN FOR NON-DESTRUCTIVE TESTING OF CONCRETE

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Growing age and high exposure of concrete structures to aggressive environment has led to the increasing need for reliable tools that will give useful information on internal structure of concrete. The paper examines the use of computer tomography scan in the study of internal structure of concrete. It is an experimental research that entails the following steps: First, a preliminary investigation of the various properties of the materials used for the production of concrete samples was carried out. Concrete samples were, then prepared, cured and subjected to computer tomography scan test at the end of the following curing days: 1, 3, 7, 14, 21, 28 and 56 days. Also, two 150mm x 300mm cylinders were used to produce reinforced concrete Result showed that when concrete sample was subjected to CT scan the internal structure and the concealed steel reinforcements were clearly shown. Visual inspection was used to analyse the results. Part of the conclusion drawn from the analysis, is that CT scan can be used to monitor the internal structure of concrete. Hence it was recommended CT scan should be used to examine the concrete at micro level especially with a means of magnifying the processed CT scan image.

Keywords: compliance, compressive strength, computer tomography scan, concrete, non-destructive testing

INTRODUCTION

The diverse application of concrete calls for a wide variety of performance requirements, what is really needed in order to conform to these performance requirements is to carry out test on concrete in the structure. This will ensure that the influence of workmanship in the actual placing, compaction and curing are reflected. Ideally, such testing should be done without damaging the concrete In view of the many shortcomings associated with the compressive strength test, there is the need for a viable alternative and non-destructive testing seems to the right choice. According to Gambhir (2006) there is now a switch over to performance oriented test through the use of non-destructive method. This perhaps, explain the reason why Akkaya et al (2002) noted that the evaluation of mechanical properties of concrete by non-destructive techniques is one of the most challenging tasks in modern civil engineering.

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Furthermore, the increasing age of reinforced concrete structures all over the world, has led to the growing need for reliable tools for concrete degradation assessment. This explains the reason why, studies of microstructure-property relationships are at the heart of modern material science. In other words, there is a demand for modelling of material properties on a meso scale rather than on the macro scale only (Reinhardt, 2002). As such, tools are needed that allow close examination into a material rather than onto a surface only - molecular analysis.

Besides that, many of the industrial nations currently dedicate a considerable portion of the construction budget (40% of the construction industry’s resources) for restoration, repairs and maintenance of old structures as opposed to new ones (Shetty, 2009, Gupta and Gupta 2006 and Mehta and Monteiro 2006). Inspection of such structures is prerequisite to repairs, rehabilitation and maintenance work. According to Shetty (2009) the use of concrete structures, in recent years, has been extended to harsh and hostile conditions, having used the good sites. As such, they are exposed to aggressive environment. Thus, durability issues have gained much attention. One major problem that is of great concern to researchers is corrosion of reinforcement. This calls for the need for devising a means of monitoring the condition of the concealed steel reinforcement in the structure.

The Electromagnetic Cover Measurements is one of the methods used to locate concealed steel reinforcement. However, it can only detect the steel reinforcement and the accuracy of measurements can be affected by stray magnetic fields, multiple bars e.g. laps of closely spaced bars, light wire mesh or other metal objects between bars and surface, metal tie wires, aggregates with magnetic properties. Besides that, calibration of equipment may be affected by type of bar - diameter and deformity, aggregate and cement type. Another Non-destructive used to monitor the internal structure of concrete is the Radiography. It is based on the principle of obtaining a photograph of the interior of a concrete for which variation of density may be detected. Major shortcomings associated with it, are image enlargement and shifting concrete coring radiography, which tend to create undesirable distortion (ASNDT, 2010). Also, the interpretation/reading of processed images requires skills.

This brings the need for devising another reliable technique for monitoring the structure of concrete/materials. This is a report on an investigation into the use of CT Scan monitoring the internal structure of concrete.

MATERIALS AND METHODS

Materials
The materials used in the experiment are: Cement, fine aggregates, coarse aggregates and water. Preliminary test were carried out on these materials so as to establish preliminary test results and obtain appropriate parameters. The various tests undertaken are as follows:
Cement
The type of cement used for the study was Ordinary Portland cement, OPC, manufactured and recently supplied by the Dangote Cement Company, Plc. Various tests such as the Setting time test, Soundness and Consistency test were undertaken so as to ensure that it complies with the relevant standards. These tests were carried out on the cement used in accordance to the relevant Nigerian and British Standards, such as NIS, 445 (2003), NIS 447 (2003), NIS 455 (2003) and BS 12 (1996). These tests were undertaken in a concrete laboratory at Department of Civil Engineering, Ahmadu Bello University, Zaria.

Chemical analysis of the cement sample was also, carried out at the Centre for Energy Research and Training, CERT, Ahmadu Bello University, Zaria.

Fine aggregates
Fine aggregates used in this research work were clean and air-dried river sand obtained from Samaru – Zaria. It was sieved with a 5mm B5 112 (1971) sieve, so as to remove the impurities and larger aggregates. Before, the fine aggregate was used; it was subjected to sieve analysis. This was undertaken in accordance to the BS 933 Part 1 (1997). Other properties of fine aggregates that were investigated include: Specific gravity on both oven dried basis, apparent specific gravity and water absorption. These tests were carried out in accordance to the appropriate British Standards.

Coarse Aggregates
The coarse aggregates used were crushed granite stones obtained from single quarry site along Zaria-Sokoto road. Sieve analysis was carried out on the coarse aggregates used in the experiment in accordance to BS 933 Part I (1997). Other properties of coarse other properties of coarse aggregate that were investigated include specific gravity on oven dried basis, apparent specific gravity and water absorption. These tests were undertaken in accordance to the following British standards: BS 812 (1990), BS 882 (1992) and BS 933 (1997).

Water
Water used for mixing was clean, fresh water, free from injurious oils, chemicals and vegetable matter or other impurities.

Equipment used
In the course of carrying out the various experiments certain equipment were used, details of the types of equipment used are presented in table 1.

<table>
<thead>
<tr>
<th>Types of Test</th>
<th>Description of Equipment/Device used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer tomography scan</td>
<td>Nix high speed computer tomography scanner manufactured by clinical equipment company in 2004.</td>
</tr>
</tbody>
</table>
PRODUCTION AND TESTING OF CONCRETE SPECIMEN

Final mix design
The final mix design entails the use of absolute volume batching with nominal mix of 1:2:4 and a water-cement ratio of 0.50 to determine the proportion of each constituents to be used in the production of concrete samples, using mixing machine, a horizontal rotary drum mixer and manual compaction method.

The Computed Tomography Scan - (CT scan)
The test was carried out at the Department of Radiology, Ahmadu University Teaching Hospital, Zaria. In which a sample of concrete cubes were subjected to the CT scan after each required curing days (1, 3, 7, 14, 21, 28, 56, and 90 days). Also, two 150mm x 300mm concrete cylinders were produced and three (3) steel reinforcements were put in one cylinder and four (4) pieces were placed in the other cylinder. The procedure is as follows:

Sample was removed from curing tank, dried and weighed. It was, then, placed in CT scan machine/device. Brain protocol was used for the test. Using AX IAL scan, 2mm slice thickness, a scanogram was taken for the sample as the base which allows to plan so as to get the next series scan. The series scans were used to obtain images of internal structure of the concrete. The radiation exposure factor used was 120 KVp with standard time of 300 MAs. The images of concrete samples produced by the CT scan were then used to:

1. Examine the internal structure of concrete and to find out whether the steel reinforcements that were concealed can be seen.

Plate I: Placing of Steel Reinforcements in Test Cylinder before the CT scan Test

CT Scan images of the internal structure of concrete samples
The CT scan was able to clearly depict the internal structure of the concrete samples that were scanned. In addition, the steel reinforcements placed in the two 150mm x 300mm cylinders, were revealed - as shown in plates V
and VI. It was also observed that every part of the internal structure of the concrete sample can be closely examined by putting the yellow strip/line on the particular part of the elevation of the processed CT scan image of the sample to be examined (as shown in plate VI) and cross sectional elevation of the sample will be revealed — as shown on processed CT scan image in plate IV and V. In other words, the images are viewed in slices. This can be as small as 2mm slices. The moment the yellow line is place at the point where the internal structured is to be monitored, the cross sectional elevation will show, clearly, the internal structure.

Plate IV: Result of the Processed CT Scan Test for Days 1, 3, 7 and 14
Plate V: Result of the Processed CT Scan Test for Days 21, 28 and 56

Plate VI: Front Elevation of Cylinders Showing the Steel Reinforcements that were put in Place Before Casting the Concrete Sample
Result of CT Scan test
Scan of the Internal Structure of Concrete Sample

Result of the CT scan shows clearly that it is very effective in revealing the internal structure of concrete samples and even, the voids - as it can be seen in plates presented in chapter four. Thus, it can be said that at micro level, concrete is quite unlike what is seen with naked eyes – one solid homogenous materials, but rather it consists of aggregates, cements and voids.

Plate XI: Comparison between Three Different Processed CT scan Images of Concrete Samples

Attempt to study the relationship between the strength of concrete and the internal structure of concrete was made by observing the number, size and distribution of voids (and even counting, though it proved difficult) so as to find out whether there is a relationship. Close study of the voids revealed one interesting result: that the number and size of voids in concrete samples at early age are higher than the voids at later age. For instance when 1 day old concrete sample was compared with 14 days and 28 days the difference was clearly seen in terms of the size and number, distribution and nature of voids. Looking at the three samples, it was noted that the voids in one 1 day old concrete sample were higher than the voids in 14 days old while the voids in 28 days old concrete sample were less than the 1 day old and 14 days old. This means the higher the days the less the voids given that the concrete was produced under the same condition. Since the compressive increases with the increase in the number of days, that means voids have inverse relationship with the strength. When a means of magnifying the CT scan images is used, more information about the internal structure can be obtained.

From the foregoing discussion it means that this method can be used to solve an important problem associated with the conventional test – monitoring the level of consolidation of concrete or the uniformity of the concrete mix. Besides that, it can serve as means of assessing the permeability of concrete is a good step towards understanding problem of durability relating to chemical attack. Most especially considering the fact
that this is one of the major problem facing engineers in the construction industry.

**Detection of steel reinforcement concealed**
CT scan also reveals not only the internal structure of concrete sample but steel reinforcement. As observed earlier, three steel reinforcements were put in one cylinder and four were placed in the other cylinder. The whole steel reinforcements were clearly seen in the CT scan image. Attempts was made to see whether the CT image of those steel reinforcements can be used to determine the density/strength of steel reinforcements but such effort proved abortive.

**CONCLUSION**
After carrying out the experiments, observations, analysis and discussions, on Non-Destructive Testing of concrete, the following conclusions were drawn.

1. Computer Tomography Scan can be used to study the internal structure of concrete. Most especially the two phases of concrete on varying shapes and sizes and the binding medium can be seen clearly.

**RECOMMENDATION**
Based on the result of the study, the following recommendations are made:

1. Result of this research showed that CT scan can be used to examine the internal structure of concrete, as such; it is recommended that an in-depth study of the possibility of fabricating device which uses, the principles of CT scan should be undertaken.

2. For the fact that emphasis is made on molecular analysis of concrete in recent years which calls for tools to be used to study concrete at micro level, it is suggested that CT scan test should be used for such purpose.

3. Result of this research showed that CT scan can be used to examine the internal structure of concrete, as such; it is recommended that an in-depth study of the possibility of fabricating device which uses, the principles of CT scan should be undertaken.

4. A joint research should be undertaken between physicist, civil engineers/builders, mechanical and electrical engineers to study the possibility of designing and fabricating a portable device that uses the principle of CT scan machine; which can be used for examining the internal structure of concrete, detection of concealed reinforcement bars, examination of internal condition of concrete, etc.

5. A research should be carried out using CT scan so as to see the possibility of monitoring concrete structure exposed to aggressive environment. In view of the fact that currently engineers/designers
pay more attention to durability issues owing to the fact that the use of concrete has been extended to harsh and hostile areas.

REFERENCES


British Standard, BS 1881: 126 (1986): “Method for Mixing and Sampling Fresh Concrete in the Laboratory” BSI, Linfordwood, Milton Keynes MK14 6LE, U.K.


USE OF CRUMB RUBBER AS A PARTIAL REPLACEMENT FOR FINE AGGREGATE IN ASPHALT CONCRETE MIXES

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This work focuses on the investigation of the improvement on the properties of asphalt concrete with crumb rubber use as partial replacement for fine aggregate in the proportion of 1.0%, 1.25%, 1.5%, 1.75%, 2.0%, 2.25%, 2.5%, 2.75% and 3.0% respectively by weight. Twenty-seven (27) specimens compacted with each percentages of crumb rubber were produce for the experiment. Marshall Stability method of asphalt mix design was chosen to test the performance of the material in terms of its known engineering properties. The Marshall stability result obtained shows that sample prepared with 2.0% crumb rubber and bitumen content of 5.5% are within the standard specification for Asphalt Concrete mix design specified by Asphalt Institute.

Keywords: bitumen, crumb rubber, fine aggregate, hot mix asphalt, Marshall Method

INTRODUCTION

Pavement according to American road engineers can be described as the various layers of materials of which road is constructed above the level of formation. Flexible pavement include primarily those pavement that have asphaltic concrete surfacing which is a relatively thin wearing surface build over a base course and sub-base course and they rest upon the compacted sub-grade. In contrast rigid pavement are made up of Portland cement concrete mostly found in airports heavy duty s industrial floors slabs, ports, filling station, and heavy vehicle parts (Derrick, 1989).

Due to the increase in population of motorist, traffic volume and density on pavement structure, it becomes compulsory to test and ascertain the quality of bitumen and aggregates used in asphalt mix and to develop a new material that will improve the overall characteristics of the highway pavement. The material which is a refuse disposal, unwanted material and

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serve as environment pollution. Dealing with the growing problem of disposal of materials is an issue that requires coordination and commitment by all parties involved. One solution to a portion of the waste disposal problem is to recycle and use these materials in the construction of highways (Arnold, et al., 2008).

Waste tire products possess many beneficial properties that are useful in Civil Engineering applications like crack sealing (Rubberized asphalt crack sealant) and in road construction in general. The benefits of adding rubber to the mix, besides elimination of rubber tire waste, are increased flexibility, resistance to studded tires, increased fatigue life, reduced noise, and crack reflection control. In addition, the increased elastic response of this material also reportedly causes ice, formed on the pavement during freezing weather, to break under transient vehicle loadings (Jorgenson, 2002).

Waste materials such as scrap tire (crumb rubber) can be used as a substitute for fine aggregate in asphalt mix. This can serve as a means of transforming waste to wealth by providing a room for recycling or energy recovery for scrap tire to make it economically viable and to make the environment clean and sound.

The main aim of this research was to investigate the properties and strength of scrap tire (Crumb rubber) used as a substitute for fine aggregate in asphalt concrete. This work covers the characterization of asphalt concrete and Marshal Test on asphalt concrete.

Overview of Scrap Tire
Scrap tires can be processed into ground rubber to modify asphalt thereby creating rubberized asphalt and rubber asphalt concrete. There are numerous civil engineering applications for scrap tires. Using crumb rubber recycled from waste tires in asphalt mixtures and pavement rehabilitation treatments can be achieved in two different ways. Crumb or ground rubber can be used either as fine aggregate in the mixture or as processed rubber added to the asphalt binder. The dry process is any method that adds granulated or crumb rubber modifier (CRM) from Scrap tires as a substitute for a percentage of the aggregate in the asphalt concrete mixture, not as part of the asphalt binder. The crumb rubber is mixed with the aggregate fraction before adding the asphalt cement. The resulting product is often called rubber-modified asphalt concrete mixture. Different gradations or sizes of granulated or CRM can be used depending on the application or procedure.

Historic Review of the Use of Crumb Rubber as a Modifier in Bituminous Pavement
Rubber modification of asphalt has a long history. The earliest experiments date back to as early as the 1840s, which involved incorporating natural rubber into bitumen to increase its engineering performance properties. The process of bitumen modification involving natural and synthetic rubber was introduced as early as 1843 (Thompson and Hoiberg, 1979). Then, in 1923, natural and synthetic rubber
modifications in bitumen were further improved (Isacsson and Lu, 1999; Yildrim, 2007). According to the study of (Yildrim, 2007), the development of rubber-bitumen materials being used as joint sealers, patches and membranes began in the late 1930s. In 1950, the use of scrap tire in asphalt pavement was reported (Hanson, et al., 1994).

**Dry Process**

Using crumb rubber recycled from waste tires in asphalt mixtures and pavement rehabilitation treatments can be achieved in two different ways. Crumb or ground rubber can be used either as fine aggregate in the mixture or as processed rubber added to the asphalt binder. The dry process is any method that adds granulated or crumb rubber modifier (CRM) from Scrap tires as a substitute for a percentage of the aggregate in the asphalt concrete mixture, not as part of the asphalt binder. The crumb rubber is mixed with the aggregate fraction before adding the asphalt cement. The resulting product is often called rubber-modified asphalt concrete mixture. Different gradations or sizes of granulated or CRM can be used depending on the application or procedure. The percentage of the crumb rubber added in the dry process varies; for example, (Robert and Laing, 1996) indicated that 3% to 5% of crumb rubber by weight of the aggregate is generally used; the Asphalt Rubber Usage Guide (CALTRANS, 2006) refers to 1% to 3% of crumb rubber by weight of the aggregate in the asphalt concrete mixture. The dry process is applicable to produce CRM-modified asphalt concrete mixtures. In this process, the asphalt cement is not modified significantly by the addition of the crumb rubber; however, the properties of the resulting HMA are modified. The dry process can be used in dense-graded, open-graded and gap-graded mixtures to accommodate the rubber particles in the aggregate gradation, but cannot be used for cold mix, chip seals and surface treatments. The mixture design should take into account the lower specific gravity of the crumb rubber compared with that of conventional aggregates (CALTRANS, 2006).

**Use of Crumb Tire Rubber in Asphalt Mixes**

Rubber-asphalt mixes have been used for the following applications:

- Rubber-asphalt joint/crack sealant (Schnormeier, 1987)
- Rubber-asphalt stress absorbing membrane (SAM) (Heitzman, 1992); (Singh and Singh, 1983); (Van and Jack, 1992))
- Rubber-asphalt stress absorbing membrane interlayer (SAMI) (Heitzman, 1992); (Singh and Singh, 1983))
- Rubber-asphalt concrete (CALTRANS, 2006)
- Rubber-asphalt concrete or modified asphalt hot mix.
RESEARCH METHOD

Materials
Materials used include filler materials (cement), aggregates (Crumb Rubber, fine and coarse) and binder (bitumen).

Methods
The methodology involves the experimental tests carried out to determine the physical properties of the constituent materials and Marshall Stability Analysis of the mix.

The tests carried out on the components of HMA are as follows:

1. Tests on bitumen (Penetration test, Solubility test, Viscosity test, Ductility test, Flash and fire point test and Specific gravity test.
2. Experimental test on cement (Initial and Final setting time, Soundness test)
3. Test on aggregates (Aggregate impact value/hardness test, Aggregate crushing value, Aggregate specific gravity, Size and gradation, Specific gravity test.
4. Marshall Stability Test

Material characterization
Aggregates (coarse and fine)
The coarse aggregate used for this experiment comprises of crushed granite of different sizes obtained from a quarry along Jos road in Zaria, Kaduna state while the fine aggregate used comprises of well-graded river sharp sand obtained from Mubasul block Industry at Gaskiya Zaria, Kaduna state. The aggregates used were subjected to crushing test, impact value test and specific gravity test in accordance to ASTM code. The results were tabulated in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Crushing value (%)</td>
<td>20.5</td>
</tr>
<tr>
<td>Aggregate Impact value (%)</td>
<td>16.7</td>
</tr>
<tr>
<td>Specific Gravity (coarse aggregate)</td>
<td>2.70</td>
</tr>
<tr>
<td>Specific Gravity (fine aggregate)</td>
<td>2.65</td>
</tr>
</tbody>
</table>

Table 2: Coarse Aggregate Sieve Analysis Result

<table>
<thead>
<tr>
<th>Sieve Sizes (mm)</th>
<th>Cumulative percentage passing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.4mm</td>
<td>100</td>
</tr>
<tr>
<td>19.0mm</td>
<td>74.6</td>
</tr>
<tr>
<td>12.7mm</td>
<td>54.4</td>
</tr>
<tr>
<td>9.5mm</td>
<td>35.2</td>
</tr>
<tr>
<td>6mm</td>
<td>9.3</td>
</tr>
<tr>
<td>2.3mm</td>
<td>2.0</td>
</tr>
<tr>
<td>1.18mm</td>
<td>0</td>
</tr>
</tbody>
</table>
Dry sieve were adopted for the particle size distribution test. The sieve analysis was carried out in accordance to BS812 part 103 for coarse aggregate, fine aggregate and mineral fillers respectively. The results of the sieve analysis are shown in Table 2 and 3.

**Table 3: Fine Aggregate Sieve Analysis Result**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Cumulative Percentage Passing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm</td>
<td>100</td>
</tr>
<tr>
<td>2.36mm</td>
<td>80.1</td>
</tr>
<tr>
<td>1.18mm</td>
<td>60.0</td>
</tr>
<tr>
<td>0.6mm</td>
<td>28.2</td>
</tr>
<tr>
<td>0.3mm</td>
<td>15.9</td>
</tr>
<tr>
<td>0.15mm</td>
<td>4.0</td>
</tr>
<tr>
<td>0.75mm</td>
<td>1.1</td>
</tr>
<tr>
<td>Pan</td>
<td>0</td>
</tr>
</tbody>
</table>

**Bitumen**

The bitumen used was grade 80/100 obtained from Mother Cat Construction Company at Kafur Local Government, Katsina State. Consistency and safety test were conducted on the bitumen and the result in accordance to the corresponding clause of ASTM (2005) were as shown in Table 4.

**Table 4: Preliminary Test Results on Bitumen**

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration at 25°C</td>
<td>ASTM D5</td>
<td>95</td>
</tr>
<tr>
<td>Softening °C</td>
<td>ASTM D36</td>
<td>49.5</td>
</tr>
<tr>
<td>Flash and Fire point °C</td>
<td>ASTM D36</td>
<td>230</td>
</tr>
<tr>
<td>Solubility in CCL4%</td>
<td>ASTM D4402</td>
<td>96</td>
</tr>
<tr>
<td>Ductility at 25°C</td>
<td>ASTM D113</td>
<td>100cm</td>
</tr>
<tr>
<td>Viscosity at 60 °C (mm²/s)</td>
<td>ASTM D4402</td>
<td>121.83</td>
</tr>
</tbody>
</table>

**Cement**

The cement used was obtained from Mubasul block industry at Gaskiya Layout Zaria, Kaduna State. The test results obtained for the preliminary test on OPC are as presented in Table 5.

**Table 5: Test Result on the OPC**

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial setting time</td>
<td>Min</td>
<td>44</td>
</tr>
<tr>
<td>Final setting time</td>
<td>Hr-min</td>
<td>5hrs</td>
</tr>
<tr>
<td>soundness</td>
<td>mm</td>
<td>2</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>-</td>
<td>2.43</td>
</tr>
</tbody>
</table>
Design of the experiment

The experiment was based on the Marshall method of bituminous concrete mix; this was because of its universality in terms of known asphalt pavement properties. The relevant engineering properties of Marshall test which include stability, flow, Void Filled with Bitumen (VFB), air Void in the Mix (VIM), Void in Mineral Aggregate (VMA), Bulk specific gravity of specimen and the Optimum Bitumen Content (OBC) of the mix were determined from the Marshall test. The result of the properties obtained from the experiment were tabulated, analyzed and then compared with the standard specified by Marshall Criteria to appraise the stability or otherwise of ground rubber being used as a partial substitute for fine aggregate in asphalt concrete mix.

Table 6: Marshall Test plan

<table>
<thead>
<tr>
<th>Specimen identification</th>
<th>Percentage of CR/SS as fine aggregate in the mix</th>
<th>Number of specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>1%CR/99%SS</td>
<td>3</td>
</tr>
<tr>
<td>SB</td>
<td>1.25%CR/98.7%SS</td>
<td>3</td>
</tr>
<tr>
<td>SC</td>
<td>1.50%CR/98.4%SS</td>
<td>3</td>
</tr>
<tr>
<td>SD</td>
<td>1.75%CR/98.2%SS</td>
<td>3</td>
</tr>
<tr>
<td>SE</td>
<td>2.0%CR/98.0%SS</td>
<td>3</td>
</tr>
<tr>
<td>SF</td>
<td>2.25%CR/97.7%SS</td>
<td>3</td>
</tr>
<tr>
<td>SG</td>
<td>2.50%CR/97.4%SS</td>
<td>3</td>
</tr>
<tr>
<td>SH</td>
<td>2.75%CR/97.23%SS</td>
<td>3</td>
</tr>
<tr>
<td>SI</td>
<td>3.0%CR/97.0%SS</td>
<td>3</td>
</tr>
</tbody>
</table>

Marshall Test result

The summary of the result obtained from the stability flow test and density void analysis are as presented in Table 7 – 8.

Table 7: Marshall Analysis at 0% crumb rubber/100% fine aggregate (Control).

<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>3.97</td>
<td>243</td>
<td>1.78</td>
<td>28.51</td>
<td>36.22</td>
<td>21.31</td>
</tr>
<tr>
<td>5.5</td>
<td>6.70</td>
<td>300</td>
<td>1.49</td>
<td>39.40</td>
<td>47.27</td>
<td>16.63</td>
</tr>
<tr>
<td>6.5</td>
<td>2.73</td>
<td>564</td>
<td>1.53</td>
<td>36.78</td>
<td>46.33</td>
<td>20.61</td>
</tr>
<tr>
<td>7.5</td>
<td>3.81</td>
<td>356</td>
<td>1.55</td>
<td>35.15</td>
<td>46.75</td>
<td>24.81</td>
</tr>
<tr>
<td>8.5</td>
<td>2.96</td>
<td>410</td>
<td>1.65</td>
<td>30.08</td>
<td>43.88</td>
<td>31.45</td>
</tr>
</tbody>
</table>

Table 8: Summary of Marshal Analysis Result at Various Percentages of Crumb Rubber and Fine Aggregate with 5.5% of Optimum Bitumen Content.

<table>
<thead>
<tr>
<th>Bitumen Content (%)</th>
<th>Ground Rubber (%)</th>
<th>Stability (kN)</th>
<th>Flow (0.25mm)</th>
<th>CDM (g/cm³)</th>
<th>VIM (%)</th>
<th>VMA (%)</th>
<th>VFB (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>0.00</td>
<td>6.70</td>
<td>3.00</td>
<td>1.49</td>
<td>39.40</td>
<td>47.27</td>
<td>16.63</td>
</tr>
<tr>
<td>5.5</td>
<td>1.00</td>
<td>4.43</td>
<td>2.73</td>
<td>1.47</td>
<td>40.42</td>
<td>47.51</td>
<td>14.92</td>
</tr>
<tr>
<td>5.5</td>
<td>1.25</td>
<td>5.00</td>
<td>2.93</td>
<td>1.43</td>
<td>41.99</td>
<td>48.81</td>
<td>13.98</td>
</tr>
<tr>
<td>5.5</td>
<td>1.50</td>
<td>5.58</td>
<td>2.43</td>
<td>1.40</td>
<td>43.15</td>
<td>49.83</td>
<td>13.38</td>
</tr>
<tr>
<td>5.5</td>
<td>1.75</td>
<td>6.00</td>
<td>2.51</td>
<td>1.38</td>
<td>43.91</td>
<td>50.57</td>
<td>13.15</td>
</tr>
<tr>
<td>5.5</td>
<td>2.00</td>
<td>4.49</td>
<td>1.55</td>
<td>1.37</td>
<td>44.26</td>
<td>50.85</td>
<td>12.94</td>
</tr>
<tr>
<td>5.5</td>
<td>2.25</td>
<td>4.68</td>
<td>2.30</td>
<td>1.35</td>
<td>45.03</td>
<td>51.70</td>
<td>12.91</td>
</tr>
<tr>
<td>5.5</td>
<td>2.50</td>
<td>4.72</td>
<td>1.58</td>
<td>1.30</td>
<td>47.01</td>
<td>53.24</td>
<td>11.70</td>
</tr>
<tr>
<td>5.5</td>
<td>2.75</td>
<td>5.38</td>
<td>1.83</td>
<td>1.25</td>
<td>49.00</td>
<td>55.01</td>
<td>10.91</td>
</tr>
<tr>
<td>5.5</td>
<td>3.00</td>
<td>5.31</td>
<td>1.82</td>
<td>1.20</td>
<td>50.99</td>
<td>57.13</td>
<td>10.74</td>
</tr>
</tbody>
</table>
The dry process was adopted for this research. Crumb rubber (0.8-6.4mm) was partially substituted for fine aggregate in the asphalt mix, at typically 1%-3% to determine the stability of the Crumb Rubber (CR) being partially substituted for fine aggregate in asphalt concrete mix. Twenty-seven (27) specimens were casted, three (3) for each of the various percentage combinations of CR and SS for statistical evaluation of the test result. The Marshall Test plan was as shown in Table 6 where the symbol SA indicates specimen having 1% CR and 99% SS content while SI indicates specimens with SI indicates 3%CR and 97%SS.

RESULTS
Tests on Pure Bitumen
Based on the preliminary tests on bitumen, the results obtained are now compared with standard code of practice and are within the limits of the code specification as shown in Table 9; therefore the bitumen is good for usage.

Table 9: Results of Preliminary Tests on Bitumen.

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Method</th>
<th>Specification by Codes</th>
<th>Results Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration at 25°C</td>
<td>D5</td>
<td>40-50</td>
<td>60-70</td>
</tr>
<tr>
<td>Flash and fire point °C</td>
<td>D92</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>Solubility in trichloroethylene (%)</td>
<td>D2042</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Specific gravity (mm) at 25°C</td>
<td>D70</td>
<td>0.97-1.02</td>
<td>0.97-1.02</td>
</tr>
<tr>
<td>Ductility at 25°C (mm)</td>
<td>D113</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Viscosity at 60°C (mm²/sec)</td>
<td>D4402</td>
<td>220-400</td>
<td>120-250</td>
</tr>
</tbody>
</table>

Discussion
From the result obtained (25˚C), the penetration falls within penetration grade 80-100 which is suitable for HMA design. For the viscosity, the result obtained was 121.83mm²/sec which conforms to the viscosity requirement of 75-150mm²/sec for penetration grade of 80-100; it is therefore suitable for HMA design. The flash and fire point result obtained was 230˚C conforms to the ASTM D92 minimum requirement of 219˚C for penetration grade of 80-100; it is therefore suitable for HMA design. Solubility test result of 96% conforms to the ASTM D2042 requirement of 99% for penetration grade of 80-100. Also, ductility test result obtained was 100mm which conforms to the ASTM D113 minimum requirement of 75mm for penetration grade of 80-100; it is therefore suitable for HMA design.
Tests on OPC
The test results obtained for the preliminary test on OPC and its comparison with the Standard of Specification are presented in Table 10.

Table 10: Comparison of Test Result on the OPC with Standard

<table>
<thead>
<tr>
<th>Property</th>
<th>Test results</th>
<th>Code used</th>
<th>Code specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial setting time</td>
<td>Min 44</td>
<td>BS EN 196</td>
<td>&gt;45mins</td>
</tr>
<tr>
<td>Final setting time</td>
<td>Hr-min 5hrs</td>
<td>BS EN 196</td>
<td>&lt;10hrs</td>
</tr>
<tr>
<td>soundness</td>
<td>mm 2</td>
<td>BS EN 196</td>
<td>&lt;10mm</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>. 2.43</td>
<td>ASTM C188</td>
<td>3.15</td>
</tr>
</tbody>
</table>

Discussion
From Table 10, the initial setting time obtained was 44 minutes while the final setting time obtained was 5 hours. Comparing with the code specification, it conforms with the stipulated setting times values of 45 minutes and 10 hours for initial setting and final setting times respectively.

Also, the difference between the lengths was 2.00mm which was less than 10mm specified by the code. Therefore the cement is suitable for engineering purposes.

Table 11: Marshal Design criteria

<table>
<thead>
<tr>
<th>Description</th>
<th>Type I Base course</th>
<th>Type II Binder or leveling course</th>
<th>Type III Wearing course</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of compaction Blows, each end of Specimen</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Stability, kN</td>
<td>2224</td>
<td>3336</td>
<td>6672</td>
</tr>
<tr>
<td>Flow (0.25mm or 0.01 inch) (mm)</td>
<td>8 [2]</td>
<td>16 [14]</td>
<td>8 [2]</td>
</tr>
<tr>
<td>Air voids, %</td>
<td>3 8</td>
<td>3 8</td>
<td>4 6</td>
</tr>
<tr>
<td>Aggregate voids filled with bitumen, % VFB</td>
<td>60 80</td>
<td>65 85</td>
<td>70 85</td>
</tr>
</tbody>
</table>


Analysis of Marshall Stability Test Result
The Marshall Stability Test properties obtained with the varying proportion of bitumen content were as illustrated in Figure 1 – 6.

From Figure 1, the maximum stability obtained was 6.70kN the stability drops as bitumen content increases with the least stability been 2.96kN. Comparing with the Marshall criteria in Table 11, the maximum stability is above the minimum stability required, specified by heavy traffic category by ASTM D1559 (2004).
From Figure 2, the maximum flow obtained was 5.64mm and minimum obtained was 2.43mm, therefore, the samples with the bitumen content 5.5%, 3.0mm flow is within the specification as compared with the heavy traffic category by AASHTO T165.

From Figure 3, 1.78g/cm$^3$ was observed to be the highest value with the bitumen content of 4.5% and decrease in CDM was as a result of increase in bitumen content. Maximum value obtained was 1.78g/cm$^3$.

Figure 1: shows graph of stability against bitumen content.

Figure 2: shows the graph of flow (mm) against bitumen content
Figure 3: Graph of bulk specific gravity against bitumen content.

Figure 4: Air void in mix (%) against bitumen content (%)
In Figure 4, 39.40% was the maximum value of air Void in Mix while 28.51% was the minimum value of air Void in Mix.

Figure 5: Graph of VMA (%) against Bitumen Content (%)
From Figure 5, the maximum VMA obtained was 47.27% with bitumen content of 5.5%. The maximum aggregate size used was 0.375 inch (9.5mm) which was the minimum VMA at 16%. Therefore, VMA exceeds the minimum value as provided in Table 12.

From Figure 6, the VFB increases as the bitumen content increases with the maximum of 8.5% bitumen content at 31.45% VFB and minimum of 16.63% VFB at bitumen content of 5.5%.

**Optimum Bitumen Content (OBC)**
The average value of bulk specific gravity, stability, flow, VIM, VMA, and VFB obtained above were calculated and their average bitumen content were also calculated.
Murana, Sani and Tolani

Table 13: Optimum Bitumen Content (OBC)

<table>
<thead>
<tr>
<th>Value</th>
<th>Optimum bitumen content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>6.70</td>
</tr>
<tr>
<td>Flow (mm)</td>
<td>5.64</td>
</tr>
<tr>
<td>CDM (g/cm^3)</td>
<td>1.78</td>
</tr>
<tr>
<td>VIM (%)</td>
<td>39.40</td>
</tr>
<tr>
<td>VMA (%)</td>
<td>47.27</td>
</tr>
<tr>
<td>VFB (%)</td>
<td>31.45</td>
</tr>
<tr>
<td>Average</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Therefore, the OBC adopted for the rest of the experiment was 5.5%.

Analysis of marshal test result with crumb rubber as partial replacement for fine aggregate

Analysis of Marshal Test Result with Crumb Rubber as Partial Replacement for Fine Aggregate are presented in figure 7 – 12.

From Figure 7, the maximum stability obtained was 7.15 kN. The stability increases up to 2.0% replacement of fine aggregate with crumb rubber. Reduction in stability was then noticed as the crumb rubber content increases.

Figure 8 shows the flow graph. The graph shows the effect of crumb rubber on Marshal Flow. It was observed that the flow increases with increase in crumb rubber contents. The Marshal flow with crumb rubber was composed of deformation among the particle of aggregate and the deformation in the crumb rubber particles while the mixture without crumb rubber deformation was among aggregate only. The maximum flow is 3.00mm with 0% crumb rubber and minimum flow is 1.55mm with 2.0% crumb rubber.

Figure 7: graph of stability against percentage of crumb rubber
From Figure 9, the bulk specific gravity decreases as the crumb rubber content increases. The crumb rubber had significant effect on maximum density because the specific gravity of crumb rubber was less than the specific gravity of aggregate.
From Figure 10, the air void increases as the crumb rubber content increases because crumb rubber have specific gravity less than the specific gravity of aggregate and on the other hand, the mixture with crumb rubber and aggregate have surface area greater than mixture without crumb rubber i.e. pure aggregate.

From Figure 11, the Void in Mineral Aggregate increases as the crumb rubber content increases. The maximum VMA was 57.1343% at 3% crumb rubber content. This meets the requirement when compared with standard specification of Marshal Criteria as presented in Table 11.
CONCLUSION

The mix design and analysis of Crumb rubber partially replacing fine aggregate in asphalt concrete was conducted. The results obtained meet the standard specification requirement of Marshal Criteria by ASTM D1559 (2004). The Marshal test results show an acceptable result specified by the standard as the crumb rubber content increases until it reaches 2% which shows that the use of crumb rubber have more effect on asphalt mixture. This implies that 2% replacement of Crumb Rubber for fine aggregate in Asphalt Concrete should be recommended.

RECOMMENDATION

From the investigation carried out, crumb rubber was a good material to be used in asphalt concrete therefore the Federal Highway Authority should encourage the use of crumb rubber in asphalt concrete which will provide room for recycling or energy recovery of scrap tire to be economically viable and also reduce the number of scrap tire that are land filled and stock fill to make the environment clean and sound.

REFERENCES


USE OF KNOWLEDGE MANAGEMENT IN THE NIGERIAN CONSTRUCTION INDUSTRY

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Researches have shown that there is a growing recognition in the business community about the importance of knowledge as a critical resource for organizations. This has encouraged attention and support for the field of Knowledge Management (KM) by different organizations. Effective Knowledge Management Systems in organisations are supported by the use of techniques (process-based methods of gathering lessons learned from concluded projects) and technologies (documentation-based methods to learn from project experiences by focusing on aspects of the content-wise representation of the experiences and the storage of contents within the organisation). This research was carried out to investigate the use of Knowledge Management techniques and technologies in the Nigerian construction industry. Eighteen techniques and thirteen technologies were identified through literature review. The identified techniques and technologies were used to conduct a pilot survey in order to test the awareness of the techniques and technologies by respondents in the Nigerian Construction Industry (NCI). The result of the pilot survey revealed that the respondents are aware of fourteen techniques and two technologies. The fourteen techniques and two technologies were used to draw up interview questions for the respondents. Data was collected from a total number of 23 respondents. 16 of the interviewees are staff of Facility, Security and Safety Management Department (FSSMD) of the Federal Inland Revenue Service (FIRS), 5 of them are contractors on new works for FIRS while the remaining 2 are contractors on maintenance works. The interviews were taped and later transcribed. The transcription revealed that all the respondents use “Post Project Review”, “Documentation of Knowledge” techniques, among others. “Intranet/extranet” technologies are used at different levels of needs by the respondents. “Content System Management” is not used by all the categories of respondents. Major recommendations are that more awareness and orientation need to be carried out in the Nigeria Construction Industry on the role and importance of the use of Knowledge Management techniques. The Nigeria Construction Industry needs to be enlightened on the relevance of the use of knowledge management technologies for easy and proper storage of useful knowledge/lessons learnt in projects.

Keywords: knowledge, management, technique, technology

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INTRODUCTION

There is a growing recognition in the business community about the importance of knowledge as a critical resource for organizations (Holsapple and Whinston, 1987; Paradice and Courtney, 1989; Prahalad and Hamel, 1990; Nonaka, 1991; Drucker, 1993 and Gartner, 1998).

Traditionally, this resource has not been treated with the degree of systematic, deliberate, or explicit effort devoted to managing human, material, and financial resources. But in the 21st century the firm that leaves knowledge to its own devices puts itself in severe jeopardy (Ernst and Young, 1997). Some practitioners and researchers believe that knowledge resources matter more than the conventionally tended resources (material, labour, capital), and must be managed explicitly; not left to fend for itself (Stewart, 1998). Explicit and deliberate efforts at managing knowledge in organizations can benefit from an understanding of the factors, including managerial, financial, and environmental factors that influence the success of knowledge management initiatives.

Knowledge management (KM) is about managing a flow of knowledge which ideally brings employees the right knowledge, at the right time, and in the right form to where it is needed (Maki, 2008). KM involves employees across all levels of organizations, making use of technology and consists of several processes. In today’s highly competitive economy, organizations are struggling to survive and to compete. One of the strategies employed in organizations is KM with the support of a Knowledge Management System (KMS) (Al-Ghassani et al., 2001). The efficient KMS is expected to help firms to achieve sustainable competitive advantages by well utilizing existing knowledge bases. Benefits of KMS have been witnessed in many companies. Ford, Chevron, Texas instrument are obvious examples; these companies have saved several millions of dollars through the use of efficient KMS (Al-Ghassani et al., 2001). However, it is not easy to successfully adopt KMS.

For effective implementation of Knowledge Management systems within organization there must be the right enablers, procedures, processes, techniques and technologies in place (Anumba et al., 2008). Existing literature suggests that techniques and technologies used for KM depend heavily on face-to-face interaction and mostly restricted to project participants that are co-located in the same offices or organizations (Ibrahim and Kolo, 2011). KM related Researches in Nigeria have mostly been limited to assessments of Knowledge Management requirements (Adeeko, 2013), Lessons Learnt Practices (Abdu-Lawan, 2013) and Imperatives for Knowledge Management (Ibrahim and Kolo, 2011). There seem to be a dearth of research in the field of Knowledge Management techniques and technologies in the Nigerian construction industry. Hence, the use of techniques and technologies for capturing Knowledge Management in the Nigerian construction industry has not been established in literature.
RESEARCH METHOD

Both quantitative and qualitative approaches for data collection were used in this research. The qualitative research was adopted in order to obtain in-depth information regarding the awareness of the techniques and technologies by the prospective respondents. This was necessitated by the fact that no previous study seem to have captured the respondents. The level of awareness derived from the quantitative research was used to draw up a questionnaire for the quantitative approach. Structured and semi-structured interviews were conducted. Weighted means were used to arrive at the conclusions concerning the awareness of the techniques and technologies. While analysis of semi-structured interview was used in the next stage of the study (level of usage of the known techniques/technologies). The interviews allow for a fairly lengthy response to questions, cross checking of people’s understanding of key issues, probing people’s responses and creating more direct responses. The most common sources of qualitative data include interviews, observations, and documents (Patton, 2002), none of which can be analysed easily by statistical software.

The following steps were used to arrive at achieving the aim and objectives of this research work.

i. The techniques and technologies used for Knowledge Management were identified from existing literature. Eighteen techniques and thirteen technologies were identified. These techniques and technologies that are essential for managing knowledge effectively were used for this research.

ii. The identified techniques and technologies were used to conduct a pilot survey in order to test the awareness of the techniques and technologies by respondents in Nigeria.

iii. Fourteen techniques and two technologies seen to be comprehended by the respondents in the pilot survey were used to draw up interview questions for the respondents. Individual semi-structured interviews were conducted. Data collected from respondents were taped and later transcribed.

iv. The transcripted responses from the interviewees were used to draw conclusions and make recommendations.

The staff in FSSMD interact with other staff of FIRS and contractors working for FIRS across the nation and FSSMD is divided into divisions-Project Management Division (PM), Estate Management Division (EM), Cost Management Control Division (CMC) and Security and Safety Management Division (SSM). The total number of staff in FSSMD is 177.

The composition is as follows:

1. Project Management Division 39
2. Estate Management Division 40
3. Cost Management Control Division 17
4. Security and Safety Management Division 37
5. Regional facility Officers total 34
6. Administrative staff 7
7. Drivers 4

This makes both FIRS staff and contractors an ideal population for the study. Of the 177 staff in FSSMD, only Project Management and Estate Management Divisions (79 staff in all) take part in construction and maintenance works. A total number of 23 respondents were interviewed. 16 (representing 20% of Project Management/Estate Management Divisions) of the interviewees are staff of FSSMD (the other 80% were not comfortable participating in the study). 5 of the respondents are contractors on new works (25%, agreed to participate) while the remaining 2 (7%, agreed to participate) are contractors on maintenance works. These groups are the most knowledgeable about KM techniques and technologies in use at FSSMD. In all, there are 177 FSSMD staff, 20 new works contractors and 28 maintenance contractors presently in FIRS (FSSMD Annual report, 2013).

Sixteen staff members were interviewed. The staffs interviewed were selected as a result of their willingness to participate in the exercise. Most others had reservations about their voices being taped (23 staff members). Eleven of the 16 respondents are the highest ranking officers and leaders of a particular team (a team comprises of several construction professionals) responsible for monitoring projects. The 5 contractors for new works were readily available and willing to participate. Other contractors were either not available or unwilling to participate. Only two maintenance contractors agreed to partake in the interview.

RESULTS

Awareness of Knowledge Management Techniques and Technologies

In order to test the awareness of the KM techniques and technologies, a pilot survey was undertaken via a structured interview. A set of structured questions were administered to 20 number contractors who were conveniently available within Abuja metropolis. The contractors were asked to rank their awareness of the 17 techniques and 12 technologies identified from literature. The respondents were asked to rank their awareness/use of the techniques/technologies on a scale of 1 to 5, where 1= “Never Heard of it”, 2= “Heard of it only”, 3= “Heard of it and use it”, 4= “Use it often”, 5= “Always use it”. The tabulated responses are shown below:
Table 1: Awareness of Knowledge Management Technique

<table>
<thead>
<tr>
<th>S/NO</th>
<th>TECHNIQUE(S)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Weighting mean</th>
<th>Rank</th>
</tr>
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<tbody>
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<td>Post Project Review</td>
<td>0</td>
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<td>6</td>
<td>4.10</td>
<td>3</td>
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<td>0</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>4.00</td>
<td>5</td>
</tr>
<tr>
<td>(iii)</td>
<td>Communities of practice</td>
<td>4</td>
<td>2</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>2.50</td>
<td>12</td>
</tr>
<tr>
<td>(iv)</td>
<td>Documentation of Knowledge</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>14</td>
<td>4</td>
<td>4.10</td>
<td>3</td>
</tr>
<tr>
<td>(v)</td>
<td>Preparation of Standard Reusable details</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>2</td>
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</tr>
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<td>0</td>
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<td>14</td>
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<td>8</td>
<td>8</td>
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<td>Knowledge team</td>
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<td>14</td>
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<td>4</td>
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<tr>
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<td>0</td>
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<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3.30</td>
<td>6</td>
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<td>(xiii)</td>
<td>Recruitment</td>
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<td>12</td>
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<td>0</td>
<td>3.00</td>
<td>9</td>
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<tr>
<td>(xiv)</td>
<td>External Sources of Knowledge</td>
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<td>4</td>
<td>10</td>
<td>4</td>
<td>0</td>
<td>2.80</td>
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<td>Reassignment of People</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>2.70</td>
<td>11</td>
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<tr>
<td>(xvi)</td>
<td>Research Collaboration</td>
<td>1</td>
<td>3</td>
<td>14</td>
<td>0</td>
<td>2</td>
<td>2.65</td>
<td>12</td>
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<tr>
<td>(xvii)</td>
<td>Partnership-like Arrangement</td>
<td>12</td>
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<td>4</td>
<td>4</td>
<td>0</td>
<td>2.40</td>
<td>16</td>
</tr>
</tbody>
</table>

An average weighted mean score of 2.50 was adopted as a pass mark for the awareness. 2.50 is half of the highest weighting and is between “heard of it” and “heard of it and use it”. Thus the average mark of 2.50 connotes awareness. From table 1 it can be deduced that the respondents are duly aware of fourteen techniques.

The respondents showed awareness for the following as identified from literature survey- “Post Project Review (PPR)”, “Post Project Appraisal (PPA)”, “Committees of Practice (CP)”, “Documentation of Knowledge (DK)”, “Preparation of Standard Reusable Details (PSRD)”, “Team Meetings, Presentation and Workshops (TPW)”, “Knowledge Team (KT)’, “Succession and Management and Mentoring (SMM)”, “Expert Directory (ED)”, “Training (T)”, “Forum (F)” and “Recruitment (R)”.  

1177
Table 2: Awareness of Knowledge Management technologies

<table>
<thead>
<tr>
<th>S/NO</th>
<th>TECHNOLOGIES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Weighting mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
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<td>RECALL</td>
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<td>0</td>
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<td>2</td>
<td>1.40</td>
<td>13</td>
</tr>
<tr>
<td>(ii)</td>
<td>Project Intranet and Extranet</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>3.80</td>
<td>1</td>
</tr>
<tr>
<td>(iii)</td>
<td>Groupware System</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>2.20</td>
<td>3</td>
</tr>
<tr>
<td>(iv)</td>
<td>Custom Design Software</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>2.00</td>
<td>5</td>
</tr>
<tr>
<td>(v)</td>
<td>Micro Articles</td>
<td>12</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>1.90</td>
<td>6</td>
</tr>
<tr>
<td>(vi)</td>
<td>Audio Diary</td>
<td>14</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1.70</td>
<td>10</td>
</tr>
<tr>
<td>(vii)</td>
<td>Data Warehousing</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>1.90</td>
<td>6</td>
</tr>
<tr>
<td>(viii)</td>
<td>Decision Support Systems</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>2.10</td>
<td>4</td>
</tr>
<tr>
<td>(ix)</td>
<td>Content Management Systems</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>2.90</td>
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</tr>
<tr>
<td>(x)</td>
<td>Document Management Systems</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1.90</td>
<td>6</td>
</tr>
<tr>
<td>(xi)</td>
<td>Artificial intelligence tools</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1.60</td>
<td>11</td>
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<tr>
<td>(xii)</td>
<td>Simulation Tools</td>
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<td>0</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>1.90</td>
<td>6</td>
</tr>
<tr>
<td>(xiii)</td>
<td>Semantic Network</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1.60</td>
<td>11</td>
</tr>
</tbody>
</table>

An average weighted mean score of 2.50 was adopted as a pass mark for the awareness. 2.50 is half of the highest weighting and is between “heard of it” and “heard of it and use it”. Thus the average mark of 2.50 connotes awareness. The respondents showed awareness for “Project Intranet/Extranet (PI/E)” and “Content Management System (CMS)”. The respondents were totally unaware of the remaining eleven (11) technologies- “RECALL”, “Groupware system”, “Custom-designed software”, “Micro Articles”, “Audio diary”, “Data warehousing, data mining and OLAP”, “Decision Support Systems”, “Document management systems”, “Artificial intelligence tools”, “Simulation tools” and “Semantic networks”.

Usage of Knowledge Management Techniques and Technologies

The transcription of the interviews revealed usage of the following techniques-

i. FSSMD staff use “Post Project Reviews (PPR)”, “Post Project Appraisal (PPA)”, “Documentation of Knowledge (DK)”, “Training (T)”, “Forum (F)”, “Recruitment (R)”, “External Source of Knowledge (ESK)”, “Reassignment of People (RP)”, “Team Meetings, Presentations and Workshops (TPW)” (without presentation) and
“Succession, Management and Mentoring (SMM)” (without succession).

ii. Maintenance contractors use “Post Project Reviews (PPR)”, “Post Project Appraisal (PPA)”, “Documentation of Knowledge (DK)”, “Training (T)”, “Forum (F)”, “Recruitment (R)”, “External Source of Knowledge (ESK)”, “Reassignment of People (RP)”, “Team Meetings Presentations and Workshops (TPW)” (but presentations not done) and “Succession, Management and Mentoring”.

iii. New work contractors use “Post Project Reviews (PPR)”, “Documentation of Knowledge (DK)”, “Training (T)”, “Forum (F)”, “Recruitment (R)”, “External Source of Knowledge (ESK)”, “Reassignment of People (RP)”, “Team Meetings Presentations and Workshops (TPW)” (but presentations not done) and “Succession, Management and Mentoring (SMM)”.

The use of technologies is as follows

i. FSSMD staff use “Project Intranet/Extranet (PI/E)” for office communication where information are passed across to staff within and outside the organisation, in form of mails and voice calls. “Content Management System (CMS)” is not used by FSSMD staff.

ii. Maintenance contractors do not use both “Project Intranet/Extranet (PI/E)” and “Content Management System (CMS)”.

iii. New work contractors do not use both “Project Intranet/Extranet (PI/E)” and “Content Management System (CMS)”.

DISCUSSION OF RESULTS

The findings of this research are discussed under each technique and technologies. Each technique/technology is discussed singly for the purpose of clarity and orderliness.

KM techniques:

i. Post project review (PPR); this is carried out on completed projects to find lessons learnt in order to promote collaboration and agreement on “what” and “why” there were advantages and disadvantages. The study reveals that the practice of PPR is higher with the contractors than with the client organisation. Lack of documentation is a key weak area for the client organisation while the contracting organisations engage fully in all aspects of PPR. This is an improvement over Adeeko (2013) assertion that the reasons for successes of projects are not clear due to lack of documentation. Abdu-lawan (2012) also asserted that the concept of Lessons was a novelty in Nigeria. This study proves otherwise. It is evident that the conduct of Lessons Learnt Practices (LLP) in Nigeria depends on the organisation involved.

ii. Post project appraisal (PPA): is a systematic and comprehensive review of the economic, environmental, financial, social and
technical aspects of projects. The use of PPA by the respondents studied is quite minimal. The respondents most inclined to conduct PPA are a portion of the Client organisation. PPA tends to reveal weaknesses and organisational faults. This may explain why contractors are reluctant to practice it. While the maintenance unit of the client-organisation practices it in order to arrest future negative occurrences. Adeeko (2013) asserted a minimal use of assessment criteria by Nigerian consultancy organisations to gauge performance.

iii. Communities of practice (CP): is an interactive and discussion forum used to share lessons learnt, documents, discuss ideas and build professional knowledge. FSSMD staffs of FIRS, new works contractors and maintenance contractors do not practice CP formally. Rather, professional workshops and conferences are attended to acquire and share knowledge. Perhaps the fact that workshops and conferences seem to capture all that is required as knowledge at a particular time makes the internal interaction less common for the participating organisations. This finding emphasises Zarewa (2012) finding that LLPs are not formalized in projects.

iv. Documentation of Knowledge (DK): this is the act of capturing and documenting knowledge throughout its life-cycle. None of the three categories of respondents has a central registry or data base created for knowledge documentation. Rather, hard filing system to document information, data and lessons learnt are used, showing the insistence on traditional method of doing things against the reliance on modern technology. This contrasts with Adeeko (2013) report that there is an increase in the use of technology to manage knowledge in Nigerian consultancy firms. Perhaps consultancy firms find modern technology more potable and accessible for instant use due the nature of their responsibilities.

v. Preparation of Standard Reusable Details (PSRD): PSRD is prepared for the purpose of standardisation of assessment documents across units of an organisation. All the three categories of respondents do not prepare PSRD for KM capturing. Perhaps this may be another reluctance to deviate from “traditional ways” of doing things by the Nigerian populace.

vi. Team meetings, presentation and workshops (TPW): this involves group of individuals on the same team working together to accomplish an ultimate goal, after which presentations are made by team members on experiences gained. The study found that the three categories of respondents carry out TPW except that individual experiences are not shared at presentations. The core of TPW is the presentation which gives an avenue for sharing and subsequent reuse of knowledge. This finding corroborates Adeeko
Abdulrazaoq, Abdullahi and Ibrahim (2013) report that employees in most consultancy firms are reluctant to share experiences perhaps for fear of losing relevance.

vii. Knowledge team (KT): an action group devoted to helping organisations make better informed decisions and develop better strategies for using ICT to enhance learning and performance. The practice of assembling KT s is completely absent in all the three categories of respondents. This may likened to the cost associated with the setting up of such a team. Setting up of the team may require thorough search of the organisation to select competent individuals and the purchase of relevant ICT gadgets.

viii. Succession and Management and Mentoring (SMM): this is an effort designed to ensure the continued effective performance of an organisation, division, department or work group. This is done by making provision for the development, replacement and strategic application of key people over time. FSSMD staff practice mentoring (where knowledge is passed from higher ranking staff to sub-ordinate staff) but succession is not practice. While new works contractors and maintenance contractors practice mentoring and succession. The practice of SMM is poorer with the client organisation. This may not be far from the fact that a number of the contracting organisations approached are owned by individuals who may wish for their wards to succeed them.

ix. Expert Directory (ED): ED is a manual containing names of experts enlisted by an organisation for the purpose of easy access when required. None of the three categories of respondents have an ED. Perhaps this is informed by the hesitance of organisations to invest in a comprehensive list of experts while thinking that getting the experts is not a difficult task at any point in time.

x. Training (T): this is an acquisition of knowledge, skills and competences as a result of been taught. Training is used by all the categories of respondents. The Client organisation is more interested in training staff for achieving excellence while training is used to motivate staff of the contracting organisations. Zarewa (2012) reported that participants “loss the opportunity to share and use knowledge derived from experience to promote the recurrence of desirable outcomes and preclude the recurrence of undesirable outcomes”. This implies that the respondents are not using training to achieve the intended purpose of sharing knowledge as suggested in existing literature.

xi. Forum (F): is an open-space assembly to hear and debate on experiences. The result of the research shows that the three respondents participate in a yearly forum to discuss issues and proffer solutions. The ability to capture and disseminate the output of the yearly forums is questionable due to the absence of a central data base for KM practice.
Recruitment (R): is the process of attracting, screening, selecting and binging on board qualified persons for a job. FIRS organisation has a department that is in charge of recruitment. FSSMD advises FIRS Management to recruit more professionals, stating the categories of professionals to be employed. Recruitment is also part of activities of new works contractors and maintenance contractors. Recruitment is crucial to the survival of any organisation and that explains why each of the three respondents participates fully in the exercise.

External Sources of Knowledge (ESK): these are sources of knowledge engaged from outside the organisation. FSSMD sources for external expert advice through the use of consultant by engaging them to assist in project delivery and giving their professional advice. Both categories of contractors also engage in ESK. FSSMD may be engaging in ESK for the purpose of attaining excellence and covering large volumes of works while contractors will be doing so to beat competition.

Reassignment of People (RP): is the practice of reshuffling team members in order to generate a variety of experiences for every member of the organisation. FSSMD do reassign staff from one project to another when there are problems that need special attention. Although this does not happen often. New works contractor and maintenance contractor do it more often. Fong and Yip (2006) reported that the absence of RP in organisations resulted in missing the benefits of proper sharing, capture and reuse of knowledge which minimises the risks of reinventing the wheel, repeating costly mistakes and many other benefits by the project participants. The practice in FIRS may result in a more positive outcome.

KM technologies:

i. Project Intranet/extranet (PI/E): intranet allows for the integration of multimedia communication and can act as a platform for groupware applications and publishing. Extranet is an extension of the intranet to the firm’s external network. FSSMD staff use the intranet/extranet for office communication where information is passed across to staff within and outside the organization in form of mails and voice calls. New works contractors use internet for communication only but do not use intranet/extranet. Maintenance contractors do not use intranet/extranet. The use of PI/E by all categories of respondents is poor. This may be connected to the lack of adequate knowledge of the availability and cheapness of the PI/E set up. Most respondents assumed PI/E was the same as internet.

ii. Content Management Systems (CMS): this is a computer programme that allows the publishing, editing and modification of the content of reports from a central interface. FSSMD staff, new
works contractors and maintenance work contractors said they are not aware of this technology. This finding corroborates Adeeko (2013) and Robinson et al., (2001) claim that despite the importance of collaborative software for the sharing and transferring of knowledge in organizations, the tool is rarely used and it is perceived as being of little or no use to the majority of respondents.

CONCLUSION

From the findings made, it can be concluded that the use of Knowledge Management Techniques by staff and contractors of Facility, Security and Safety Management Department (FSSMD) of Federal Inland Revenue Services (FIRS) in Nigeria has improved over the last few years. However, there is still room for improvement especially in the use of soft data storage and management. The use of modern Knowledge Management Technologies in Nigeria is almost non-existent.

REFERENCES


USER SATISFACTION WITH SPACE FLEXIBILITY IN OFFICES OF SELECTED TERTIARY INSTITUTIONS IN NIGER STATE, NIGERIA

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The design of office buildings and other buildings in tertiary institutions have mainly been determined by the management of the institutions with little or no input from the end users. It is expected of any building design that the building suits the needs of the users and not the users adapting to the building. The nature of work and facilities being used by the staff has also changed with the adoption of ICT facilities. The most significant change that has affected the office design is the increase in staff population in many tertiary institutions, which has increased the number of shared offices and an increase in number of staff per office. It can be observed that despite these changes in office use and capacities, there has not been any change in the design of newer offices. The problem therefore is that users of offices are finding it increasingly difficult to perform their duties conveniently due to the degree of adaptation they could adjust to within the building. The aim of this research is to examine the user satisfaction with the flexibility of offices spaces. The research method adopted is mixed method with the use of structured questionnaire and observation schedule. The data would be analysed using SPSS software and the results transferred to Microsoft Excel. The results will show that the users of offices in tertiary institutions are not satisfied with the office spaces. It will also reveal that space flexibility will improve user satisfaction with office. The paper will conclude that to achieve space flexibility in offices there is need to group functions properly.

Keywords: flexibility, office space, satisfaction

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INTRODUCTION

The office is ranked second behind the home where any gainfully employed person spend the most time of the day (Schweizer et al., 2007; Leech, Nelson, Burnet, Aaron, and Razenne, 2002). In Nigeria, an average of eight hours of a working day which represents a third of the day is spent by government workers in their offices. It is usually a thing of joy when people get employed as this offers a new sense of responsibility to the worker. In many establishments the management of such institutions always seek to make provision of office accommodation for the new employee. These offices are allocated to new staff and are expected to serve them throughout their stay with the establishment while allocation of offices is based on career progression. The office environment where the workers function is of significant importance because it can affect their general wellbeing and comfort. According to Adedeji and Fadamiro (2012), the internal and external aspects of the workplace environment affects the workers level of comfort (visual comfort, spatial arrangement, security and overall workstation comfort). It is therefore important to ensure that offices provided for the users' suit their basic needs and desires. This is achieved through a design process that allows for information regarding them be collated and used in the design parameters. The need for flexibility of the office space is of importance because the occupants and their requirements vary, however a general range could be provided to accommodate their needs. The present practice of office provision that makes use of solid block as partitioning restricts the flexibility possibilities for the occupants hence the need to examine their level of satisfaction.

DESIGN PROCESS IN OFFICE PROVISION IN NIGERIA

It is common design practice in the design of tertiary institution buildings in Nigeria that office design is often discussed with the management team of the establishment as client and the architect(s) usually produces a design that is presented to the management team for approval. This practice is in accordance with the design process described by Adedayo (2013) which showed that prospective users of buildings are not often included in the process as shown in figure 1.0a. The figure though represents a housing process is applicable to the practice of office design because there is no provision within the loop to accommodate the office users. The usual practice is that the architect assumes the spatial need of the users, segregates based on rank of employees and hence produce a design that suits the ranking system.

The comfort of the end users are never sought so the users are forced to adapt to the offices provided and oftentimes this can affect their level of productivity. According to Vischer and Fischer (2005), the aim of any building design is to achieve high level of user comfort, in order to achieve this, there is always the need to evaluate what users consider as comfortable enough for them. This should be reflected in the design of new office buildings. In the design of tertiary institutions buildings in Nigeria
and Niger State in particular, the assumption is that lecturers are simply involved in research and teaching regardless of their Departments and Specializations, while other staff simply carry out administrative work with no specialization. It is hence common to find that the office designs are usually the same regardless of the faculty, while the usual difference is the choice of form and attention accorded to the size of space provided. The nature of activity nor the manner in which it is expected to be carried out within the offices space are never examined in detail with the view of making it flexible. It is common to find shared offices in many institutions because the cost of providing building structures to accommodate the workers is usually high, this is supported by McCoy (2005), when it stated that the cost of building ranks second to the worker’s salary.

![Fig. 1.0a Schematic representation of mass housing process provision in Nigeria](source: Adedayo (2013))

In the development of tertiary institutions in Nigeria particularly those owned by the Government, the institutions usually commence activities from a temporary site while the construction of the permanent site is ongoing. It can be understood when the buildings at the temporary site do not offer the required satisfaction to the end users because they are adapted buildings, however the same should not be the case for the purpose built offices. While it might be difficult to attend to every workers’ satisfaction in terms of office needs, there is however the need to offer the satisfaction of flexible spaces within the defined space provided. According to Wheeler (2006) “Workplace design should enable clients to do their jobs easily, remain flexible so end users can adjust the space according to their particular work style and be adaptable so that it can work well into the future.” The research is based on this quotation as it shows that the performance of the user of an office space is usually affected by their perception adequacy and flexibility the space offers. The manner by which office users in the 21st century work has changed over the years based on
the introduction and dependency on new forms of technology. There is therefore the need to examine the perception of users to flexibility offered within their office. In doing this a Post Occupancy Evaluation method is considered best, because according to Meir, Garb, Jiao and Cicelsky (2009), the information obtained from the current users of a building will assist in the development of new buildings. The aim of this paper therefore is to examine the perception of office owners with respect to the flexibility of the office space. The research is based on the findings of interactions with the different Officers in-charge of the Physical Planning Unit of the different institutions, which can be summarised as:

1. The office building designs and construction of tertiary institutions in Niger State do not have any input from the end-user.
2. The designs of the office buildings are done based on the assumption that all workers will perform their duties in the same manner.

It can be seen from these assumptions that these assumptions if found to hold in any institution, can affect the overall satisfaction of the office owners because they usually have different needs and aspirations as stated by Hofman and Halman (2006) that users of buildings usually have different expectations from the building they occupy irrespective of whether it is a house or office building. The issue of office flexibility is important because office users have different approaches towards performing similar task particularly in tertiary institutions where the individual workers strive to create an identity for themselves.

**PUBLIC BUILDING OFFICE TYPES**

Tertiary institutions can be considered as public buildings owing to the fact the general public can have access to it and it is a place where different people can come and transact business. There are several variations of office designs provided by architects that are done to suit the needs of the organization, however these offices can be grouped based on open-office system, enclosed office system or combination of both. According to Danielsson and Bodin, (2008) the usual traditional offices we see are occupied by one or two person(s) and it is usually created with use of enclosed walls and has all that is considered necessary to perform their duty. This might not be the case because what is considered necessary is based on what the management of the establishment thinks. The enclosed walls are usually of solid materials and in Nigeria the materials are usually sandcrete blocks. There are however defined restrictions on the available space within such office and the type of furniture used in such enclosed office are often restrictive. The open-office on its own part offers a wide range of adaptation and it is dependent on the external walling which serves as its form of enclosure. Brennan, Chugh, and Kline, (2002) were of the view that open office have varied range base on their design complexity and that the office users were separated with the arrangement of their furniture especially their desks.
According to Sanders and McCormick (1993) the office arrangement can be separated with the use of plants, cabinets or moveable low screens. Charles, Danforth, Veitch, Zwierzchowski, Johnson, and Pero, (2004) said “Open-plan office refers to an office space divided into relatively small cubicles/workstations by partitions (also known as screens or panels) and modular furniture.” In examining some office complexes in Nigeria the open offices are usually defined with the use of tables and they are arranged in geometric manner. Usually many establishments practice a combination of both forms of office designs with the enclosed office reserved for the staff that are higher in rank within the establishment organogram and the staff on lower ranks are kept in large shared offices. The issue of privacy and security are often achieved in the enclosed offices while the same cannot be said of the open office system. The issue of flexibility of the spaces in traditional office design is usually not the focus of the architects working on such schemes. The tertiary institutions office buildings are also treated as public buildings by the architects and it is therefore common to find a combination of both types of office system design. The issue of flexibility is also treated as secondary as attention is often focussed on privacy, security and distinction of staff.

OFFICE TYPES IN TERTIARY INSTITUTIONS IN NIGER STATE

There is often no significant difference between the office buildings found in Government Ministries and Agencies when compared with those found in the Universities in Nigeria. The focus oftentimes is based on aesthetic values of the buildings and the costs of such buildings. It is expected that university workers find a way of performing their duties properly, hence open offices are usually never different likewise the traditionally enclosed offices. According to Campus Planning Office (2013) document, the office spaces in the university should be such that it caters for academic and administrative work to be undertaken by those concerned adequately. This implies that there are differences in the requirements for various offices within the university and that the general approach towards office design should not be employed here. In many institutions found in Nigeria, majority of the workers usually make do with what is available and this affects their performance. A good environment is believed to be very important for workers’ productivity of which lecturers are included (Naseem, Sheikh, and Malik, 2011 and Newsham, Brand, Donnelly, Veitch, J., Aries, and Charles, 2009).

A common practice with the allocation of offices within institutions in Niger State is one that is based on the hierarchy of staff based on their rank, with the highest ranking staff (professors) getting the supposed best office space. It is common place to find the junior lecturers being allocated open offices or shared offices with high population, this practice is blamed on the inadequacy office space. According to Oyetunji (2013), Mike (2010) and Myerson and Bichard (2010) lecturers in open offices do not find these
spaces appropriate for their work, this is due to distractions from others and high volume of traffic visitors into the offices. Ajala (2012) is of the view that lecturers require office spaces that allow them to concentrate and improve their productivity and this is usually found in enclosed offices. The same scenario is found with the non-academic staff offices in these institutions. The cost of providing this type of office is often given as the reason why open offices are given to the junior academic/non-academic staff. The problem with this approach is that the junior staff will eventually advance in their careers and hence also need similar office spaces allocated to the senior officers. This helps to bring to fore the need for flexibility of the office spaces provided so that as workers in tertiary institutions progress career wise the office could be adjusted to suit the current needs. In order to achieve this there is need to ensure that space flexibility is already included in the design of such spaces from its inception. The design, construction and choice of building materials in majority of the tertiary institutions in Niger State do not allow for flexibility of the office spaces.

OVERVIEW OF OFFICE SPACE FLEXIBILITY

It is generally assumed that to achieve space flexibility the preferred option in terms of office design is the open-plan office type. According to Charles, et al (2004), organisations in an attempt to reduce space costs and provide flexibility usually adopt the open-plan office system. The factors responsible for organisation gravitating towards space flexibility differ based on the organisation vision and mission, however, Gilbert, E. (1996), Nawawi, A., Khalil, N. (2008) opined that the need to develop competitive advantage and improve productivity is key towards adoption of flexibility. In tertiary institutions in Nigeria, the factor responsible for the type of flexibility offered is due to the nature of the design of the office space and the growing demand for office spaces. Table 1.0 shows the nature of the type of office provided and table 2.0 shows the average number of users per office in some of the selected institutions:

<table>
<thead>
<tr>
<th>Category of Staff</th>
<th>Type of Office Occupied</th>
<th>Purpose built</th>
<th>Partitioned office</th>
<th>Open Office</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td></td>
<td>51</td>
<td>60</td>
<td>13</td>
<td>2</td>
<td>126</td>
</tr>
<tr>
<td>Non-Academic</td>
<td></td>
<td>53</td>
<td>20</td>
<td>30</td>
<td>0</td>
<td>103</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td></td>
<td><strong>105</strong></td>
<td><strong>81</strong></td>
<td><strong>46</strong></td>
<td><strong>3</strong></td>
<td><strong>235</strong></td>
</tr>
</tbody>
</table>

Source: Authors' fieldwork, 2014

A key benefit of space flexibility is the opportunity of achieving space efficiency which suits the management of the establishment. According to
a Space Management Group (2006) document, there are three factors considered in determination of efficiency of a space:

1. The quantity of space, generally calculated in terms of floor area though occasionally volume may also be relevant
2. The number of users, potential and actual
3. The amount of time the space is used.

These factors also play a role on the general wellbeing of the users of the office space and this is often evident through the method by which they seek to arrange furniture within the office towards achieving maximum productivity. The materials used in achieving flexibility in offices include; furniture, panels, demountable materials and railings. In achieving flexibility in office, facility managers usually focus on what would yield productivity for the establishment and never from the users’ point of view.

Table 2.0: Number of Occupants per Office based on Category of Staff

<table>
<thead>
<tr>
<th>Category of Staff</th>
<th>1 person</th>
<th>2 people</th>
<th>3 people</th>
<th>4 people and above</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>36</td>
<td>42</td>
<td>23</td>
<td>17</td>
<td>118</td>
</tr>
<tr>
<td>Non-Academic</td>
<td>15</td>
<td>25</td>
<td>25</td>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>51</strong></td>
<td><strong>68</strong></td>
<td><strong>48</strong></td>
<td><strong>56</strong></td>
<td><strong>223</strong></td>
</tr>
</tbody>
</table>

Source: Authors’ fieldwork, 2014

The essence of seeking users’ view in terms of flexibility is due to the fact that they are the beneficiaries of the building. The method of allocation of office spaces in many tertiary institutions in Nigeria can be said to be unsustainable given the fact that the rate of office provision does not correspond to the rate of promotion of staff nor the employment rate in the institutions. It would therefore be important to seek ways of ensuring that the current spaces are flexible enough to meet the aspirations of the office users as they progress. This provides the base for evaluating the perception of flexibility in offices as this would assist in ensuring that key issues are tackled at the design stage by the people involved in office management in the tertiary institution.

RESEARCH METHOD

A post occupancy evaluation method was adopted for the research as this gives a view of the users’ opinion of the subject matter under investigation. According to Adedeji and Fadamiro (2012) Post Occupancy Evaluation (POE) has generally been accepted as method of obtaining opinion of users in the built environment especially where it relates to perception studies. According to Zimmerman and Martin (2001), more specifically POE tests generic and specific aspects of the planning and detailed design of facility buildings. It also tests their impact on building users with respect to
several parameters such as: health and safety, security, indoor environment quality and functions.

Niger state in Nigeria was selected because it has a wide variety of tertiary institutions which are spread across the State, hence giving a mix blend of respondents for the study based on diverse cultural backgrounds. A questionnaire was developed and administered to the respondents selected from five tertiary institutions out of a study population of 13 tertiary institutions and it was done on the basis of staff population. A total of 500 copies of questionnaire was administered with 238 copies returned giving a 47.6% return rate. The selection of respondents within the institutions was spread amongst the Academic and Non-academic staff using a Stratified Random sampling method. The category of staff selected was because they formed the bulk of people to be considered in the design of office buildings. Ten research assistants were selected from the Masters students of the Department of Architecture, Federal University of Technology Minna and they were distributed amongst the five institutions to administer. The data was collated, sorted out based on the institutions and entered in SPSS for analysis purposes while the results are presented in tables and charts. Pictures of some selected office interiors are presented as plates to explain further the issues within the discussion of results. The calculation of the rating of selected perception questions was based on the Likert scale with the view of establishing a finite decision upon which the recommendations of the research would be based.

**Table 2.1: Institutions Studied**

<table>
<thead>
<tr>
<th>Name of Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zungeru Polytechnic</td>
</tr>
<tr>
<td>Ibrahim Badamosi Babangida University</td>
</tr>
<tr>
<td>Fed. Uni. of Tech. Minna</td>
</tr>
<tr>
<td>Federal Polytechnic Bida</td>
</tr>
<tr>
<td>College of Nursing Bida</td>
</tr>
</tbody>
</table>

Source: Authors’ fieldwork, 2014

**RESULTS AND DISCUSSION**

The results show that the perception of the users vary widely in terms of office space and flexibility when examined individually with respect to the institutions however when combined and viewed together it gives an average perception of the measurement. The Likert scale measurement is discussed in the first part of this section while selected specific cases are discussed subsequently.

**Likert Scale Measurement of Space and Flexibility Perception**

A weighted scoring of 1-4 was apportioned to the different options for choice for the respondents based of their perception of the variable being measured. The scoring of the options are stated below;

| Very Dissatisfied | 1 |
Dissatisfied 2
Satisfied 3
Very Satisfied 4

Table 3.0 shows that majority of the respondents are spread within the satisfied and dissatisfied section of the scale of measurement. The number of respondents in each section is multiplied by the weighted score allocated to it, the calculation for this is shown in table 4.0 and the total score across the rows are added up and presented as the total at the end of the table.

Table 3.0: Number of respondents per opinion on Satisfaction with office space and flexibility measured

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Very Dissatisfied (X1)</th>
<th>Dissatisfied (X2)</th>
<th>Satisfied (X3)</th>
<th>Very Satisfied (X4)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of Office size</td>
<td>31</td>
<td>92</td>
<td>100</td>
<td>15</td>
<td>238</td>
</tr>
<tr>
<td>Rating of sitting options in Office</td>
<td>17</td>
<td>129</td>
<td>79</td>
<td>12</td>
<td>237</td>
</tr>
<tr>
<td>Rating of Circulation space in Office</td>
<td>8</td>
<td>145</td>
<td>71</td>
<td>14</td>
<td>238</td>
</tr>
<tr>
<td>Rating of position of Fittings in Office</td>
<td>31</td>
<td>104</td>
<td>89</td>
<td>14</td>
<td>238</td>
</tr>
<tr>
<td>Rating of privacy level in Office</td>
<td>38</td>
<td>97</td>
<td>77</td>
<td>22</td>
<td>234</td>
</tr>
<tr>
<td>Rating of Visitor's space in Office</td>
<td>46</td>
<td>105</td>
<td>77</td>
<td>7</td>
<td>235</td>
</tr>
<tr>
<td>Rating of position of ICT facility in Office</td>
<td>64</td>
<td>112</td>
<td>53</td>
<td>8</td>
<td>237</td>
</tr>
<tr>
<td>Rating of Interference with physical space in Office</td>
<td>29</td>
<td>96</td>
<td>98</td>
<td>12</td>
<td>235</td>
</tr>
<tr>
<td>Rating of flexibility of Office space</td>
<td>35</td>
<td>118</td>
<td>76</td>
<td>9</td>
<td>238</td>
</tr>
<tr>
<td>Rating of flexibility of office building</td>
<td>16</td>
<td>120</td>
<td>94</td>
<td>6</td>
<td>236</td>
</tr>
<tr>
<td>Rating of flexibility of Chief Executive Officer's Office</td>
<td>9</td>
<td>59</td>
<td>100</td>
<td>65</td>
<td>233</td>
</tr>
</tbody>
</table>

Source: Author’s fieldwork, 2014

It can be observed from table 5.0 that majority of the respondents are dissatisfied with the office spaces provided for them and they also consider the Chief Executive Officer’s (CEO) office as being the best office in terms of flexibility. The view can be understood based on the fact that attention is often placed on this officer’s office. This trend is repeated as the category of staff offices is considered with the Dean’s office better than the Head of Department and the Professors office. However it can be explained why these officer’s offices are better than others but the requirements by the other officers does not necessarily mean they seek to have same type of office as those of the CEO. In some case cases the officers simply require larger spaces if they must share offices while others require conveniences within the office. There is therefore need to examine the relationship between selected variables within the study population.
Table 4.0: Sum of respondents’ responses on Satisfaction with office space and flexibility

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Very Dissatisfied (X1)</th>
<th>Dissatisfied (X2)</th>
<th>Satisfied (X3)</th>
<th>Very Satisfied (X4)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of Office size</td>
<td>31</td>
<td>184</td>
<td>300</td>
<td>60</td>
<td>575</td>
</tr>
<tr>
<td>Rating of sitting options in Office</td>
<td>17</td>
<td>258</td>
<td>237</td>
<td>48</td>
<td>560</td>
</tr>
<tr>
<td>Rating of Circulation space in Office</td>
<td>8</td>
<td>290</td>
<td>213</td>
<td>56</td>
<td>567</td>
</tr>
<tr>
<td>Rating of position of Fittings in Office</td>
<td>31</td>
<td>208</td>
<td>267</td>
<td>56</td>
<td>562</td>
</tr>
<tr>
<td>Rating of privacy level in Office</td>
<td>38</td>
<td>194</td>
<td>231</td>
<td>88</td>
<td>551</td>
</tr>
<tr>
<td>Rating of Visitor’s space in Office</td>
<td>46</td>
<td>210</td>
<td>231</td>
<td>28</td>
<td>515</td>
</tr>
<tr>
<td>Rating of position of ICT facility in Office</td>
<td>64</td>
<td>224</td>
<td>159</td>
<td>32</td>
<td>479</td>
</tr>
<tr>
<td>Rating of Interference with physical space in Office</td>
<td>29</td>
<td>192</td>
<td>294</td>
<td>48</td>
<td>563</td>
</tr>
<tr>
<td>Rating of flexibility of Office space</td>
<td>35</td>
<td>236</td>
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</tr>
<tr>
<td>Rating of flexibility of office building</td>
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</tr>
<tr>
<td>Rating of flexibility of Chief Executive Officer's Office</td>
<td>9</td>
<td>118</td>
<td>300</td>
<td>260</td>
<td>687</td>
</tr>
</tbody>
</table>

Source: Author’s fieldwork, 2014

The interpretation of the results obtained based on the Likert scale calculation is based on the range of scale stated as follows:

1.0 - 1.49 Very Dissatisfied
1.5 - 2.49 Dissatisfied
2.5 - 3.49 Satisfied
> 3.5 Very Satisfied

Table 5.0: Respondents’ opinion on Satisfaction with office space and flexibility interpretation

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Sum</th>
<th>Mean</th>
<th>Interpretation</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>Rating of sitting options in Office</td>
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</tr>
<tr>
<td>Rating of Circulation space in Office</td>
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<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of position of Fittings in Office</td>
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<td>2.36</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of privacy level in Office</td>
<td>551</td>
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<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of Visitor’s space in Office</td>
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<td>2.19</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of position of ICT facility in Office</td>
<td>479</td>
<td>2.02</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of Interference with physical space in Office</td>
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<td>2.40</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of flexibility of Office space</td>
<td>535</td>
<td>2.24</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of flexibility of office building</td>
<td>562</td>
<td>2.38</td>
<td>Dissatisfied</td>
</tr>
<tr>
<td>Rating of flexibility of Chief Executive Officer's Office</td>
<td>687</td>
<td>2.95</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

Source: Author’s fieldwork, 2014
Flexibility of Office Rating Based on Category of Staff
Usually there are two major categories of staff in any tertiary institution in Nigeria (academic and Non-academic). They usually require different kind of office spaces however this hardly is the case when the buildings in these institutions are being designed. The only difference is usually the office of the management staff that vary from others, it is therefore not a problem for the facility managers in the institutions to allocate the offices to anybody without any modification regardless of the duty the person is expected to perform. In figure 1.0 it can be observed that the percentage of respondents that were dissatisfied with their office space is slightly higher in the academic staff category. This can be understood because majority of the academic staff interviewed usually consult with group of students within the office and the space is often inadequate. They also complained of inadequate space for storage and circulation within the office. In the case of the non-academic staff, their lack of satisfaction has to do with the circulation space and the permanent position of furniture they are restricted to due to the rotational policy of the institutions. The academic staff also complained of inability to rearrange the office to hold small group discussion with colleagues or students within the office. In many cases the possibility for the use of projector within the office is quite difficult given the layout of the office particularly in shared offices. The percentage that considered the option as satisfactory were those at the higher cadre of category of staff based on the fact that many have larger office spaces and were often one or two person maximum per office.

![Figure 1.0: Distribution of staff with level of satisfaction with flexibility of space. Source: Authors’ fieldwork (2014)](image)

Flexibility of Office Rating Based on Occupation of Office
The cost of providing infrastructure in tertiary institutions in Nigeria is quite high and hence the slow rate of infrastructural provision in these institutions, however there is a growing staff population in these institutions through employment. It is common to find many institutions encouraging shared office system so as to accommodate the new members of staff. In some institutions the creation of new departments are not
followed with the provision of new infrastructures rather than they share existing office spaces and in some cases the existing offices are partitioned. In figure 2.0, there is little difference in the percentage that were dissatisfied with the flexibility of their office space with 66% of those in shared offices dissatisfied while 63% was the case in the single office occupation. The key reason for the high level of dissatisfaction with the officers occupying single offices was the small space available for them that ranged between 9m$^2$ to 16m$^2$ this affected the arrangement possibilities within the office. In the case of shared office, the 34% that were satisfied with the flexibility were those who were often two per office and usually had larger office space. This was the case in offices occupied by senior lecturers and above at the universities who had office spaces of about 36m$^2$ and where either two or three per office had just a single table each. There were cases where senior Non-academic staff were accommodated in offices that were 2.4m wide hence flexibility could be said to be non-existent even though they were alone in the office. This accounted for some of the percentage of dissatisfaction from those who occupied single offices. This figure 2.0 goes to show that flexibility is not just the requirement of those in shared offices but it also affects those in single occupied offices.

![Figure 2.0: Satisfaction with flexibility of office space based on office occupation. Source: Authors' fieldwork (2014)](image)

**Perception of Privacy rating in office based on Number of people per office**

Privacy is a major concern in many office visited during the course of the research and many respondents claimed that they usually locked their lockers whenever they were leaving the office particularly those in shared offices. The reason many gave for this action was the need to avoid invasion of their privacy from office colleague going through their desk. In many cases where respondents had shared offices they complained about their inability to hold any private discussion within the office especially when another colleague was around and to counter this problem they usually go outside the office to the corridor or lobby. In figure 3.0 there is
significant increase in the percentage of respondents that were dissatisfied with the level of privacy as the number of people per office increased. In the case of those that were dissatisfied in single person occupation of office, they complained about the partition material used to separate their office from the others as it offered visual barrier only and not sound barrier. The essence of privacy is quite important in tertiary institution office because there are often many cases where students want to come for counselling on issues that they would not want other officers to hear. In an attempt towards achieving significant amount of privacy many office occupants usually seek to take the advantage of locating their desks at the far corners of the office. In some partitioned offices the partitioning walls do not get to the ceiling level hence creating a means of interference during discussions.

Figure 3.0: Satisfaction with privacy level of office space based on number of persons per office. Source: Authors’ fieldwork (2014)

CONCLUSION
The need for office space in many tertiary institutions in Niger state is quite high and government cannot meet this need, however the management of these institutions should begin to consider the need to provide spaces that meet the need of the users. An important factor that should be considered in office provision by architects and the approving
management of institutions is that of office flexibility. This should be done based on what the office users consider as requirement for flexibility. During the course of the research many younger officers considered the senior officers of the institutions as having better office spaces and hope that someday they would get similar offices, however going by the current rate of infrastructural development this dream is unrealistic. The good option is for management to begin to examine how they could make the current available office spaces flexible enough to allow for acceptance by the current occupiers such that they would be satisfied with the office hence reducing the demand for newer offices on the account of dissatisfaction of the current one. The architects involved in office design for tertiary institutions should begin to consider the principle of space flexibility so that the buildings would fit the needs of the users as it changes over the course of their employment. In conclusion it is apparent that any staff not satisfied with his or her office would most likely not be productive which in turn affects the overall vision of the establishment. It is therefore recommended that staff should be allowed to make inputs in design of office spaces and the arrangement of the existing offices. In cases of shared offices, it is recommended that rather than have staff of the same level share office, it might be better to have a mix of cadre share offices as this would affect their space requirement. The use of non-transparent partitions would enhance privacy while the use of demountable fittings would enhance flexibility. It is important to consider office space flexibility in tertiary institutions given the changing mode of conducting duties in tertiary institutions given the influence of technology.

REFERENCES


USER’S PREFERENCES IN MASS HOUSING ESTATE IN NIGER AND KWARA STATES OF NIGERIA

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An examination of selected low income mass housing schemes built by government and private developers in Nigeria reveal a similarity amongst them, which is lack of involvement of house owners. The design process adopted for these houses showed that mass housing schemes designs have been based on the assumptions of user needs. The degree of importance users placed on the various aspects of the houses was never considered. In the 100 years of Nigeria’s development between 1914 and 2014 there has been significant changes in many sectors, however the nature of the houses being built in mass housing schemes across the country remain the same. The problem with the assumption method of housing provision is that the target peoples’ needs and desires are never achieved even with the change in government policy towards housing provision. The aim of this paper is to determine the level of importance placed on different aspects of housing by the house owners. The research made use of mixed research method by using questionnaire and observation method in gathering the data from field surveys in Niger State and Kwara State. The perception of the house owners was collated and SPSS was used to analyze the data. The results showed that house owners placed high importance on some aspects of the houses measured. The research concludes that there is need for a drastic change from the design process in mass housing provision in Nigeria as Nigeria marks its 100 years. The change should be towards designing for user focused housing designs.

Keywords: design assumption, design process, mass housing, perception

INTRODUCTION

Urbanisation is often closely related with rapid increase in population and the subsequent increase in urban-rural migration which could be a direct result of the rate of infrastructural provision in urban centre in Nigeria. The problem with this growth is the housing shortage which has been put at between 16 and 17 million housing units by several researchers such as Kabir and Bustani (2009), Ademilluyi and Raji (2008), Akeju (2007) and Adedeji (2005). The growth of a city according to Bello (2009) comes along with an increase in demand for land and infrastructure, hence it is noticeable in many cities in developing countries that these demand pose

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challenges for the different policy makers and professionals involved in city planning. The resultant effect of these challenges is the approach citizens undertake towards meeting their housing need through self-help means; this option has brought about resultant problems due to unplanned nature of majority of these solutions. Tracing the development of housing provision in Nigeria, Olotuah (2007) stated that the 1928 bubonic plague in Lagos led to the intervention of government in housing provision. The early intervention of government in housing was the provision of staff quarters for workers of colonial masters and later the working class citizens. The clients in these housing schemes are usually government or the employer, the houses were designed not to be user specific, since the occupants were transient. This concept has been adopted by architects and Housing developers in mass housing schemes. One hundred years on, however the users are no longer transient. According to Adedayo (2012a), house owners in mass housing schemes in Nigeria have sought to make their houses suit their needs through a process of customization. It is based on this need that this research seeks to examine user preferences in housing designs of mass housing schemes for the low income earners, because the people who occupy these houses usually do not have the same need or characteristics. This is why the transformations that occur in housing estates do not follow a particular pattern but rather users’ desires.

**Public Housing Development in Nigeria**

The development of housing for the public started with the provision of Government Reserved Areas (GRA) which housed the colonial masters and later transferred to the Nigerians who took over their offices and houses. Aribigbola (2008) stated that Nigeria government direct intervention in housing provision started with the provision of quarters for expatriate staff and selected indigenous staff. This trend later spread to other sectors of the country, a key factor to this trend was that only government was considered to have the financial capacity to embark on housing provision since it was capital intensive (Ajanlekoko, 2001). An attempt to meet the housing demand by the general public, some Federal Government Ministries, Tertiary Institutions and Companies provided houses for their staff which they referred to as staff quarters. The idea was that these staff would live in these houses for the period they were in the employment of the establishment. However this gradually became a failure as the rate of population growth and employment demand was not met with corresponding housing provision. The Rural-Urban migration was another key towards increase in the demand for housing in the urban centres. There have been several approaches towards meeting the housing deficit which has ranged from policy formulation to direct intervention with the construction of houses by government (Ademilluyi and Raji 2008). In tracing history of housing in Nigeria, Government had a plan of delivering about 202,000 housing units every year to Nigerians, this was between 1975 and 1980, this plan did not materialise. Between 2010 and 2014 the Government plan is to deliver 1 million housing units to the Nigerian populace however the approach has changed. The Government has decided
to take back stage by simply providing enabling environment for the private sector to meet this target. The problem with this plan however is that even though the country is faced with variety of problems in housing in 2014, the approach by housing developers and architects has not changed from the pre-independence and early 1980s’ method of providing a single design for the mass housing scheme. In simple words the developers still treat the house owners in mass housing schemes as though they were transient as was the case with staff quarters.

In an attempt to quickly recoup their investment the housing developers have focussed on the high and middle income earners. However what is common to any of the estates or mass housing schemes built are the changes that theses house owners always sought to make on their houses which are often due to the differences that exist amongst them. This view is supported by Natakun and O’Brien (2008) when it examined the user extensions to government buildings and concluded that the needs of the users were a key factor that motivated the changes. It can be observed that despite the several interventions of both Government and private sector in housing, the gap between demand and supply of houses is still on the increase and there seems to be no clear attempt to examine what the prospective house owners want.

**Low-income Mass Housing and Its Target Groups**
The development of mass housing schemes in many developing countries is often planned for the low and middle income earners. This particular group of people are seen as those who cannot readily provide a house for themselves or access the high-end houses provided by housing developers which usually outweigh their income. The provision of mass housing therefore is seen as the best alternative for meeting housing demand in Nigerian urban centres. According to Okpoechi (2014), the mass housing schemes in Nigeria has been faced with a lot of challenges one of which was that of quality and this is manifested by the level of acceptance of the scheme by the people it was meant to serve. It also stated that the target group was simply determined by the classification of income group; hence none identification of the specific target group needs which then affects the house type provided. Onu and Onu (n.d) equally identified the target group of mass housing schemes in Nigeria as the low-income earners of the society. It went further to state that the low-income categories are further divided into those with regular income and those without income.

The classification of these target groups is usually based on the Net salary of the workers who are interested in the housing schemes; usually this excludes the workers that are not in government employment. In cases where these people try to access these housing schemes they do so by proxy. The mass housing schemes are basically targeted at those with some form of income who can make down payment and continue to pay the mortgage on the house. The mass housing developers have always assumed the classification of target group to be purely based on the income level of the people and this assumption is not limited to Nigeria alone;

The use of income group as a means of determining the target group helps solve the affordability aspect of the mass housing scheme target, while this deals with the economic part of the housing scheme, the part of characteristics of the target group is often overlooked. The architect therefore usually produce a single design and replicates it around the site, it is the expectation of the developer that the design provided meets the desires of the prospective house owner. A situation where the house owner was not sought for at the beginning will only ensure that the design brief becomes a failure hence the product (house) also becomes a failure too. It is not just the income of the prospective owner that should form the basis of the housing scheme rather the household characteristics of the owner should also be key in determining the house type. This creates the need for participation of prospective house owners in mass housing provision from the inception stage in order to ensure that their peculiarities are captured.

**User Participation in Mass housing Schemes**

The need to get the prospective house owners involved in the provision of houses in mass housing schemes right from the onset is often a challenge for the developers. The architects usually consider the developer as the client and it is his desire that often becomes the focus. The process of getting the house owners involved within the mass production method in practice in Nigeria has always been a challenge (Adedayo 2012b). It has been stated that none participation of the prospective house owners in mass housing schemes usually leads to housing transformation. The importance of user participation is the direct impact it has on the house owner’s satisfaction with the house as stated by Onder, Köseoğlu, Bğlen, and Der, (2010) and Ammar, Ali, and Yusof, (2013). The satisfaction of the house occupant is usually the aim of the architect when carrying out any design, however in the cases of mass housing schemes in Nigeria that focus appears to be relegated. The users of a building usually have the best knowledge of how their activities interplay and the nature of spaces required to effectively perform them, there is need to allow them participate in the process (Christiansson, Svidt, Pedersen, and Dybro, 2011). The main benefit of involving the houses owners in mass housing schemes at the inception of the design is that it allows them to state their preferences within the house and have it included in the design. This allows for the delivery of an acceptable product that meets the needs and aspirations of the users. In majority of the mass housing schemes provided in Nigerian urban centres the house owners are left out of the loop until the end of the cycle and are only involved at the end when the house had been produced.

**User Preferences in Housing Selection**

In the design of individual houses that are commissioned by the house owners the architect usually has no challenge in determining the user preferences which would have been obtained at the briefing stage and then translated into the design. In the case of mass housing scheme the
preferences of the house occupants are usually assumed in Nigeria since there is no post occupancy evaluation carried on these houses by the developers. In the case of developed countries, the developers usually seek out the preferences of the prospective house owners and hence build houses along these preferences. According to a Victorian Auditor-General’s Report (2012) on access to public housing in Australia there is a division within the housing authority that collects data on housing occupants’ characteristics and preferences which is now used to develop future houses. It implies that there should be a system of collection and collating the data on user preferences in housing. The determination of user preferences is usually a difficult task for the architects because they vary and could be very diverse.

According to Timmermans, Molin, and Noortwijk, (1994), though it is difficult to interpret the preferences of users with regards to housing, choice models could be used to express these choices. In doing this the preferences could be categorised and offered as options for them to select from. Leishman, Aspinall, Munro, and Warren, (2004), stated that the preferences within the house could be the size of the spaces, the nature of fittings and some cases arrangements of adjoining spaces. In determining user preferences the various aspects of the house have to be divided into sections and the user be made to rate the options that they have interest in participating. This action would help assist the architect or developer determine which aspects of the house the preferences would have significant impact on. According to Zinas, and Mohd Jusan, (2010), “Every person lives and operates within the framework of choosing from alternatives of life’s endeavours in whatever area.” This implies that in handling house owners’ preferences in mass housing schemes there is a need to provide options for them to choose from after collating their preferences. It should be noted that not all the preferences of the users can be provided for in attempting to meet their needs. However it is important to seek these preferences out and this can only be done through either a post-occupancy evaluation or before the construction of the houses.

**RESEARCH METHOD**

The research approach to this study was the use of a post-occupancy evaluation approach. A questionnaire was developed and question relating to aspects of individual housing that house occupants considered as important in participating were grouped and they were required to respond to it. The survey was conducted in Ilorin, Kwara State and Minna Niger State, Nigeria. The choice of the two cities was due to the fact that they are both State capitals and majority of the mass housing schemes have been concentrated in the State capitals and the population of people that seek accommodation are usually higher. The population of occupants within the estates gives a diverse mix of people with different cultural heritage, with people from northern and southern Nigeria. Two housing estates each were selected in each of these estates and questionnaire was administered.
to the occupants. A total of 300 copies of questionnaire were administered during the fieldwork in four selected estates, two estates from each city and this was distributed evenly and 120 copies were returned. There were eight housing estates that met the criteria of minimum 100 housing units within the estates, the estates were randomly drawn from a pool using the hat and draw method. The results were then grouped based on the town of study which are Minna and Ilorin. The houses were randomly selected within the estates. The data was collated and analysed using SPSS version 20 software to generate the results which were then transferred to Microsoft Excel package to generate the tables for presentation and discussion. The discussion is based on the on the results generated from the analysis of the Likert scale measurement that was used as a mode of measuring the responses of the occupants.

**FINDINGS AND DISCUSSION OF RESULTS**

<table>
<thead>
<tr>
<th>Housing Preference Category</th>
<th>City</th>
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<th>Unimportant</th>
<th>Important</th>
<th>Very Important</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Ilorin</td>
<td>0</td>
<td>5</td>
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<td>9</td>
<td>52</td>
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<td>Minna</td>
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<td>32</td>
<td>19</td>
<td>58</td>
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<td>45</td>
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<td></td>
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<td>3</td>
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<td>4</td>
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<td>26</td>
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<td>28</td>
<td>58</td>
</tr>
<tr>
<td>Number of Rooms Preference</td>
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<td>2</td>
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<td>4</td>
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<td>32</td>
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<td>Ilorin</td>
<td>0</td>
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<td>35</td>
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<td>52</td>
</tr>
<tr>
<td></td>
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<td>2</td>
<td>7</td>
<td>31</td>
<td>18</td>
<td>58</td>
</tr>
</tbody>
</table>

The analysis of the data obtained through questionnaire was done using likert scale as an assessment tool and is presented in table 1.0, 2.0 and 3.0. In table 1.0 the distribution of the respondents are shown is based on the preference with aspects of the housing. The grouping of the preferences is
done to accommodate different specific options and thus seeks to address the broad aspect of the housing.

The weight range between 1 and 4 was assigned to the level of importance placed on any preference option by the house occupants based on the various categories of questions based on Hofman and Halman (2006). The weight score is used to multiply the number of respondents per category which is used to calculate the mean score of the choices. Table 2.0 shows the weighted scores of each preference option.

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<td>2</td>
</tr>
<tr>
<td>Important</td>
<td>3</td>
</tr>
<tr>
<td>Very Important</td>
<td>4</td>
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</tbody>
</table>

Table 2.0: Distribution of respondents’ preferences weighted score

<table>
<thead>
<tr>
<th>Housing Preference Category</th>
<th>City</th>
<th>Very Unimportant</th>
<th>Unimportant</th>
<th>Important</th>
<th>Very Important</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Arrangement Preference</td>
<td>Ilorin</td>
<td>0</td>
<td>10</td>
<td>114</td>
<td>36</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Minna</td>
<td>1</td>
<td>12</td>
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<td>76</td>
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<td>14</td>
<td>93</td>
<td>72</td>
<td>181</td>
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</table>

Source: Author’s Fieldwork (2013)

The interpretation of the result obtained in Likert scale, is based on the scoring range of the scale stated as:
The result as presented in table 3.0 shows that the respondents considered all the sections stated in preferences options sought in the housing as being important. This gives an idea of which sections of the individual houses that the architect should allow the prospective house owner to have some say. In cases of preferences that had to do with the beauty of either the exterior or interior of the building the variety of ideas are quite wide and each individual had different opinion about what beauty should be. The failure to guaranty these opinions of the house owners can increase the cost of the house because they would always seek to achieve these individual preferences. On the issue of choice of fittings preferences, the opinions of the respondents differ greatly because it has a direct impact on the overall beauty of the interior space.

The choice of fittings is one that is directly linked to the availability of the money from the on-set to the client. It is usually assumed that the target group in mass housing do not have money to achieve certain level of beauty, while this might be true at the inception of the project but over the
life span of living in the house this might not be the case due to the incremental nature of achieving their needs and aspirations. The level of importance place on the number and sizes of rooms is based on the difference between the family characteristics of the house owners which are never the same hence the provision of standard format does no down well with them. It can be concluded that user preferences is important in mass housing schemes.

CONCLUSION

In conclusion the study has shown that house occupants of mass housing schemes consider certain preferences in the overall housing scheme provision as important because of the unique nature of their families. These uniqueness are usually not captured by the architects working in mass housing schemes due to the generic nature of housing design principle. The lack of recognition or inclusion of this unique aspect of preferences by architects and housing developers has ensured that the needs and desires of the house owners are met through user adaption methods. The produced house can be considered as not being satisfactory for the house owners in terms of meeting their needs and aspirations which is the fundamental of any housing design. It is safe to conclude that the method used by architects involved in mass housing schemes which does not offer user preferences was good during the period of staff accommodation where the occupants are consider as transient. In cases where the mass housing schemes are not meant for people who are transient, then the approach of the developers and the architects must change to take into account of the user preferences as they arise. The need for this change is due to the fact Nigeria has grown to 100 years old and the housing sector has equally evolved, also the people whom these housing estates are being developed for have also changed.

REFERENCES


Adedayo


VIRTUAL REALITY AND THE BUILT ENVIRONMENT CURRICULUM

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Virtual reality (VR) is an advanced visualisation tool used for the simulation of 3D interactive environments with visual, audio and tactile effects. Its applications in the construction industry include construction integration, computer aided design and drafting (CADD), construction scheduling, construction process/modelling, productivity management and safety management. Its rapid adoption in the construction industry has been deterred mainly by its excessive cost, hence only large companies could readily invest in the technology. Efforts have been made by some UK universities in introducing VR to their built environment curriculum as a move to increase in the long run, the awareness of VR in the industry, and also to expose students to advanced visualisation tools. This paper examined what UK universities are doing about integrating VR to their built environment curriculum. Data were obtained from a web-based survey distributed to 46 respondents in 36 universities offering six selected built environment courses. Results indicate that a significant percentage of UK universities have introduced VR in their built environment curriculum with a majority in Architecture courses. This further confirms the predominance of visualisation tools in Architecture programmes than in other construction disciplines. Also, methodologies for delivery varied from institution to institution. It was recommended that VR instructors exploit innovative practical sessions like online VR resources and simulation games that help stimulate the learning process.

Keywords: built environment curriculum, industrial application, United Kingdom, virtual reality, visualisation

INTRODUCTION

Information is recognised as a key management resource in the construction industry and its exchange as one of the critical tasks in the construction management process (Harris and McCaffer, 2006). Visualisation in construction is concerned with digitising information to enable speed, virtual proximity and seamlessness in the collaborative work of the multi-disciplinary team of professionals in the industry. The decreasing cost of computer hardware and software is making visualisation tools more accessible to construction professionals within the industry (Muhammad, 2007). Virtual reality (VR) can be described as a

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computer technology used for the simulation of three dimensional interactive environments with visual, audio and tactile effects. These environments can be models of real or imaginary worlds.

Contrary to popular perception, VR systems are in two main categories — immersive VR and Desktop VR. The main difference between the two is that as opposed to the use of a typical graphic screen for the desktop VR, in the immersive VR this is replaced by a head mounted display (HMD) and data gloves that ‘immerse’ the user in the simulated environment. A third type of VR system is the projection-based VR system where large display screens are used to display the virtual environment. General applications of this technology can be seen in medicine, product design, and entertainment (Druck, 2006). VR promotes the understanding of complex construction systems even in people with limited past experiences or knowledge about that system (Fernandes et al, 2006). The applications of VR in construction is at different stages of trials and developments. Construction industry application of VR include computer aided design (CAD), design and analysis of construction equipment, construction process/scheduling, training of project teams and construction integration. Within the context of the construction industry, the VR environment enables unforeseen problems often caused by professionals’ decisions, faulty work and health and safety issues to be evaluated in respect of time, cost and resources (Goulding et al, 2012). Several studies on the application of VR in construction have confirmed that the industry has long viewed VR technologies as expensive and time-consuming. However, the industry’s unique tendency to lag behind in terms of taking advantage of new technologies and innovative practices is well documented (Jupp, 2014; Anumba et al in 2005; Olofsson and Worksepp, 2005). Previous research has demonstrated various promising benefits of visualisation and VR to the UK construction industry (Keenaghan and Horvath 2014; Bouchlaghem et al, 2004; Vries et al 2004; Messnar et al, 2003; Retik and Shapira, 1998); however, it can be argued that these perceived benefits are hinged on the increased affordability and awareness of the technology. Compatibility of VR with existing CAD technologies is another challenge to the total uptake of VR in construction.

Introducing VR to the built environment curriculum even in countries other than the UK have shown that the awareness and usage of the technology in construction could be improved in the long term. Goedert et al (2011) posited that there is currently a need to improve construction education and training by incorporating advances in simulation, modelling and semantic web and software engineering. Active project based learning will more likely meet educational objectives than traditional lectures in construction education (Betts et al, 1993 in Muhammad, 2007). This suggests that better prepared graduates entering the workforce can be attained due to project-based experiential learning made possible by construction simulation (Betts et al, 1993 in Muhammad, 2007). While some UK universities have introduced VR to their built Environment curriculum in rather different ways, there is little information that deals
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particularly with a survey of its introduction to the built environment curriculum across the UK universities. This paper examines what UK universities are doing about integrating VR to their built environment curriculum. The research questions posed for this study are ‘to what extent have UK universities introduced VR to their built environment curriculum?’ and ‘what are the methods of instruction for VR in the built environment curriculum?’

LITERATURE REVIEW

Visualisation involves the use of interactive graphic representations of data. The collaborative nature of work in construction requires that all stakeholders have a shared understanding of issues (Bouchlaghem et al, 2004). Visualisation tools remain the future for the effective communication and sharing of data among construction practitioners (Muhammad, 2007).

Although the term virtual reality was first used in the 1980s it has its historical roots in the 1920s when simulation was used for aviation practice to train pilots to land safely without fear of causing damage to the aircraft (Phiri, 1999). The first milestone in the development of VR was when filmmaker Morton Heilig invented the ‘Sensorama’ in 1962, a video game that gave stereo sound, video feedback by means of 3D photographic slides, motion and even aroma effects to increase the realism to the user. The Sensorama was however, not interactive as it did not allow the user to physically interact with the simulator (Steed, 1993 in Muhammad, 2007). In the late 1980s scientists at NASA AMES, created the VIEW system (Virtual Interactive Environment Workstation), the first ever VR system that integrated the head mounted display (HMD), data glove, voice recognition and 3D audio. They also developed the first commercially viable HMD called the visual environment displays (VIVED), which was based on a scuba diver’s face mask with optical screen displays from two Sony Watchman handheld televisions (Costello, 1997). A more recent VR milestone is the invention of teleimmersion in 2000 which enables users in different geographical locations to collaborate in real time in a shared, simulated environment as if they were in the same physical room. Teleimmersion is however distinct from VR because, in the former, the user is placed, and interacts with another real environment while in VR, the user is given the impression of being in a simulated environment.

While Huang et al (2010) observed that VR is a technology that has become extremely popular in recent years it is at the same time, subject to numerous definitions (Goulding et al, 2012). It has no one common definition, but rather common characteristics. Such variations in descriptions although general in nature, sometimes have a bearing to the specific discipline or use the VR technology is being applied to. Where some observers associate VR with the tools (HMD, data gloves etc.) used for interaction with a virtual environment (VE) like video games
(Abdousalam, 2005); Otto et al, (2002) described the phrase ‘Virtual Reality’ as a specific configuration of software and devices and a user’s interaction with a computer generated graphical world. VR can also be described as ‘I3’ (immersion-interaction-imagination). In simple terms, VR is the science of integrating man with information (Kevin et al 1993). Abdousalam (2005) suggested that as long as a system can provide the user with a sense of presence, such a system can be qualified to be called a VR system.

Virtual Reality systems are classified based on the user’s level of presence within the VR medium and the combination of computer hardware, software, input/output devices and the data (Abdousalam, 2005) and (Hughes, 2005). The level of presence or ‘immersion’ (mental and physical) in VR is based on certain parameters that include the level of interaction, the image complexity, stereoscopic view, field of regard and the update rate of the display (Costello, 1997 and Huang, 2011). The two basic types of VR systems are the immersive VR and the non-immersive (Desktop) VR. A third type of VR is the semi-immersive VR system (notably CAVE) which is a projection-based system.

VR related technologies are often misconstrued to mean another type of VR system (Abdousalam, 2005). Where VR technology generates virtual environments, VR related technologies are used to generate composite images of virtual worlds and real worlds. Abdousalam, (2005) stated that ‘mixed reality’ is a computer system that generates a composite image of two or more video streams that can be displayed using HMD or conventional display It is a mix of augmented reality, virtual reality and augmented virtuality. This is better explained by the virtual continuum (VC) created by Milgram et al (1994) where they stated that all realities lie along it. (Figure 1).

![Virtual Continuum](image)

**Fig 1.** Virtual continuum adapted from Abdousalam (2005) in Muhammad (2007)

As a visualization tool, VR has strong applications in construction integration, computer aided design and drafting (CADD), construction scheduling, construction process/modelling, document management, productivity management, safety management and constructability (El-Ghandour and Al-Hussien, 1998 and Whyte, 2003). While architectural design has been the main driving force for developments in 3D modelling and VR in construction, findings by Whyte (2003) suggest that there is a low use of virtual reality amongst the architectural practices. On the
contrary, consultant engineers, contractors and real estate owners have made the largest investment in VR. The history of construction education simulation can be traced back to the development of the Critical Path Method (CPM) and Program Evaluation and Review technique (PERT) (Goedert et al. 2011). Virtual reality systems have become popular for teaching and training in today's high tech world (Cliburn, 2004; Goedert et al, 2011; Huang et al, 2010).

Introducing VR to the built environment curriculum could be seen as a move to improve the access and usage of VR technology in construction and in general, improve construction education (Muhammad, 2007). From a training perspective, a VR interactive training environment can get learners to experience the training goals. Today’s built environment students have not only acquired basic IT skills from an early age, but have already been taught the use of CADD and other related visualisation tools (Horne and Hamza, 2006). Adopting flexible modes of delivery in education reflects the peculiar requirements of the changes in higher education pedagogy in the 21st century (Muhammad, 2013). Furthermore, the so-called Generation Y students (internet generation) exhibit learning styles such that delivery methods adapt to the students instead of the students adapting to traditional delivery methods. Several efforts in introducing VR in the built environment education have been reported (Ellis et al, 2006; Goulding et al, 2012; Horne and Hamza, 2006; Messnar and Horman, 2003). Finding from these studies posit that advanced visualisation tools aids learning and instruction in the construction sector and can significantly improve the ability of students to develop a more in-depth understanding of the construction process and construction planning of complex building and infrastructure projects.

**RESEARCH METHOD**

**Data Collection**

The research method adopted for this study consisted of literature review and web-based survey. The literature review helped position the study within its theoretical context (theories on VR and related technologies and their application to construction). Alternative survey methods were evaluated before the final survey method was chosen for the study. Personal interviews may provide the most rewarding form of measurement, they are however, not feasible for this study in terms of cost and the geographical spread of respondents. Email surveys on the other provide certain merits over personal interviews including speed, low cost and the opportunity to attach pictures and sound files. However, they have no checks to ensure that respondents have not ignored instructions, and it is easy for respondents to delete the email because most people dislike unsolicited emails even more than solicited emails.

Web-based surveys provided a more economical and faster survey method considering the geographical spread of respondents across the UK. The
email survey was sent to 46 UK universities offering six selected built environment courses including architecture, building surveying, construction management, civil engineering, quantity surveying and facilities management. The ‘Survey Monkey’ survey software was used in designing, collecting and analysing the responses. The meaning of VR as described by Otto et al (2002) was adopted for this study which describes Virtual Reality as a specific configuration of software and devices and a user’s interaction with a computer generated graphical world. It includes the three basic types of VR namely the immersive VR, semi-immersive VR and desktop VR. Content validity of the survey questions was carried out to eliminate ambiguous and difficult questions by an expert in the School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, UK. Limitations of this study which the authors acknowledges are that response rates from mail survey questions are often very low and questions are subject to misinterpretation by respondents. Also, problems encountered by students when learning VR and pitfalls associated with introducing VR where not studied.

Survey Sample
The final sample size of 46 respondents from 36 universities in the UK was obtained by purposive sampling method. This was employed for both the tutors and their universities. This was because selecting the most suitable respondents from all the UK universities was paramount to obtain the most suitable source of information as they provide the VR instruction to the learners.

Universities Selection Process
Criterion 1:
The UCAS website was used to obtain the universities running the six selected built environment programmes of architecture, building surveying, construction management, civil engineering, quantity surveying and facilities management. This was done on a regional basis as given on the UCAS website totalling 12 UK regions (East, East Midlands, Greater London, North-East, Northern Ireland, North-West, Scotland, South-East, South-West, Wales, West-Midlands and Yorkshire and Humberside). The universities from each of the 12 regions were chosen on their nationwide rankings in the 2006 Sunday Times university league table published by the Sunday Times, United Kingdom.

Criterion 2:
Whether any staff of a selected university has research or teaching interest, or function in the university in construction IT.

Criterion 3:
Availability of a VR facility in the institution. The VR facility must not necessarily be in a school/department that has a built environment course but some other school/department in the university. The second and third criteria often complemented each other in certain universities.
Respondents’ selection process

Criterion 1:
Wherever possible, respondents were selected based on their expertise in their chosen built environment disciplines of architecture, building surveying, construction management, civil engineering, quantity surveying and facilities management.

Criterion 2:
The respondent must have either teaching or research interest in construction IT or both.

Criterion 3:
This concerned the function of the respondent in his university. But, where there are more than one prospective respondent in a built environment school/department in a university, the respondent with the highest function in the department was selected.

Descriptive Statistics (means and percentages) was used to analyse data using ‘Survey monkey’ and inferences were subsequently drawn.

RESULTS AND DISCUSSION

A well-structured questionnaire with open and close ended questions was used to collect primary data from tutors in the universities under study. The questionnaire captured relevant data of the respondents’ departments, adoption of VR in their built environment courses at both undergraduate and postgraduate levels, methodologies for introducing VR, types of VR software used for instructional purposes and major reasons for introducing VR. A total of 46 questionnaires were administered out of which sixteen (16) representing 35% completed the survey. Three (3) respondents representing 6% partially completed the survey. Also, one of the respondents was solicited separately to answer a few questions by email.

Figure 2 shows the distribution of the respondents’ schools/departments of built environment courses:

Figure 2. Distribution of respondents according to built environment courses
Although facilities management was among the six selected built environment courses, there was no respondent after applying the criteria for the respondents' selection process. It is likely that VR has little or no use for Facilities Management in the industry. The large number of architecture respondents selected for the survey suggests that architecture in the built environment education is the largest user of VR and most other visualisation tools. The responses from Civil Engineering and Construction Management indicate that little is done in introducing VR to their curriculum. There is no correlation between these results and what obtains in the industry where consultant engineers are present the largest user of VR (White, 2003).

From figure 3 responses on VR instructions in built environment programmes (undergraduate and postgraduate taught) in respondents’ institutions revealed that 54% of institutions have in some way introduced VR in built environment programmes while 33% have not done so. Also, 13% of the respondents declined to respond to the question. This shows that a significant number of UK universities have attempted introducing VR to their built environment curriculum. This suggests that both the industry and academia appreciate the far reaching importance of VR to the industry and have supported its introduction to built environment programmes in UK universities. The implication of this is that the academia and to large extent professionals have seen the importance of VR to construction and have taken the necessary steps to introduce it into schools.

In establishing the extent of VR instruction for built environment programmes in UK universities, it became pertinent to investigate whether VR was taught at the undergraduate or postgraduate level only or a combination of both in the universities studied. Figure 4 showed that 37% of the respondents indicated that VR was being taught at the undergraduate level only, 25% in postgraduate level only and 38% in both undergraduate and postgraduate levels. It is clear that VR is introduced in the postgraduate taught programmes as much as the undergraduate programmes. Also, universities with VR instruction at both undergraduate and postgraduate level offers its students broad insights to VR applications in construction. However, the choice or combination of VR instruction must be prioritised according to the learning objectives of the built environment programmes.
Responses were sought to describe the methodology for VR instruction with a view to learn best practice. From figure 5, 44% of the respondents employed lectures mainly for teaching the fundamentals of VR which ranged from full lectures, part of a lecture or instruction in a semi-immersive VR facility. About 19% of the respondents indicated that practical sessions in conjunction with the lectures were employed as a useful method to refresh students’ understanding of VR. 12% of the respondents used websites developed by their universities for web-based VR sessions to complement lectures and practical sessions. Also, the results shows that about 6% of the respondents stated that students were given coursework after practical sessions using Desktop VR to enable them work afterwards on their own. Seminars and workshops were also employed.

![Fig 5. Methodology for VR instruction](image)

It was discovered that the methodologies used varied with respondents’ universities however, the three most popular methods were lectures, practical sessions and web-based learning. The predominance of lectures for VR instruction indicates that student need to understand the fundamentals of VR and industrial applications before using the VR system itself. The use of practical sessions to compliment lectures can be said to be essential so that students can get a first-hand experience of a VR system and applying whatever has been taught in lectures. For web-based VR sessions albeit encouraging suggests a forward thinking move to expose students to mainstream VR applications and users especially in the case of the university using “Second Life”. Also, seminars and workshops have the potential to expose students to critical issues affecting VR, provide hands-on training and contact with industry experts in construction IT. The right mix of the methods gleaned from the results could provide best practice for teaching VR. What is important, however, is that course delivery is crucial to the students’ achievement of the learning objectives of VR.
The types of VR software for used for instructional purposes in the respondents’ institutions will give an insight on the range of software for specific built environment programmes which is contingent on the type of the VR system in use (immersive or semi-immersive). Table 1 shows information on the VR software used for educational purposes. Most of the VR software packages were for Architecture courses followed Building Surveying and Quantity Surveying. No data was obtained for Construction Management and Civil Engineering courses. Similarly, there was no data for fully immersive VR software for any of the courses under study. This suggests that most universities use desktop VR followed closely by semi-immersive VR which may be attributed to the high cost of fully immersive VR suites. The high cost of fully immersive VR suites can be overcome where such suites are already available for non-built environment programmes in the respondent’s university. Nonetheless, accessibility to such VR suites might present another constraint particularly if used for high end research.

However, the predominant number of Architecture respondents and the resultant large number of VR software for Architectural courses poses a limitation in the diversity of responses from all the built environment courses under study. This reason may be attributed to the predominance of VR use among Architecture educators. In addition, it was discovered that no two universities are using the same VR software for a particular course. This suggests that each institution has its own preferences as regards the choice of VR software. This confirms the observation by Horne and Hamza, (2006) that the selection of VR technologies must be in a manner that it is appropriate for the intended user.

<table>
<thead>
<tr>
<th>Semi-Immersive VR</th>
<th>Desktop VR</th>
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<tbody>
<tr>
<td>Architecture</td>
<td>Building/Quantity</td>
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<td>VR4MAX</td>
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<tr>
<td>Vega Prime</td>
<td>Second Life</td>
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<td>MultiGen</td>
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<tr>
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<td>Quest 3D</td>
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<tr>
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<td></td>
<td>ArchiCAD</td>
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<td></td>
<td>Unreal tournament</td>
</tr>
</tbody>
</table>

The survey also explored reasons for the integration of VR instruction in built environment programs. Figure 6 shows that 34% of the responses cited the need to keep students to be abreast of emerging technologies and
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taking advantage of same as the main reason. 25% of the respondents stated that VR provides opportunities for architectural discourse where it adds ‘interactivity’ and ‘immersion’ to the traditional forms of representation and critique. Research oriented interests constituted 17% of the responses while student demand, VR as a vital part of a module and application of novel technologies in construction constituted 8% each.

A strong correlation was observed between universities that have introduced VR in their built environment curriculum and the reasons for doing so. All respondents that confirmed the introduction of VR gave their reasons for doing so. One respondent mentioned that students are not highly receptive to the idea of VR, but hopeful that could change when they eventually go into industry. This suggests that tutors must develop exciting methods of teaching VR to meet its learning objectives. Although 3D visualisation is generally exciting, learning how to work with it could prove to be a daunting task to some learners.

![Fig 6. Reasons for introducing VR in built environment curriculum](image)

The results in Figure 5 indicate that the majority of UK’s built environment educators have recognised the importance of exposing their students to emerging information technologies. This supports the premise of this study that awareness to VR can be improved in the construction industry by introducing it in the built environment curriculum. The wide-reaching implication for doing so supports Latham report’s recommending that Virtual Reality should be encouraged in the construction industry to ensure clients’ understanding of what s/he is getting.

**CONCLUSIONS**

The study has confirmed that a significant percentage of built environment programmes in UK universities have introduced VR to their curriculum. This supports the premise of this study that awareness to VR can be improved in the construction industry by introducing it in the built environment curriculum. Although the methodology for delivery varied
from institution to institution, this variation can be attributed to the learning objectives of VR in a particular built environment curriculum.

VR instruction was more significant in architecture than in other built environment programmes. Consequently, there are more VR software packages or applications for architecture programmes. This suggests that the major users of advanced visualisation tools in the construction industry are the architects. However, because the majority of the respondents were architecture instructors, certain results may not be easily generalizable to other responses obtained from the questionnaire. Thus, critical questions like methodology for VR instruction and VR software used for instructional purposes would have provided opportunities to learn best practice for the non-architecture built environment educators.

The study recommends that VR instructors exploit innovative practical sessions and web based sessions that favour students’ active, participatory, experiential learning—the learning style they exhibit in their personal lives.

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APPENDIX

Sample Research Questionnaire

1. Please indicate your school/department
   - Architecture
   - Building surveying
   - Construction/Project management
   - Civil/Structural engineering
   - Facilities management
   - Quantity surveying
   - Others (please specify) …………………

2. Has your institution introduced VR to any of your built environment programmes?
   - Yes
   - No
   - Others (please specify) …………………

3. Please indicate which built environment programmes(s) modules(s)
   - Undergraduate level
   - Postgraduate taught level

4. Please describe your methodology for introducing VR and, if possible, how a typical VR lecture is given
   ……………………………………………………………………………………………..
   ……………………………………………………………………………………………..
   ……………………………………………………………………………………………..

5. What VR software(s) do you use for instructional purposes in your institution? Please list all that apply.
   - Fully immersive VR with head mounted displays (HMD) and data gloves
   - Semi-immersive VR (large projection displays)
   - Desktop VR

6. What were the major reason for introducing VR in to your built environment curriculum?
   ……………………………………………………………………………………………..
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WAYFINDING IN MULTI-LEVEL BUILDINGS: A STUDY OF THE SENATE BUILDING, AHMADU BELLO UNIVERSITY

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Large numbers of multi-level buildings have been developed over the years in a disorganized manner producing complex environments where navigation poses great difficulties and frustration to users. Such difficulties become pronounced during emergencies where panic induces crowd stampedes often resulting in fatalities. Wayfinding research for multi-level buildings has become even more pertinent in Nigeria following the spate of insecurity recorded in recent years. A pilot survey involving 50 students, staff and visitors was carried-out to find effective ways of managing information for improving wayfinding performance in emergency situations as well as Visibility Graph Analysis (VGA) from Space Syntax. This was to explore the relationship between physical features and coded information in the Senate Building of Ahmadu Bello University, Zaria-Nigeria. Results from the survey support findings from literature as respondents agree more with elements of physical features as their navigation guides within the Senate Building followed by coded information, then social practices. VGA run on the floor plans of the Senate Building however reveal that while a number of physical features are located in the most visually integrated areas, coded information were often located in less visible areas. This finding reveals why users may find it tasking to find their way out of the Senate Building during a fire or security emergency by relying on coded information as wayfinding guides. This paper recommends the management of Ahmadu Bello University Zaria provide properly designed signage and graphics placed at areas of high visual integration as well as employ security personnel with training in emergency management. Architects and other design professionals also need to pay closer attention to the design and location of physical features as wayfinding systems for multi-level buildings in future.

Keywords: Ahmadu Bello University, emergency, Senate Building, multi-level buildings, wayfinding

INTRODUCTION

The disorderly and unsystematic manner in which a large number of multi-level buildings have been developed over the years has resulted in complex environments comprising lengthy and confusing corridor systems
with bends, turns, and confusing signs (Rooke, 2012). Such settings challenge and frustrate building users and visitors, especially in chaotic situations where humans have tendencies to exhibit their most disastrous form of collective behavior. Notable is crowd stampede induced by panic, often resulting in fatalities as people are trampled (Hajibabai et al., 2006). Inexperienced building users suffer most in such situations (Holscher and Brosamle, 2007), as their knowledge about the building layout and navigation routes is little compared to that of visitors and staff in the building. Most architects and designers give low priority to wayfinding, seeing it as a hindrance to attractive design or a problem to be solved with signage (Carpman and Grant, 2002). Considering the invaluable role of wayfinding on human psychology and occupants’ satisfaction especially in emergencies such as fires and insecurity alerts, inattention to wayfinding by designers has reduced the inclusiveness of buildings for all categories of users (Hunter, 2010).

Studies on wayfinding largely focus on large institutional complexes such as hospitals and school environments outside Nigeria (Rooke, 2012; Holscher and Brosamle, 2007). Comparatively little wayfinding research exists within the country despite insurgent attacks on educational facilities and tertiary institutions especially in northern parts of the country. Importantly, it is not clear which building features are associated with wayfinding and of these which are most visible to end users in the Nigerian context. This is important as wayfinding is critical for the fast evacuation of people in complex buildings during fire and insecurity related emergencies reported within northern parts of Nigeria in recent months (Chothia, 2015; New York Times, 2014; Babatunde, Unwana-Obong and Olarewaju, 2014; Oladunjoye and Omenu, 2013; Amnesty International, 2013).

This study aims to bridge this gap using the Senate building of Ahmadu Bello University (ABU) Zaria-Nigeria as a case study. Specifically, the study poses two research questions. First, which features do users associate with wayfinding within the Senate building of ABU? Second, which are the most visible features to aid wayfinding within the Senate building? Answers to these questions are important for future renovations, maintenance works and policies to be adopted towards improving wayfinding in this and other similar buildings.

The Senate building was chosen for this pioneering study because it is the tallest multi-level structure in the oldest and largest university in northern Nigeria. It is an eight-storey building with a square floor plan of about 2500 square metres (Plate 1). There are 3 identical approaches leading to entrances on the ground floor. The Senate building has a system of three lifts running from the ground floor to the 8th floor and two pairs of staircases; one from the ground floor to the roof and the other pair from the ground floor to the first floor (Abdurrahman, 1979). The 3rd to the 8th floors have balconies open to a central square void of 13.5 metres side, which gives a view to the open sky whilst providing a roof to the Council chamber below (Plate 2).
The paper is structured along 6 sections after the introduction. The second section provides a brief review of literature on wayfinding leading to the framework presented in the methodology. This is followed by a discussion of results from the study. The paper rounds up with conclusions and references pertinent to the study.

WAYFINDING
Wayfinding is a purposive, directed and motivated activity involving movement and decision making while assessing alternatives (Golledge, 1999). Although cognitive and environmental psychologists have long been concerned with wayfinding, it is becoming more prominent in the field of design. The interests in wayfinding seems to be unified as a result of the dire need to find more effective solutions that go beyond the normal practice of using signs towards comprehending how building users find their ways in, about and out of buildings (Rooke, 2012).

The literature on wayfinding is generally categorized in three phases-Pre Passini Era (PrePE), Passini Era (PE) and Post Passini Era (PoPE) (Rooke, 2012; Hao and Ching Chiuian, 2009). PrePE is dominated largely by cognitive research such as the pioneering work of Lynch (1960). Wayfinding is explained in terms of spatial orientation and cognitive maps. Spatial orientation is defined as the natural ability to formulate and adequate cognitive map of a setting in relation to the surrounding environment (Passini, 1984). A cognitive map is defined as the mental representation or overall mental image of a layout or spaces (Arthur and Passini, 1992). This era is credited with exploring spatial characteristics facilitating cognitive mapping (ibid). A notable criticism of these approaches however is the tendency to focus on human perception and information processing with less attention given the built environment within which wayfinding occurs (ibid). Additionally, cognitive mapping and externalized spatial knowledge is difficult to assess and measure reliably.
In response, Romedi Passini challenged the concept of spatial orientation with the idea of spatial problem solving where humans depend on information within the built environment to aid information processing, decision-making and decision execution (Passini 1977, 1984). This argument is extended to environmental communication (Arthur and Passini, 1992) where architectural and information components of wayfinding are clearly distinguished with relevant evidence into design guides (Hunter, 2010). Research efforts in the PoPE focus in part on producing design guides to improve wayfinding.

Despite such efforts, there still exists a scarcity of theories and analytical techniques to adequately address spatial problem solving such as non-static navigation as well as the predictability of variables/factors influencing wayfinding. A number of studies involving space syntax attempt in part to bridge this gap using axial and Visibility Graph Analysis (VGA) to analyze individual human cognitive processes and behavior within complex buildings with respect to parameters such as visual access and building configuration (Peponis, Zimring and Choi, 1990; Haq and Zimring, 2003; Holsher, Meilinger, Vrachliotis, Brosamle and Knauff, 2005; Holsher, Brosamle and Vrachliotis, 2007). Many of these studies map participant movement and behavior patterns to measureable parameters of the building layout. Whist recording degrees of success in connecting behavioral data from a wayfinding experiment to formal spatial analysis of the setting using verifiable quantitative methods, “future work will be crucial to actively vary the space syntax properties of wayfinding tasks and layout variants in order to test the value of space syntax as a predictive theory of human spatial behavior” (Holsher, Brosamle and Vrachliotis, 2007, p. 161).

Volumes of design principles/guidelines on improving wayfinding design have emerged over the years, with relatively little conceptualization. Heulat’s principles integrate most of these features towards improving wayfinding (Figure 1). It is accompanied by a comprehensive list itemizing specific guidelines for design.

![Figure 1: Building block model for successful wayfinding. Source: Huelat (2007).](image-url)
Rooke (2012) addresses this conceptual gap using a theoretical framework for addressing wayfinding problems based on the tri-partite concepts of physical features, coded information and social practices from Knowledge Management research evaluated using Unique Adequacy approaches from Ethnomethodology (Figure 2). “This represents a new way of researching wayfinding problems . . . in response to the current call for a better and deeper understanding of the situated behavior of wayfinders” (p. 166). The framework gives priority to communication through physical properties of the built environment over coded information and social practice as cues for wayfinding in complex environments. Communication by majority of users is largely done visually. In addition, the study provides a simple tool in form of a wayfinding wheel for decision-making in design or improvement of complex environments. The framework was however evaluated within hospitals where access is easily granted and pedestrian routes largely predefined. This is also true of airports, train stations and conference centers where many of the studies reviewed earlier were conducted. Daily wayfinding for general purposes in multifunctional university buildings or departmental stores where the start and destination for individual wayfinding tasks are not predetermined remain under explored by researchers (Hao and Ching Chiuan, 2009). More studies need to further validate the prescriptive wayfinding framework within other settings (Rooke, 2012).

![Prescriptive framework for addressing wayfinding problems. Adapted from Rooke (2012).](image)

**METHODOLOGY**

To answer the research questions posed by the study, two sets of analysis were conducted. The first was a survey to ascertain which of the three concepts suggested by Rooke (2012) is most employed for wayfinding by users in the Senate building in ABU. The second involves the use of Visibility Graph Analysis (VGA) from space syntax and a mapping of features constituting physical properties of the built environment, coded information and social practices to establish the most visible features in
the Senate building, ABU as communicating with the built environment during wayfinding is largely visual.

The most pragmatic approach would have been to map out user routes and experiences during routine fire alarm checks or experiments as employed in most wayfinding empirical studies reviewed. This was not possible in the present study for several reasons. First, routine and periodic fire alarm checks where inhabitants of a building assemble at designated muster points are not common in the study environment. Second and importantly, any routine fire or security check in the form of an alert will be taken as a real emergency due to the frequency of insurgent attacks recorded in the northern parts of Nigeria. Consequently, permission for access into the Senate building is restricted.

**Questionnaire survey**

A questionnaire survey was therefore designed to elicit descriptions of, as well as document opinions, attitudes and behaviour of wayfinders with regards alternatives they would choose to evacuate the Senate Building in the event of a fire or security alert. A structured questionnaire with close-ended questions on 18 items rated on a 5 point Likert scale was employed. The items are wayfinding alternatives in the Senate Building and literature developed from the tri-partite prescriptive framework of wayfinding illustrated in Figure 2. 6 alternatives were included for each of the three aspects of knowledge during the wayfinding procedure-physical properties, coded information and social practices. The scales assume the agreement of a wayfinder for any of the alternatives is linear, thereby attaching a numerical value to each response.

100 questionnaires were randomly distributed via fieldwork over a period of four working days in and around the Senate Building to staff, visitors and students. 87 were returned. To increase randomization and reduce bias, 50 of the returned questionnaires were employed for analysis. Purposive randomization was used to select the questionnaires in a ratio of 1 visitor: 2 staff: 3 students. The ratio resulted in having forms from 8 visitors, 17 staff and 25 students for statistical analysis.

**Visibility Graph Analysis**

Visibility Graph Analysis (VGA) otherwise called Isovist analyses are useful for analyzing the degree of visibility of the location or focal part of a building or urban area (Maina, 2014). An isovist field represents the view a person has from a given point(s) in an urban or enclosed space. It is mostly employed for wayfinding or orientation purposes (van Nes, 2011). The isovist field is one of the three basic geometric elements in Space Syntax analysis (Klarqvist, 1993).

Space Syntax quantitatively expresses the relationship between geometries delineating human activity as part of a whole system or layout of connected spaces using a specific mathematical measure such as the integration value (IV). Space syntax is about “applying configurational measures to the patterns of different geometric elements that are created by buildings and cities” (Hillier, 2005, p. 7). The choice of geometry to
choose from depends on the aspect of functionality and movement being investigated (Maina, 2014). In VGA, a grid of points is overlaid on the plan. A graph is then made of the points, where each point is connected to every other point that it can see/view. Visual integration of a point is based on the number of visual steps it takes to get from that point to any other point within the system (Turner, 2004). VGA was used in this study to address the research question regarding features of the Senate building most visible to users for wayfinding.

University College London’s Depthmap™ Software v10 was used to run the VGA of floor plans of the Senate Building. Depthmap™ is an open source application used to perform visibility analysis of architectural and urban systems. It takes input in the form of a plan of the system, and is able to construct maps of visually integrated locations within it (UCL, 2012). In this study, points and locations of physical features, coded information and social practices were identified during a recognizance survey. These were then mapped on printed floor plans of the Senate building in form of letters ‘P’, ‘C’ and ‘S’ respectively. Digits were added to the codes to differentiate elements of the same category (eg. P1, P2, C1, C3, C4, S3 etc in Figures 5-10). Floor plans of the Senate Building in DXF formats drawn in AutoCAD™ were then exported to Depthmap™ v10. The VGA was run on the floor plans with grids of 450mm and 600mm. IVs of each of the mapped points were recorded for analysis.

**DATA ANALYSIS AND PRESENTATION**

Numerical data obtained from the Likert scale questionnaire on wayfinders’ evacuation alternatives were analyzed using simple frequencies and means to establish which of the three components the framework illustrated in Figure 2 is most employed for wayfinding within the Senate building. Individual items on the questionnaire were ranked based on a relative agreement index (RAI) obtained as a ratio of the sum of actual agreement scores (AS_{ac}) and maximum possible agreement score (PAS_{max}) on the 5 point Likert scale for each question (Ibem, Opoko, Adeboye and Amole, 2013). Mathematically, this is expressed as:

$$RAI = \frac{\Sigma AS_{ac}}{\Sigma PAS_{max}}$$

IVs of the mapped locations of physical features, coded information and social practice points were then recorded on each floor. The means of IVs were obtained using Microsoft Excel spreadsheets to establish the most visible features within the Senate building. Results from these procedures are presented below.

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*The maximum score for any item per respondent is 5 (on a 5 point Likert scale with 1 for strongly disagree to 5 strongly agree). For 50 questionnaires, the possible maximum score per item will be 250.*
RESULTS AND DISCUSSION

Results from the survey questionnaires

Results from the questionnaires show that wayfinders within the Senate building agree more with employing physical features as wayfinding elements with a mean value of 3.16. These are followed by coded information and social practices with mean values of 2.91 and 2.69 respectively (Table 1). Friedman’s ANOVA ($\chi^2=12.584$, dof 2) confirms a statistically significant difference between the means ($p=0.002$). These findings support the prescriptive framework of addressing wayfinding developed by Rooke (2012) illustrated in Figure 2.

<table>
<thead>
<tr>
<th>Survey questions</th>
<th>Corresponding Likert Scale item</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 1-6</td>
<td>Physical features (Entrances, exits, staircases, lifts, windows etc)</td>
<td>3.16</td>
</tr>
<tr>
<td>Q 7-12</td>
<td>Coded information (Signage, graphics, posters, notices, memory etc)</td>
<td>2.91</td>
</tr>
<tr>
<td>Q 13-18</td>
<td>Social practices (Following firemen, security personnel, other visitors)</td>
<td>2.69</td>
</tr>
</tbody>
</table>

Specifically, users choose entrances/exits, stairs and mechanical sounds as the first three items for wayfinding in the Senate building in the possibility of a fire or security alert (Table 2). Lifts and elevators on the other hand ranked lowest ahead of following visitors. This finding may not be unrelated to the fear of lifts failing to work due to erratic electric supply and the feeling of being trapped during a fire or security emergency. Chronic epileptic power supply is a serious challenge for many sectors of the Nigerian economy in recent years.

Respondents also noted the role ABU security personnel play as this item ranked 6th just below signs/visuals and route from memory. This is not surprising as security personnel are at the first point of entrance outside the only open gate into the Senate building (Figure 5, S1). Additionally, the social culture within many parts of Nigeria encourages seeking directions from people around a building. This may have contributed to the relatively high ranking of this item.

Coded information in the form of letters, graphics, pictures, notices on boards as well as posters were generally ranked low (Table 2). The exception to this finding are signs/visuals which ranked 4th.
Table 2: Ranking of individual tri-partite items within the Senate building from survey responses

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>Likert item</th>
<th>ΣASac</th>
<th>RAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>P</td>
<td>Entrances/exits</td>
<td>193</td>
<td>0.772</td>
</tr>
<tr>
<td>Q2</td>
<td>P</td>
<td>Stairs</td>
<td>179</td>
<td>0.716</td>
</tr>
<tr>
<td>Q4</td>
<td>P</td>
<td>Mechanical sounds e.g. loudspeakers, public address systems</td>
<td>174</td>
<td>0.696</td>
</tr>
<tr>
<td>Q7</td>
<td>C</td>
<td>Signs/visuals</td>
<td>161</td>
<td>0.644</td>
</tr>
<tr>
<td>Q12</td>
<td>C</td>
<td>Route from memory</td>
<td>160</td>
<td>0.64</td>
</tr>
<tr>
<td>Q13</td>
<td>S</td>
<td>Follow ABU security personnel</td>
<td>158</td>
<td>0.632</td>
</tr>
<tr>
<td>Q17</td>
<td>S</td>
<td>Follow firefighters</td>
<td>158</td>
<td>0.632</td>
</tr>
<tr>
<td>Q6</td>
<td>P</td>
<td>Corridors/balconies</td>
<td>157</td>
<td>0.628</td>
</tr>
<tr>
<td>Q15</td>
<td>S</td>
<td>Follow volunteers</td>
<td>155</td>
<td>0.62</td>
</tr>
<tr>
<td>Q5</td>
<td>P</td>
<td>Openings such as windows</td>
<td>153</td>
<td>0.612</td>
</tr>
<tr>
<td>Q14</td>
<td>S</td>
<td>Follow others</td>
<td>149</td>
<td>0.596</td>
</tr>
<tr>
<td>Q8</td>
<td>C</td>
<td>Bold words/letters/captions</td>
<td>144</td>
<td>0.576</td>
</tr>
<tr>
<td>Q9</td>
<td>C</td>
<td>Graphics/pictures</td>
<td>140</td>
<td>0.56</td>
</tr>
<tr>
<td>Q10</td>
<td>C</td>
<td>Notices on boards</td>
<td>136</td>
<td>0.544</td>
</tr>
<tr>
<td>Q11</td>
<td>C</td>
<td>Posters</td>
<td>131</td>
<td>0.524</td>
</tr>
<tr>
<td>Q16</td>
<td>S</td>
<td>Look for information desk</td>
<td>105</td>
<td>0.42</td>
</tr>
<tr>
<td>Q3</td>
<td>P</td>
<td>Lifts/elevators</td>
<td>93</td>
<td>0.372</td>
</tr>
<tr>
<td>Q18</td>
<td>S</td>
<td>Follow visitors</td>
<td>81</td>
<td>0.324</td>
</tr>
</tbody>
</table>

Results from the VGA

Results from the VGA reveal that physical features such as columns, doors and lifts recorded high IVs. Stairs were generally not as visible as other physical features. Social practice components such as security desks were also found to be located at strategic entrance points into the Senate building as noted in the preceding paragraphs (Figures 5, 8 and 9). This explains the relatively close mean IVs of physical features and social practices at 6.55 and 6.51 respectively (Table 4). These values suggest that these are the most visible features for wayfinding for users of the Senate building in ABU.

A strong inter-dependent relationship was recorded between coded information and physical elements such as notices on boards and signage were mostly located around physical features (Figures 5, 6 and 10). A number of these were however located in less visible areas or printed directly on walls. This finding is supported by the slightly lower mean IV of 6.17 obtained for coded information (Table 3). Incidentally, coded information are the most visible in upper floors (Figure 4). These floors (3rd to 8th) are largely employed for administrative functions. The lower floors, which cater to general functions such as the Academic office and other related activities recorded relatively lower IVs. These are areas attracting the most number of students, staff and the general public.
Table 3: VGA IVs recorded for the tri-partite wayfinding components in the Senate building

<table>
<thead>
<tr>
<th>Tri-partite components</th>
<th>Ground Floor</th>
<th>1st Floor</th>
<th>2nd Floor</th>
<th>3rd Floor</th>
<th>4th, 5th, 6th Floors</th>
<th>7th Floor</th>
<th>8th Floor</th>
<th>Mean IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical features</td>
<td>8.05</td>
<td>5.04</td>
<td>6.62</td>
<td>6.6</td>
<td>6.8</td>
<td>6.17</td>
<td>6.55</td>
<td>6.55</td>
</tr>
<tr>
<td>Coded Information</td>
<td>5.47</td>
<td>5.83</td>
<td>0</td>
<td>8.95</td>
<td>7.43</td>
<td>8.2</td>
<td>7.3</td>
<td>6.17</td>
</tr>
<tr>
<td>Social practices</td>
<td>7.8</td>
<td>5</td>
<td>5.4</td>
<td>6.8</td>
<td>6.1</td>
<td>7.03</td>
<td>7.42</td>
<td>6.51</td>
</tr>
</tbody>
</table>

Legend

- P1- Entrance gate
- P2- Column
- P3- Door
- P4- Lift
- P5- Emergency exit
- S1- Security desk
- S2- Waiting/refreshment area
- S3- Reception
- C1- Directional arrow
- C2- Notice board
- P6- Stairs
- P7- Balcony
DISCUSSION ON FINDINGS

Survey responses validate tri-partite concept of knowledge flows
Findings from questionnaire responses validate the tri-partite concept of knowledge flows accruing from Rooke (2012). Specifically, the findings suggest that physical features especially entrances, exits, stairs as well as mechanical sounds are the most preferred features in the event of wayfinding during an emergency. This underscores the need for architects and other professionals in the built environment such as structural engineers and interior designers to pay closer attention to the design and location of physical features within multi-level buildings to aid and improve wayfinding. Traditionally, entrances and exits are designed with
emphasis from exterior facades of buildings. This finding suggests that architecturally, main doors at entrances and exits also need to be carefully designed from within buildings to aid wayfinding. Additionally, mechanical devices such as loudspeakers were found to rate high as a wayfinding cue by respondents. It is therefore imperative that these be adequately incorporated during the design stage especially with respect to strategic locations for wayfinding decision-making. It also implies that regular checks and routine maintenance be conducted to ensure they remain in good working order.

**Lower visibility in critical decision making areas such as staircases and notices**

Findings from survey questionnaires reveal that stairs as physical components of the built environment serve as strong wayfinding cues within the Senate Building, ABU. However, the main staircases linking all floors are not visible from the main ground floor entrances. The recognizance survey prior to the VGA revealed that entrances to both staircases were dark and not always visible, posing wayfinding challenges for vertical navigation. Holsher, Brosame and Vrachliotis (2007) proffer similar findings in their study of a complex multi-level conference centre. “In general, stairways should help in integrating vertical information while exploring multi-level buildings . . . Taken together, the analyses revealed that except for global building characteristics, the staircases are the single most clearly identified cause of wayfinding problems in our setting” (ibid, p. 155-156). As a design consequence, architects and designers need to consider the importance of visibility and other tactile means around staircases to aid wayfinding. This is important as staircases often serve as the only means of vertical movement for many buildings in Nigeria largely because of lifts being restricted or not fully operational due to inadequate or epileptic power supply.

VGA and the recognizance survey also reveal a relationship between locations of physical features and coded information. This collaborates with previous studies (Rooke, 2012). Architects, graphic designers and interior decorations need to take advantage of this relationship to create more congruent wayfinding information to users through the design of elements such as columns, entrances and exits. Future studies should consider possibilities of presenting coded information within physical elements as well as exploring non-visual means of communicating with the built environment.

**CONCLUSIONS AND RECOMMENDATIONS**

This paper investigated the concepts of wayfinding in multi-level buildings using the Senate building of Ahmadu Bello University in a pilot study. This was done to improve the gap in research on wayfinding in multi-level institutional buildings in northern Nigeria in the event of fire and security alerts/emergencies.
In response to the first research question about which features users employ in wayfinding, findings from the study, though tentative reveal that physical features notably entrances/exits, stairs and mechanical sounds were ranked highly by respondents within the Senate building in line with findings from literature. Mapping and VGA revealed the location of physical features and social practice items in highly integrated visual points. Coded information record slightly lower average IVs overall.

Peoples’ judgments and their ability to make quick decisions to navigate complex environments are influenced by how architects and designers increase the inclusiveness of buildings for everyone. This paper therefore recommends that in order to improve wayfinding in and out of the Senate building in the event of fire and security emergencies, the following measures be adopted by the management of the institution and included in a maintenance/improvement policy document:

- Hidden staircases and fire-exits should have properly designed signage and graphics pointing in their directions.
- Properly designed and well-lit signage and graphics should be adequately placed at decision points and high visually integrated areas at heights where they are easily seen. Many were noted to be below eye level. Particular attention in this regard needs to be paid more public areas such as the ground and first floors where these are needed.
- Mechanical devices such as public address systems, fire alarms and security sensors need periodic checks to ensure they are in good working order.
- Security personnel need periodic training on emergency management. Adequate measures also need to be in place in order to ensure that security desks and posts are not left vacant as their occupants are usually of great help to wayfinders.

Similarly, as a recommendation for practice, architects need to re-evaluate visibility, lighting and design considerations for escape staircases, entrances and exits in buildings as these are crucial for evacuating people during emergencies. Though considered default in architectural practice, it has become imperative for design professionals to pay special attention to physical building elements as wayfinding features whilst serving their primary functions of structural support as well as aiding access and movement within buildings.

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