Volume 2, Numbers 1 & 2, 2018

JOURNAL OF CONTEMPORARY RESEARCH IN THE BUILT ENVIRONMENT (JOCREBE)

ISSN: 2636-4468

PUBLISHED BY
DEPARTMENT OF BUILDING
FACULTY OF ENVIRONMENTAL STUDIES
UNIVERSITY OF UYO,
P. M. B. 1017, UYO, NIGERIA

Journal of Contemporary Research in the Built Environment
Volume 2, Numbers 1&2, 2018 ISSN: 2636-4468

Editorial Objectives and Scope:
The Journal of Contemporary Research in the Built Environment (JOCREBE) is an interdisciplinary peer-reviewed journal dedicated to publishing papers which advance knowledge on the practical and theoretical developments as well as original research work in all aspects of sustainable built environment, encompassing all capital projects including buildings, civil engineering as well as repair and maintenance of sustainable infrastructures. That is the journal covers all aspects of science, technology, business and management concerned with the whole life cycle of the built environment, from the design phase through to construction, operation, performance, maintenance, conservation and its deterioration and demolition.

Frequency of Publication
The Journal publishes two issues in one volume yearly with the first issue published in March and the second in September.

Subscription and Advertisement
The subscription and advertisement rates can be obtained from the Editor-in-Chief or the Managing Editor.

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PUBLISHED BY
Department of Building
Faculty of Environmental Studies
University of Uyo, Uyo, Nigeria

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EDITORIAL

Akaninyene A. Umoh
Editor-in-Chief

The "Journal of Contemporary Research in the Built Environment" Volume 2, Numbers 1 and 2 edition is out. The articles published in this edition were those that have scaled through our peer review mechanism and covered areas of sustainable construction in the Built Environment. On behalf of the Editorial Board, I thank all our esteem contributors for their well researched papers that have addressed most of the problems of the built environment. I equally wish to invite you and our reading audience to go with me into the highlight of papers published in this composite issue, and wish you an enriching experience as you make effort to go through the full publication. Happy reading!

The first paper by Aluko, Dipeolu and Omoniyi is on enablers of effective professional services in the Nigerian building industry; and aimed at achieving improvement of service delivery through identification and establishing of main factors affecting professional services in the building industry. A cross-sectional survey of randomly selected firms of construction professionals were used for the study. Findings indicated that the three most important factors were the use of modern hardware and software, commitment of staff, and ability of the client to choose the right design team for their projects. The analysis of variance conducted showed differences in the perceptions of the professionals in respect of the following: frequency of changes in regulations by government, capacity of the local building materials industry, supply and price of construction materials, availability of specified materials and enforcement of regulations on foreign firm's practices.

The second paper by Okeke and Ajiero undertook an exploratory study of the potential of biogas production from wastes generated in University of Uyo, as an alternative source of energy for the University Cafeteria. Three different types of wastes were collected from the Annex Campus of the University for the study - cow dung, poultry litter and kitchen wastewater. The study adopted an experimental design that involved the treatment and use of the collected wastes as substrate for digestion and generation of biogas. The results indicated that the co-digested 11.5kg of combined cow dung, poultry litter and kitchen wastewater, produces 8500ml of raw biogas; and that to obtain pure methane from the raw biogas, impurities such as carbon dioxide and hydrogen sulphide were removed using two chemical scrubbing solutions, comprising of ordinary water with sodium hydroxide, and ferric chloride with sodium hydroxide. Test for combustibility of the purified gas indicated a positive result, as the gas supported burning.

The next paper by Ebong, Bassey and Oguike investigated the variables influencing construction site layout planning for effective site security. A Survey research method was adopted for the study. Copies of questionnaire were administered on construction/site managers involved in various sizes of construction projects in Akwa Ibom State. A total of 15 variables identified in the literature were evaluated using relative importance index

(RII). The results showed that grouped location of facilities, security evaluation, and perimeter control measures, access control, positioning of objects for clear lines-of-sight and strategic lighting are the most important variables (ranks 1 – 6 respectively) in construction site layout planning for security and crime prevention.

The fourth paper by Musa, Lawal, Yusuf and Almustapha focused on identifying an ideal room orientation for low energy consumption for hotel buildings in the hot dry climate of Birnin Kebbi. The study employed a quasi-experiment approach using Autodesk Ecotect software to simulate a model selected from a typical hotel room grid of 3800mm length x 6000mm width and 3000mm height using Birnin Kebbi data files. Results of the simulation show that the South-facing room consume less energy (269kWh/m^2) followed by North-facing (404kWh/m^2) and then the East-facing room layout (481kWh/m^2), while West-facing room layout (489kWh/m^2) having the highest energy consumption.

The fifth paper by Effiong and Ekop assessed the impact of oil and gas exploration on phase II of the building cycle with particular reference on the three oil producing communities of Akwa Ibom State- Estern Obolo, Ikot Abasi and Ibeno. A survey research design involving observation and assessment of structures was adopted for the research. A five point Likert scale was used in assessing building conditions using structural and environmental indicators as drawn from literature. The assessment was carried out on buildings that are within 1m radius of the oil exploration site which thus constitute the population of the study. The buildings were further categorized into residential and commercial buildings. The sample size was drawn using 50% of the total building within the study area. The relative important index method was used in the study to determine perception of the level of impact of oil exploration on buildings. The results revealed that there is a strong impact between emissions from the flare gas and buildings. Oil spillage and gas flaring are the causes of attendant problems the people of the area are facing; and that the most visible consequences of oil and gas exploration on buildings was corrosion of roof tops that leads to changes in colour and leakage which is as a result of emissions of SO_2, NO_2 and PM_{10} during gas flaring and oil spillage.

The next paper by Ikediashi and Otali evaluated dispute resolution approaches for construction disputes in Nigeria. An exploratory questionnaire survey approach was adopted in which 55 valid responses were received from 120 target respondents which included Builders, Architects, Quantity Surveyors, and Engineers; and data collected were analysed using frequency counts, mean score, standard deviation and Mann Whitney U test. Findings revealed that poor communication and interpersonal skills, delay in payment, and poor workmanship in that order were the three top rated factors responsible for disputes in the construction industry; while cultural differences, project uncertainty, and error in contract documents were the least three rated factors in that order. Additionally, negotiation, mediation, and adjudication were the three most effective strategies for resolving disputes in the industry.

The seventh paper by Otali, Umoh and Benedeth assessed the factors influencing the adoption of sustainability practices among small, medium and large construction firms in Niger- Delta, Nigeria. A Survey design approach was adopted and data were obtained using 1179 copies of structured questionnaire administered on respondents who responded based on a five- point scale rating; and the data were analysed using simple percentage, mean score and Kruskal Wallis test. Findings indicated that there is no significant variation in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in Niger-Delta, Nigeria; that the first three drivers that have high influence on the adoption of sustainability practices

among small, medium and large construction firms in Niger-Delta are organisation's cultural values, amount of resources allocated to sustainability and organisation's structure and system; the enablers of adoption of sustainability among the firms are capacity building and development; while lack of education and lack of training are the barriers that have very high influence on the adoption of sustainability practices among small, medium and large firms. The study concluded that lack of top management support highly influenced the adoption of sustainability practices among small, medium and large construction firms in Niger-Delta, Nigeria.

The next paper by Anih and Ajiero proposed the introduction of Building Information Modeling (BIM) approach to the professionalism of estate surveying and valuation as a tool to bridge the gap in attaining international best practices in real estate development. The study adopted a qualitative approach to the presentation. It is a conceptual paper involving literature reviews and explanations of concepts, graphics, and models. The study did not involve field observations of collation of numeric data. The functions carried out by Estate Surveyors and Valuers were compared with the components of BIM such as 3-D, 4-D, etc., to show the relevance of the concept in real estate development. It is found out that Building Information Modeling (BIM) is an emerging trend in the construction industry amidst the third world nations and Nigeria in particular, and that the development of 3-D, 4-D, 5-D, 6-D and 7-D with their specialties are great attributes of this modeling. This is profitable for shared knowledge resource for information about a facility forming a reliable basis for decisions during property life cycle from inception to conclusion.

Paper ninth by Otali, Umoh and Benedeth assessed the economic performance of small, medium and large construction firms in Niger Delta, Nigeria. The study adopted s survey design approach. 1179 copies of structured questionnaire based on five-point scale were administered on respondents by the researcher and research assistants. Methods of data analysis were simple percentage, mean score, Kruskal Wallis test and Bonferroni dunnett test. Findings revealed that the overall level of employment growth among construction firms in Niger-Delta is moderate, and that the level of employment growth among large construction firms is higher than the level of employment growth among small and medium construction firms in Niger- Delta. Further, the overall level of financial turnover growth of construction firms in Niger Delta is moderate. The level of financial turnover growth of small, medium and large firms is also moderate. This study also revealed that the level of financial turnover growth of large construction firms is higher than the level of financial turnover of small and medium construction firms in Niger- Delta. The net income growth of construction firms in Niger Delta, Nigeria was found to be of moderate level; and that the level of net income growth of large construction firms is higher than the net income growth of small and medium construction firms in Niger- Delta.

The tenth paper by Almustapha, Musa and Adegboyega assessed traditional Human Resource Development (HRD) strategies in North-western, Nigeria construction firms. Data for the study were collected through field work, involving the administration of a structured questionnaire to elicit information available and categories of Human Resource (HR) in the construction firms, and the data collected were analyzed using descriptive and inferential statistical tools. Findings revealed that, predominant HR in the sampled construction firms was bricklayers' and. concrete technologist, while professional staff among the HR categories was given more priority. With respect to traditional HRD strategies practice in the study area, training programme and mandatory training of new

employees were the major HRD strategies in practice. However, production skill was rated higher among the HRD practice by construction firms.

The eleventh paper by Effiong and Ekung assessed the scope of incentives within transactional-traditional procurement framework with a view to determine their appropriateness to address community stakeholders' needs towards curbing projects opposition during implementation. The study involved a questionnaire survey of 200 construction professionals and community leaders in Akwa Ibom and Imo States, Nigeria, and the collected analysed using the mean item score, and Chi-square was used in the test of hypothesis. The study revealed that fragmented practice, opportunism, moral hazards and adverse selection attributes inherent in traditional procurement framework inhibit progressive dialogue, inclusive progressive interaction, and open and transparent dealings with community stakeholders. Transactional contractual practice therefore hinders effective engagement with the community during project implementation.

The last paper by Oladokun, Oladokun and Adewuyi sought to identify, assess and categories the factors influencing outsourcing of functions as effective management strategy by telecommunications firms in Nigeria. A survey research design was adopted. A two-stage sampling procedure was used for the study. Firstly, the telecommunications firms that took part in the study were selected using a stratified random sampling and secondly, the employees of these selected firms who are directly involved with outsourcing of functions were selected using the random sampling approach. A total of one hundred and eighty (180) copies of questionnaire were administered, and fifty-three (53) respondents returned complete copies of the questionnaire. The results show that all the factors identified have means greater than 3 which shows that majority of the respondents agree that those factors are the ones actually influencing outsourcing of functions by telecommunications firms in Nigeria. Through the use of factor analysis technique, these factors were reduced and grouped into a smaller number with the dictates of what is obtainable in telecommunications firms in Nigeria as 'cost and flexibility related factors', 'quality and time related factors', 'allow resources to focus on core competency factors', and 'innovation related factors'.

Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

ENABLERS OF EFFECTIVE PROFESSIONAL SERVICES: EVIDENCE FROM THE NIGERIAN BUILDING INDUSTRY

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ABSTRACT

Purpose: This study is aimed at achieving improvement of service delivery through identification and establishing of main factors affecting professional services in the building industry.
Design/methodology/approach: A cross-sectional survey of randomly selected firms of Architects, Structural Engineers, Mechanical and Electrical Engineers and Quantity Surveyors was used for the study. Mean Score (MS) was used to rank the factors and ANOVA was used to test the hypothesis of the study.
Findings: The three most important factors were the use of modern hardware and software, commitment of staff and ability of the client to choose the right design team for their projects. The result of ANOVA result showed a differences in the perceptions of the professionals in respect of the following: frequency of changes in regulations by government, capacity of the local building materials industry, supply and price of construction materials, availability of specified materials and enforcement of regulations on foreign firm's practices.
Research limitations/implications: The generalisation and application of the results of the study to projects which do not have full services of Architects, Structural Engineers, Mechanical and Electrical Engineers and Quantity Surveyors.
Practical implications: The result will guide practitioners on the effects of these factors for learning and sharing of knowledge on their experiences in order to improve service delivery.
Originality/value: The enablers identified in this study will provide the support that makes competitive services possible, providing understanding and insight into the elements that catalyses success in professional services.

Keywords: Building projects; consultants; building industry; professional services; Nigeria.

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1. INTRODUCTION

Consultancy services in building projects are interconnected and complements each other (Brandl, 2010). The services are normally provided by architectural, engineering and quantity surveying firms and are largely based on knowledge acquired by the human capital of the firms (Jewell, Flanagan & Anac, 2010). This implies that activities in building projects are team work and the project delivery process is rooted in team practice approach where each member of the team performs unique roles (Kwofie, Amos-Abanyie & Afram, 2016). According to Olatunde, Ogunsemi and Oke (2017), the composition of construction team members has a significant effect on the completion time of construction projects, and recommended that effort should be made in establishing roles of team members when they are appointed. The team could either be within the same organisation or put together as consultants from different organizations as a unified team for the delivery of the project design (Oyedele, 2013).

Meanwhile, it has been reported that these service providers in Nigeria are not meeting the needs of their client because of conflicting design information, delays in issuing revised drawings, dimensional inaccuracies resulting into delays in project delivery (Aiyetan, Smallwood & Shakantu,2014). Oyedele et al. (2015) emphasise further that these deficiencies have resulted in poor construction quality performance. In addition, Mbamali and Okotie (2012) identifies threat of globalization as a result of debit balance of trade in professional services in building practice in Nigeria.

Several factors in the environment constitute enablers or bottlenecks for these professionals in an attempt to improve their services for the benefits of their clients who are investing resources in the projects. These factors manifest in form of internal factors (controllable) and external factors (uncontrollable), which organization often attributes to their success or failures (Assessing Women in Engineering (AWE), 2005). This study is aimed at achieving improvement of service delivery through identification and establishing information on these factors so that project team can learn and share knowledge on their experiences.

2. REVIEW OF RELATED LITERATURE

Factors that can influence activities in construction settings are very important (Ejohwomu, Oshodi & Lam, 2017). Zhao, Zuo, Zillante and Zhao (2012) asserted that the knowledge of these factors are necessary to be competitive in the market place. Some of these factors can be internal which the stakeholder has control over, and it could be external in which case the person has no control over such factors (Plotnik & Kouyoumdjian, 2011). This study equally focuses on both internal and external factors that act as barriers towards providing effective services. The internal factors are staff development and motivation (SDM), innovation (INV), investment in information and communication technology (ICT) and internationalization (INT). External factors are regulatory framework (RGF), construction materials (CMT), client factors (CLF), competition (CMP) and professional fees (PFF).

In line with this, Ling, Ibbs and Hoo (2006) emphasise that keeping up with new laws and regulations is one of the most significant risks faced by architectural and engineering design firms. According to Zhao et al (2012), sound regulatory framework has a lot of implications on professional staff registration and licensing, requirements of procurement acts for tender, and requirements for collaborations with foreign firms. It protects local

firms from foreign firms with stronger human and technical resources. The development of knowledge and expertise in the industry drives the human capital and play a major role in engineering, procurement and construction projects in the industry (Nguyen & Hadikusumo, 2017). Lowendahl (2005) opines that efforts at maintaining the best professionals in the building industry requires investment in human capital development.

Educated experts build reputation for the organization and thereby attract interesting clients and projects. This lead to better relationship that galvanize competitive advantage for firms (Nguyen & Hadikusumo, 2017). The adoption of ICT has become a norm during design process by design firms. Russell (2007) says that the development of Computer-Aided- Design (CAD) programs have assisted firms in no small measure, it leads to easier distribution of the service product more efficiently. Firms that give attention to research and development (R&D) get new knowledge that can be applied in practice to achieve innovations (Ling et al. 2006). Scholars particularly from technology and science-based disciplines emphasized investment in R&D to be very critical for a successful innovation (Czarnitzki & Thorwarth, 2012; Filippetti & Archibugi, 2011; Zhao & Ordonez de Pablos, 2011).

The importance of management competencies cannot be over-emphasized as this determine the right allocation of expertise of the employees (Brandl, 2010). As a result of the strong dependency on experts, commitment and loyalty of employee are important and should possess the characteristics of human relations for the image of the firm (Razavi, Safari, Shafie & Khoram ,2012). To retain qualified staff and avoid unnecessary staff turnover, firms should attract good staff with salary, social welfare, remuneration package and benefit package (Zhao et al., 2012).

The study of Kamal, Yusof and Iranmanesh (2016) emphasized the capacity of firms to innovate in order to remain competitive in ever dynamic environment. Other researchers (Roxas, Battisti & Deakins, 2013; Moohammad, Yusof & Kamal,2014) observe that larger firms have the capacity to innovate than smaller firms because of access to resources. In contrast, Yusof, (2011) notes that smaller firms have the tendency to innovate because of flexibility. Kamal et al, (2016) suggested that experience would have significant effect on the innovation orientation of firms. Innovation in project-based firm involves using new or improved services for clients and using new technologies to solve clients' problems better than existing technologies (Blindenbach-Drissen & Ende, 2006).

In a project based organization, the various dimensions of innovations are categorized as process innovation, product/technological innovation, strategic innovation and should be seen as strategies to cope with ever increasing challenges in the globalized environment of construction industry (Terzungwe, 2013). Kissi, Dainty and Liu, (2012) advocate for environment that is supportive in construction professional services firms for their human assets to seek innovative solutions in the ever-changing environment. The level of innovations and creativity in design help firm to remain competitive. Clients prefer firms that have capacity to provide innovative ideas covering broad areas of their services (Zhao et al. 2012). Kamal et al. (2016) differentiates between innovation creation and innovation adoption. According to Kamal et al. (2016) the method and regularity of research and development (R&D) activities determines major difference between innovation creation and innovation adoption. Innovation creation involves investment in R&D by the organization. It involves collaboration with external sources of information like research institutes (Zhao & Ordonez de Pablos, 2011).

In the past, professional services have been delivered locally. However, advancement in technology and deregulation in most countries have resulted into larger and global PSFs operating beyond their geographical boundary. This is known as internalization (Brock & Alon, 2009). The concept is used to describe the outward movement of economic activities

of a firm from its domestic market to international market (Wong, 2012). Brandl (2010) reported that firms that operate internationally are more likely to survive than firms operating in domestic market only. Internalization as a concept is often used interchangeably with globalization. This opens up economic space for global participants who are more skillful and with advancement in information and communication technology (Mbamali & Okotie, 2012). Globalization promotes open competition, specialization and breaks down economic barriers (Brandl, 2010). However, Nigerian's building industry are in a disadvantage position from globalization as a result of debit balance of trade in professional services and construction materials, foreign companies' domination of project execution and diminishing opportunities for the indigenous professionals to development (Mbamali & Okotie, 2012). Some of the strategies that can be developed by firms towards internationalization includes establishment of good relationship with clients and government, focusing on new emerging markets, formation of strategic alliance with local architectural and engineering firms and business restructure (Zhao et al. 2012). Internationalization processes in professional service firms are however not industry specific, it is driven by the characteristics of the firm concerned (Canavan, Sharkey-Scott & Mangematin, 2012).

Design team requires information about different types of building materials in order to evaluate and specify building materials during the design process and crucial for successful implementation of any design concept (Tas, Yaman, & Tanacan, 2008). This is of course subject to the availability of these materials in the market. The issue of accessing up-to-date information about the materials, the sources and how they are obtained remain topical issue in the industry (Hoxha, Haugen, & Bjorberg, 2017). Hoxha, et al., (2017) emphasise energy efficiency and durability as critical consideration in choosing sustainable building materials. It is important however that building material information bank, classification systems for these materials preferably using information technology will give practitioners easy access to reliable, timely, up-to-date and accurate technical information.

2.1. Attribution theory

The concept of attribution theory is concerned principally with interpretation of information by individuals to determine cause of events (Savolainen, 2013). Plotnik and Kouyoumdjian (2011) categorise causal attribution into internal and external attributions. Identifying the cause of an event is the major issue attribution theory seeks to unfold (Weiner, 1995). It uses the term causal locus as the location of a cause that is either within (internal) or outside (external). Internal attribution refers to factors that an individual has control over while external attribution refers to issues over which a person has little or no control over (Weinere, 1995; Kouyoumdjian, 2011). Success is often associated with internal attribution while associating failures to external attribution. This is termed self-effacing (Stewart, 2005). Valerie and Brian (2008) defined attribution as the internal (thinking) and external (talking) process of interpreting and understanding reasons for our achievement including those of others. According to the study, attribution is not only based on 'casual locus' but also on stability and controllability. This agrees with the assertions of other researchers (Stewart, 2005; Plotnik & Kouyoumdjian, 2011) as pointed out above.

Attribution theory have been used in construction related studies in the past. It was used to explain the study of assessing women in engineering project (AWE,2005); factors responsible for ineffectiveness of communication in mass housing projects (Kwofie, Adinyira, & Fugar, 2015); factors responsible for nail injury as a result of risk behaviours in using tools and work pressures on site (Albers, Hudock, & Lowe, 2014) and factors

responsible for ineffective communication in construction projects in developing countries (Ejohwomu et al. 2017). From the above, it is reasonable to conclude that causal attribution is crucial to develop appropriate response strategies to mitigate observed weaknesses. This study therefore extends the concept of attribution theory to the assessment of factors affecting the provision of professional services in building projects.

3. RESEARCH METHOD

The population consists of firms of Architects, Structural Engineers, Mechanical and Electrical Engineers (M&E), and Quantity Surveyors who are involved in recently completed or on-going building projects that have reached advanced stage of completion for both public and private clients. The public clients whose building projects formed the basis of the population of the study are Universities, Polytechnics, Colleges of Education approved by the National Universities Commission (NUC), National Board for Technical Education(NBTE) and the National Commission for Colleges of Education (NCCE). This was retrieved from the websites of NUC (http//www.nuc.edu.ng), NBTE (http//.nbte.gov.ng/institutions) and NCCE (hhtp//www.ncce.edu.ng) on 28th March 2017.Others are Ministries, Departments and Agencies (MDA) of State governments in the South-West States of Nigeria. The private clients are Banking institutions (twenty-one in number) and Real Estate Development companies. They were identified on the Nigeria Business Directory (www.nigeriabusinessdirectory.com) on 28th March 2017.

From the client organisations, 122 building projects with a team of four consultancy firms of Architects, Structural Engineers, M & E Engineers and Quantity Surveyors were selected using purposive sampling technique. This is translated to a sampling frame of 488 consultancy firms. From this, the sample size was calculated using the following formula as posited by Udofia (2011).

$$'n' = \frac{N}{1+\mathrm{N}(e^2)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where n = sample size, 1 = Unity; *e* = Level of significance = 0.05; N = Universe or population =**488. 'n' = 488 / 1+ 488 (0.05^2) =220.** To arrive at a reasonable response rate, 70% of 220 was added, given a sample size of **374.** Questionnaire was used as the instrument for data collection. The questionnaires were delivered by hand and through electronic format using survey monkey, a software that assist in creating survey and stores data online. This involved sending a brief introductory letter to the respondents through an email along with a hyperlink (https://aluko.typeform.com/to/vgy7JZ) of the survey created electronically. From the 374 questionnaires distributed, 270 (72%) were received for analysis.

3.1. Data measurement

The factors were divided into nine major groups namely staff development and motivation, innovation, internationalization, information and communication technology (ICT), regulatory framework, construction materials industry, client factors, competition and professional fees**.** The variables are sub-divided into 38 sub-variables and perceptions

of the professionals on the effects of the variables on services were measured on a 5-point Likert scale using 1= Nil, 2=Low, 3=Average, 4= High, and 5= Very High.

4. DATA ANALYSIS

4.1. Respondents characteristics

The descriptive information in Table 1 below shows the characteristics of the respondents of the study. The majority of the respondents (73.3%) are male, while 26.7% of the respondents are female. This reveals that more male participated in this study than female. The result also shows that 16.3% of the respondents in Consultancy firms had B. Sc, 27.8% had Master's degree and 22.2% had Higher National Diploma as their highest academic qualifications. Also, 31.5% had PGD as their highest qualification while 2.2% had PhD. The results indicated the respondents in client organization had adequate academic qualification with HND as minimum qualification.

Table 1: Descriptive results of the bio-data of the respondents

Variable	Frequency	Percentage
Gender		
Male	198	73.3
Female	72	26.7
Total	**270**	**100.0**
Highest Academic Qualification		
HND	60	22.2
B.Sc	44	16.3
PGD	85	31.5
MSc	75	27.8
PhD	6	2.2
Total	**270**	**100.0**
Professional Affiliation		
MNIA	70	25.9
MNSE (Structural)	68	25.2
MNSE (M &E)	67	24.8
MNIQS	65	24.1
Total	**270**	**100**
Professional Cadre		
Graduate	142	52.6
Corporate	88	32.6
Fellow	40	14.8
Total	**270**	**100**
Professional Experience		
1-10 years	130	48.1
11-20 years	73	27
Above 20 years	67	24.9
Total	**270**	**100.0**

Table 1 further revealed that (25.9%) of the respondents in client organizations are members of the Nigerian Institute Architects, 25.2% are members of NSE (Structural Engineering division), 24.8% are members of NSE (M & E division), while 24.1% are members of NIQS. The results indicated that the four professionals who are basically

involved in providing consultancy services in building projects are evenly represented in the study. The analysis of the cadre of membership of professional bodies in Table 1 shows 52.6% are in graduate cadre, 32.6 in corporate cadre and 14.8% are also fellowship cadre in their professions. The results also revealed that 48.1% had 1-10 years of experience on the job, 27.0% had 11-20 years of experience while 24.8% had more than 20 years of experience on the job. The results show that the respondents of the study are made up of professionals with relevant experience in the industry.

4.2. The descriptive analysis of factors affecting provision of professional services of consultancy firms

The descriptive analysis was carried out using mean score of each of the factors. Table 2 shows the descriptive statistics results for the different professionals under the main category. The descriptive analysis of the thirty-eight factors was carried out using mean score.

Table 2: Descriptive results of factors affecting provision of professional services of consultancy firms in building projects

Factors	MS	Rank	Group
The use of modern hardware and software	3.99	1	ICT
Commitment of members staff	3.83	2	SDM
Ability to choose the right design team	3.80	3	CFF
Client's financial position	3.76	4	CFF
Staff education and training	3.75	5	SDM
Previous relationship with the client	3.74	6	CFF
Authority for design team effective perform	3.71	7	CFF
Availability of materials for design	3.69	8	CMT
Supply and price of construction materials	3.68	9	CMI
Adoption of building information modelling	3.56	10	ICT
Effects of sub-standard materials	3.54	11	CMI
Client's involvement in design process	3.50	12	CFF
Internet for comm link among employees	3.49	13	ICT
Adequacy of fees paid by clients	3.48	14	PFF
New methods for service leverage	3.48	14	INV
New activities for knowledge of employees	3.48	14	INV
Salary and social welfare structure	3.47	17	SDM
Payment of fees by milestone	3.45	18	PFF
New internal administration and operation	3.44	19	INV
Capacity of the local materials industry	3.43	20	CMI
ICT link to all relevant external information	3.40	20	ICT
Regulation of fees by the government	3.40	22	PFF
Public clients' response to fees payment	3.38	23	PFF
Private clients' response to fees payment	3.34	24	PFF
Availability of created new line of services	3.33	25	INV
Allocation of resources to R&D in ICT	3.33	25	ICT
Available govt regulatory framework	3.31	27	RGF
Policy framework for tech staff registration	3.25	28	RGF
Requirements of procurement acts for profs	3.25	28	RGF
Fair competition between small & large firms	3.18	30	CMP
Competent Staff with international exposure	3.16	31	INT
Enforce regs on foreign firms' practices	3.16	31	CMP
Strategies for entering international market	2.99	33	INT
Networking/collaboration with foreign firms	2.98	34	INT
Regulations to encourage internalizations	2.97	35	INT
Frequency of changes in regulation	2.96	36	RFF
Legislation protection for indigenous firm	2.91	37	CMP
Level of involvement in international market	2.90	38	INT

The results are shown in Table 2. The factors that had the highest mean scores are the use of modern hardware and software (ICT=3.99), commitment of staff (SDM=3.83), ability of the client to choose the right design team (CLF=3.80), the client financial position (CLF=3.76) and staff education and training (SDM=3.75). The implication of this is that deployment of modern technological tools, the design team commitment, and education/training of the design team have the highest effect in delivering excellent service by consultancy firms. The factors with the least effect based on mean scores are: frequency of changes in regulations by government (RGF=2.96); government protection through legislation for indigenous firm (CMP=2.91) and firms' degree of involvement in international market (INT=2.90).

4.3. Test of hypothesis

The variations in the perceptions of the four professionals on the factors affecting the professional services by the firms was carried out to test the hypothesis of the study. The hypothesis states that there is no significant difference in the perceptions of Architects, Structural Engineers, M & E Engineers and Quantity Surveyors on the factors affecting professional services by consultancy firms. To test the hypothesis, Analysis of Variance (ANOVA) was used. The hypothesis was tested at $p \leq 0.05$. The rule for the rejection of the hypothesis (Ho) is that when the calculated p-value is ≤ 0.05, the test rejects the hypothesis. But when the calculated p-value > 0.05, the test accepts the hypothesis. The results of the test of the hypothesis are presented in Table 3 below.

The results in Table 3 show that the p-value for the test of difference in the perceptions of the four professionals on the effect of five factors namely frequency of changes in regulations by government, capacity of the local building materials industry, supply and price of construction materials, availability of specified materials for design and enforcement of regulations on foreign firm's practices on the provision of consultancy services are less than the critical p-value (0.05). Therefore, the test rejects the hypothesis. The results imply that there is a significant difference in the perceptions of the architects, structural engineers, mechanical and electrical engineers and quantity surveyors on the effects of these five factors on the level of provisions of professional services.

The results of the mean score of the effect of the five factors in Table 3 show that the frequency of changes in regulations by governments has the highest effect on the level of provision of M&E services (MS = 3.27). The factor has the second highest effect on QS services (MS = 2.91) and least effect on the level of provision of architectural services (MS =2.79). The capacity of the local building materials industry has the highest effect on the level of provision of QS services (MS = 3.59), the second highest effect on architectural services (MS = 3.52) and least effect on the level of provision of structural engineering services (MS =2.79). Supply and price of construction materials has the highest effect on the level of provision of architectural services (MS = 3.80). The factor has the second highest effect on M&E services (MS = 3.74) and least effect on the level of provision of structural services (MS =3.31).

On the other hand, availability of specified materials for design has the highest effect on the level of provision of QS services (MS = 3.84). The factor has the second highest effect on architectural services (MS = 3.80) and least effect on the level of provision of structural engineering services (MS =3.40). The enforcement of regulations on foreign firm's practices has the highest effect on the level of provision of QS services (MS = 3.34).

Table 3: Summary of results of ANOVA for test of difference in the perceptions of professionals on the factors affecting the provision of professional services of consultancy firms in building projects

Factors	Arc MS	SE MS	M&E MS	QS MS	Sum of Squares	F-value	P-value	Rmks
Staff Development and Motivation								
Staff educational and training	3.87	3.66	3.81	3.66	2.28	0.73	0.54	NS
Commitment of members of staff	3.91	3.71	3.83	3.88	1.69	0.69	0.56	NS
Salary and social welfare structure	3.61	3.37	3.34	3.55	3.86	1.21	0.31	NS
Innovation								
New Improved Service leverage methods	3.48	3.49	3.50	3.49	0.07	0.01	0.99	NS
New activities for knowledge of employees	3.36	3.61	3.46	3.49	2.25	0.88	0.45	NS
New internal administration and operation	3.35	3.45	3.41	3.53	1.13	0.46	0.71	NS
Availability of created new lines of service	3.43	3.32	3.30	3.35	1.56	0.55	0.65	NS
Internationalization								
Level of involvement in international market	2.92	2.99	2.93	2.77	1.94	0.51	0.68	NS
Networking /collaboration with foreign firms	2.84	3.12	2.97	2.98	2.65	0.61	0.60	NS
Strategies for entering international market	2.96	3.12	2.96	2.94	1.46	0.44	0.72	NS
Competent staff with international orientation	3.15	3.21	3.08	3.19	0.72	0.19	0.90	NS
Regulations to encourage internalizations	2.71	3.04	3.00	3.14	7.17	2.01	0.11	NS
ICT								
The use of modem hardware and software	4.06	3.84	3.96	4.12	3.20	1.17	0.32	NS
Adoption of building information modelling	3.67	3.53	3.52	3.49	1.37	0.38	0.77	NS
Allocation of resources to R&D in ICT	3.29	3.24	3.41	3.37	1.21	0.40	0.76	NS
Internet for communication among employees	3.40	3.59	3.51	3.48	1.31	0.38	0.77	NS
ICT link to all relevant external information	3.44	3.26	3.40	3.51	2.42	0.77	0.52	NS
Regulatory Framework								
Available government regulatory framework	3.20	3.19	3.42	3.44	3.79	1.52	0.21	NS
Frequency of changes in regulation	2.76	2.88	3.27	2.91	9.27	3.16	0.03	S
Policy framework for tech. staff registration	3.22	3.07	3.39	3.31	3.70	1.46	0.23	NS
Requirements of procurement acts for profs	3.12	3.22	3.24	3.44	3.50	1.35	0.26	NS
Construction Materials Industry								
Capacity of the local materials industry	3.52	3.06	3.54	3.59	12.54	3.92	0.01	S
Effects of sub-standard materials	3.59	3.31	3.63	3.62	4.83	1.12	0.34	NS
Supply and price of construction materials	3.80	3.31	3.74	3.62	10.14	3.25	0.02	S
Availability of specified materials for design	3.80	3.40	3.71	3.84	8.17	2.99	0.03	S
Client Factors								
Ability to choose the right design team	3.74	3.63	3.87	3.98	4.60	0.06	0.98	NS
Previous relationship with the client	3.70	3.75	3.77	3.75	0.16	0.06	0.98	NS
Authority for design team effective performance	3.67	3.59	3.69	3.91	3.94	1.81	0.17	NS
Client's financial position	3.84	3.64	3.75	3.81	1.61	0.52	0.67	NS
Client's involvement in design process	3.48	3.52	3.50	3.49	0.08	0.03	0.99	NS
Competition								
Legislative protection for indigenous firm	2.81	2.74	3.09	3.01	5.63	1.82	0.14	NS
Enforcing regulations on foreign firms' practices	2.92	3.07	3.33	3.34	9.03	3.08	0.03	S
Fair competition between small and large firms	3.05	3.15	3.27	3.28	2.55	0.80	0.50	NS
Professional Fees								
Adequacy of fees paid by clients	3.59	3.42	3.58	3.32	4.17	1.06	0.37	NS
Payment of fees by milestone	3.61	3.35	3.51	3.32	3.79	1.06	0.37	NS
Private clients' response to fees payment	3.38	3.28	3.42	3.26	1.22	0.38	0.77	NS
Private clients' response to fees payment	3.57	3.38	3.36	3.20	4.73	1.57	0.20	NS
Regulation of fees by government	3.48	3.32	3.43	3.38	0.93	0.20	0.99	NS

Significant *p < 0.05 MS= Mean Score; Number of Respondents =270, S=Significant, NS=Not Significant

The factor has the second highest effect on M&E services (MS = 3.33) and least effect on the level of provision of architectural services (MS =2.92).

Table 3 however shows that the p-value for the test of difference in the perception of the four professionals on the effect of the remaining thirty-three factors on the provision of consultancy services are higher than the critical p-value (0.05). Therefore, the test accepts the hypothesis. The results indicate that the perceptions of architects, structural engineers, M&E engineers and QS on the effect of the 35 factors on the provision of consultancy services are not significantly different. The implication is that the thirty-three factors have the same effect on the level of provision of consultancy services of architectural firms, structural engineering firms, M&E engineering firms and QS firms.

5. DISCUSSION

The result of the study revealed the interactions of challenges which the design team faces in the process of giving direction to the implementation of building projects. The conception and eventual successful implementation of any building depends on the effectiveness of the design team, as the client decision to implement the project rest on the appraisal guide of the design team. The study is also consistent with Chileshe and Yirenkyi-Fianko (2012) with respect to availability of specified materials, supply and price of construction materials and the effects of sub-standard building materials.

Zhao, et al., (2012) also confirmed that factors of construction materials are emerging determinant for winning international projects. This is crucial for successful implementation of design concepts. This means that the place of the construction materials industry is very critical for the building industry. The study of Chileshe and Yirenkyi-Fianko (2012) categorised the construction materials factors as economic factors which were found to be the most impactful on projects in Ghana. The effects of sub-standard materials on building projects is also supported by Oyedele, et al (2015), and described it as critical factors affecting construction quality in Nigeria.

Factors of regulatory framework such as frequency of changes in regulations by government were found to be significant in contributing positively to overall provision of professional services in building industry. However, findings in respect of other factors such as requirements of procurement acts and available government regulatory framework showed that consultancy firms sampled were not in tandem with the laws and regulations of the industry sub-sector. This is in contrast with Ling and Low (2007) cited in Zhao *et al*. (2012). The study stated that "keeping up with new laws and regulations that are constantly being enacted is one of most significant legal risks faced by architectural and design firms". The regulatory requirements for competition are not enforced relative to foreign firms who have better financial and human resources to compete optimally. The result of this is that most indigenous firms remain at micro and small level without the ability to compete favourably.

6. CONCLUSION

In the past, elements of enablers and/or barriers of services have been carried out in general terms in the building industry. However, this study has contributed to knowledge by providing empirical analysis on the specific factors that describe performance of professional service providers in the knowledge driven sub-sector of the building industry.

The study established the factors that act as catalyst for success and/or failure of services of professionals in the building industry. The factors are frequency of changes in regulations by government, capacity of the local building materials industry, supply and price of construction materials, availability of specified materials for design and enforcement of regulations on foreign firm's practices.

The implication is that these five factors contribute positively on provision of professional services while others do not have effect. These are supposed to act as catalyst for success and/or failure of services of professionals in the building industry. The study recommends that there should be continuous investment by the professional service providers on ICT, staff development and motivation and relationship with the client. The policy maker should improve the capacity of manufacturers of local materials industry through effective legislation and increasing infrastructural development. Enforcement of relevant regulations on professional practices by foreign firms should be given a priority in order to protect the local firms. Hence, it is expected that service improvement would result from these for competitiveness in the industry. In future, further study can be explored to test the relationship between these factors and project success.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

PROSPECT OF SUSTAINABLE ENERGY (BIOGAS) GENERATION FOR USE IN UNIVERSITY OF UYO CAFETERIA

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ABSTRACT

Purpose: This study explored the potential of biogas production from wastes generated in University of Uyo, as an alternative source of energy for the University Cafeteria.
Design/methodology/approach: Three major wastes were collected from University of Uyo Annex Campus, consisting of cow dung, poultry litter and kitchen wastewater (from the University Cafeteria). As a quantitative research, the study adopted an experimental design that involved the treatment and use of the collected wastes as substrate for digestion and generation of biogas.
Findings: The experimental procedure of co-digesting 11.5kg of combined cow dung, poultry litter and kitchen wastewater, resulted in the production of 8500ml of raw biogas. Further, to obtain pure methane from the raw biogas, impurities such as carbon dioxide and hydrogen sulphide were removed using two chemical scrubbing solutions, comprising of ordinary water with sodium hydroxide, and ferric chloride with sodium hydroxide. Test for combustibility of the purified gas indicated a positive result, as the obtained gas supported burning.
Research Limitations/Implications: A bigger anaerobic digester would have been used to produce larger volumes of biogas; however, this requires more funds to execute.
Practical Implications: With the adoption of this technology in larger scale, landfilling of University of Uyo wastes would be greatly reduced and possibly eliminated. Also, if on a pilot scale, 8,500ml of raw biogas was produced from 11.5kg of combined waste, then there is need to explore the large amount of organic waste that are readily available within septic tanks or sewage systems in the University.
Originality/value: As there is currently no unit within the university where wastes are converted into renewable energy, the support and operation of this technology in larger scale would highly enhance the sustainability status of University of Uyo.

Keywords: Anaerobic digestion; biogas; cow dung; kitchen wastewater; methane; poultry litter.

1. INTRODUCTION

In contemporary times, increasing concern for environmental health, eco-friendly waste management and sustainable energy production, constitute the focus of many

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trade bodies, regulatory agencies and countries of the world. Energy, which is a driver of economic growth, is obtained from various primary sources that are not limited to coal, petroleum, nuclear, etc., but also incorporates renewable sources from wind, solar and biomass. However, the most widely used sources are the non-renewable fossil fuels that account for more than 80% of global primary energy consumption (Awwad & Mohammed, 2007), with their attendant environmental pollution.

Nigeria is not left out of such immense dependence on fossil fuel. A country endowed with primary energy resources with a record of the world's tenth largest reserve of crude oil, and an estimate of about 36 billion barrels or circa 4.896 billion tonnes of oil equivalent in 2006 (Dayo, 2008). As Nigeria is a highly populated country in Africa, it has significant resources of organic waste. Industrialization, growing urbanization, and agricultural activities have resulted in environmental pollutions from industrial, municipal and agro-allied waste. This explains why it is now critical not only to focus on the economic use of the existing limited resources, but to identify new technologies and renewable resources that explore the potentials of the energy inherent in waste, in order to minimize the increasing energy demand.

Further, biogas technology has not been widely adopted as an energy or economic strategy in many organizations and institutions in Nigeria (Ogwueleka, 2009). An institution like the University of Uyo is no exception. In the University, there has been great concern over the rising environmental pollution and fluctuating power supply. The Annex Campus, being one of the Campuses of the institution, has significant amount of wastes. Some of these wastes include municipal solid waste (MSW), such as large amount of papers, polythene bags, plastics, sewage waste, animal waste (cow dung) and wastewater from hostels and the university cafeteria. These wastes (especially cow dung from cattle left to graze within the campus) are often unsightly (see Figure 9.1). While there is need to foster a clean environment for a conducive academic learning around the Campus, more proactive measures can be put in place to ensure environmental sustainability, by utilizing these wastes as a source of energy for facilities in the University. This research is carried out to explore the possibility of biogas generation as an alternative source of energy in the University of Uyo. This will help build a body of knowledge in biogas energy generation and further create awareness of the need for sustainable energy sources in the University of Uyo and beyond.

1.1. Aim and objectives

The aim of this study is to develop a biogas system that will generate clean energy as an alternative source of energy for the University of Uyo Cafeteria. The following objectives are set to achieve this aim: To:

i. develop an anaerobic reactor for biogas production.
ii. use cow dung, poultry litter and kitchen wastewater as substrate for biogas production.
iii. determine the volume of biogas produced.
iv. scrub the raw biogas.
v. carry out a flammability test on the produced biogas

2. REVIEW OF RELATED LITERATURE

With a current population growth rate of 2.03% to 7%, energy consumption and waste generation in Nigeria is expected to soar over the next few years (Amber, Kulla, & Gukop, 2012). The average waste density currently ranges between 280 to 370 kg/m³, with waste generation rates ranging from 0.44 to 0.66 kg/capita/day (Ogwueleka, 2009). In a research by Amber, Kulla, & Gukop (2012), samples of 10 kg each of raw Municipal Solid Waste (MSW) were taken randomly from dump sites whose sources were generated from different activities in some selected state capitals representing each of the six geopolitical zones of Nigeria. The collected waste samples revealed high proportion of polythene waste from sachet drinking water, popularly known as 'pure water', and shopping bags with calorific values averaging 14.89MJ/kg (see Table 4.1 for energy contents of assessed waste materials). Additionally, on the basis of incinerating 1500 ton of MSW/day, with an average calorific value of 17.23MJ/kg and conversion efficiency of 25% and 49%, the thermal treatment of MSW resulted in the production of 700 kWh of electricity per ton of MSW combusted. In practice, about 65 to 80% of the energy content of the organic matter can be recovered as heat energy, which can be utilized either for direct thermal applications, or for producing power, via steam turbine generators (with typical conversion efficiency of about 30%) (Amber, Kulla, & Gukop, 2012).

Table 4.1: Energy content of MSW

Components	Energy content (MJ/kg)
Organic / food	11.59
Cardboard	11.033
Plastics	14.89
Polyethene	46.5
Textile	9.27

Source: (Amber, Kulla, & Gukop, 2012)

2.1. Anaerobic digestion

Anaerobic digestion (AD) is a biochemical process that converts a variety of organic matter using naturally occurring microorganisms under oxygen depleted conditions, to produce a gaseous mixture mainly composed of methane and carbon dioxide, known as biogas (Botheju & Bakke, 2011). As noted by Botheju & Bakke (2011), anaerobic digestion occurs naturally inside landfills, due to the presence of large amounts of organic waste and scarcity of oxygen. This emits a biogas normally composed of about 50% Methane, 50% Carbon IV Oxide, and trace amounts of other gases (Environmental and Energy Study Institute, 2009). The anaerobic digestion (AD) process can also be engineered to occur in a dedicated facility known as an anaerobic digester, primarily a closed vessel kept with a culture of microbes, fed regularly with digestible (organic) matter (Botheju and Bakke, 2011). Anaerobic digesters are typically large or small reactors constructed of either concrete, rubber or steel. The volume of the reactor depends on the volume of waste to be processed in the system. As with most conventional digesters, a retention time of 20 - 30 days is required to convert solid manure into methane (Sharvelle & Loetscher, 2011). According to Sharvelle & Loetscher (2011), in a simple digester, using steel, plastic or concrete, the configuration is the tank / chamber with an inlet for waste input, outlet for digestate removal as fertilizers, and a gas valve outlet for gas collection and further processing.

2.1.1. Anaerobic digestion of animal waste

Animal manure is a valuable source of nutrients and renewable energy. However, most of the manure are left to decompose in the open, settle on river beds or float on water, thereby constituting significant environmental hazards. According to Alvarez & Liden (2009), the large amounts of animal manure and slurries produced today by the animal breeding sector as well as the wet organic waste streams, represent a constant pollution risk with negative impacts on the environment. Also, air pollutants emitted from manure, consisting of methane, nitrous oxide, ammonia, hydrogen sulphide, volatile organic compounds and particulate matter, could cause serious environmental hazards and health problems (Alvarez & Liden, 2009). In some places, livestock waste is recovered and sold as a fertilizer or simply spread onto agricultural land. However, the introduction of tighter environmental controls on odour and water pollution heralded some form of waste management, which provides further incentives for biomass-to-energy conversion (Zafar, 2018). According to Steinfeld et al. (2006), the animal production sector is responsible for 18% of the overall greenhouse gas emissions, measured in Carbon IV Oxide equivalent, and 37% of the anthropogenic methane, which has 23 times the global warming potential of Carbon IV Oxide. Furthermore, 65% of anthropogenic Nitrous Oxide and 64% of anthropogenic ammonia emission, originate from the worldwide animal production sector (Steinfeld et al., 2006).

Animal wastes include livestock manures from cow dung, sheep, pig, goat, fowl and other domesticated animals. Abubakar & Ismail (2012) investigated the effectiveness of cow dung for biogas production. The average cumulative biogas yield and methane content observed was 0.15 L/kg volatile solid (VS). Further, Alvarez & Liden (2009) studied biogas production through anaerobic digestion in farm-scale units under mesophilic conditions. The results suggest that digesting a mixture of llama-cow-sheep manure at low temperature of between 291–298K (equivalent to 17.85–24.85°C), yielded methane in the range 0.07–0.14 m^3/kg. Also, in a research conducted by Recebli, Selimli, Ozkaymak & Gonc (2015), biogas production potential from bovine animal and fowl manure were separately studied. 350 kg bovine animal manure blend (175 kg manure +175 kg water) and 375 kg fowl manure blend (50 kg manure+325 kg water) were separately digested. Then the biogas production rates were evaluated and compared for the two processes. Results showed that daily 6.33m^3 and 0.83m^3 biogas productions were obtained from fermentation of bovine animal manure and fowl animal manure respectively.

2.1.2. Co-digestion of substrates

Co-digestion of animal manure with various biomass substrates increases the biogas yield and offers a number of advantages, including the management of manure and organic wastes, and mitigation of greenhouse gas (GHG) emissions (Holm-Nielsen, Al Seadi, & Oleskowicz-Popiel, 2009; Van Nes & Nhete, 2007). In co-digestion of plant material (like paper) and organic manures (like bird litter and cow dung), organic manures provide buffering capacity and a wide range of nutrients, while the addition of plant material with high carbon content, balances the carbon to nitrogen (C/N) ratio of the feedstock, thereby decreasing the risk of ammonia inhibition (Zafar, 2018). According to Zafar (2018), animal manure has a Carbon – Nitrogen ratio of 25:1, and is considered ideal for maximum gas production. Solid concentration in the feed material is also crucial to ensure sufficient gas production, as well as easy mixing and handling. Thus, the gas production per digester volume can be increased by operating the digesters at a higher concentration of solids (Zafar, 2018).

2.2. Scrubbing: removal of impurities from biogas for production of pure methane

Scrubbing in biogas production, also known as absorption is the process of removing impurities or contaminants from raw biogas, in order to enhance its combustibility. Such impurities majorly include Hydrogen Sulphide (H_2S), Carbon (IV) Oxide (CO_2), Water (H_2O), etc., although biogas is primarily composed of Methane (CH_4) and Carbon (IV) Oxide (CO_2) (Rincón, Heaven, Banks & Zhang, 2012). The presence of each of these contaminants portends varied negative aftermaths. Combustion of biogas containing H_2S produces Sulfur Dioxide (SO_2), which when combined water vapor, produces Sulfuric acid (H_2SO_4), and when exposed to the environment, causes acid rain; whereas, the presence of CO_2 and water vapor in biogas, leads to circa 80% combustion inhibition (Shah, Nagarsheth & Acharya, 2016). As noted by Shah, et al. (2016), removal of these impurities in biogas, raises the methane content of the biogas, and primary methods of scrubbing biogas include water and chemical scrubbing; other methods like cryogenic separation, membrane pressure and swing adsorption, involve higher installation costs.

3. RESEARCH MATERIALS AND METHODS

The raw materials, digester description and experimental procedures adopted for this study are covered in this section.

3.1. Raw materials

Cow dung littered on the University of Annex campus roads, poultry litter from the Faculty of Agriculture poultries and kitchen wastewater from the University Cafeteria were collected for co-digestion. These were differently treated and used as substrate for co-digestion and production of the Biogas.

3.2. Digester description

A biogas chamber made of portable plastic barrel, having a height of 0.6m that bears a slurry capacity of 20kg was constructed to be used for this experiment (see Figure 9.2). The inlet pipe (25mm dia. PVC) serves as the means of introducing the substrate for digestion; whereas, the residue is evacuated through the outlet device made up of 25mm diameter PVC pipe at the bottom. Raw biogas collection was through pressure developed within the reactor that forced the gas out through a 10mm diameter flexible rubber pipe with a valve at the top for delivery into the collection unit.

3.3. Experimental procedure

In this study, potential for biogas generation was investigated using a batch process, in which the slurry was added once in the digester for the whole duration of the process. The experiment was carried out by co-digestion of the raw materials consisting of cow dung, poultry litter and kitchen wastewater (Figure 9.3 & 9.4).

Pre-treatment was carried out for cow dung and the poultry litter at 90oC for 8hours. Having each mixed with some quantity of the kitchen wastewater, the cow dung weighed

3.5kg before, and 3.2kg after treatment. The bird litter weighed 3.5kg before, and 3.1kg after treatment. Both were thoroughly mixed using 5kg of the kitchen wastewater to attain a sufficient slurry before feeding into the reactor. A summary of the experimental procedure is revealed in the flow chart below (Figure 5.1).

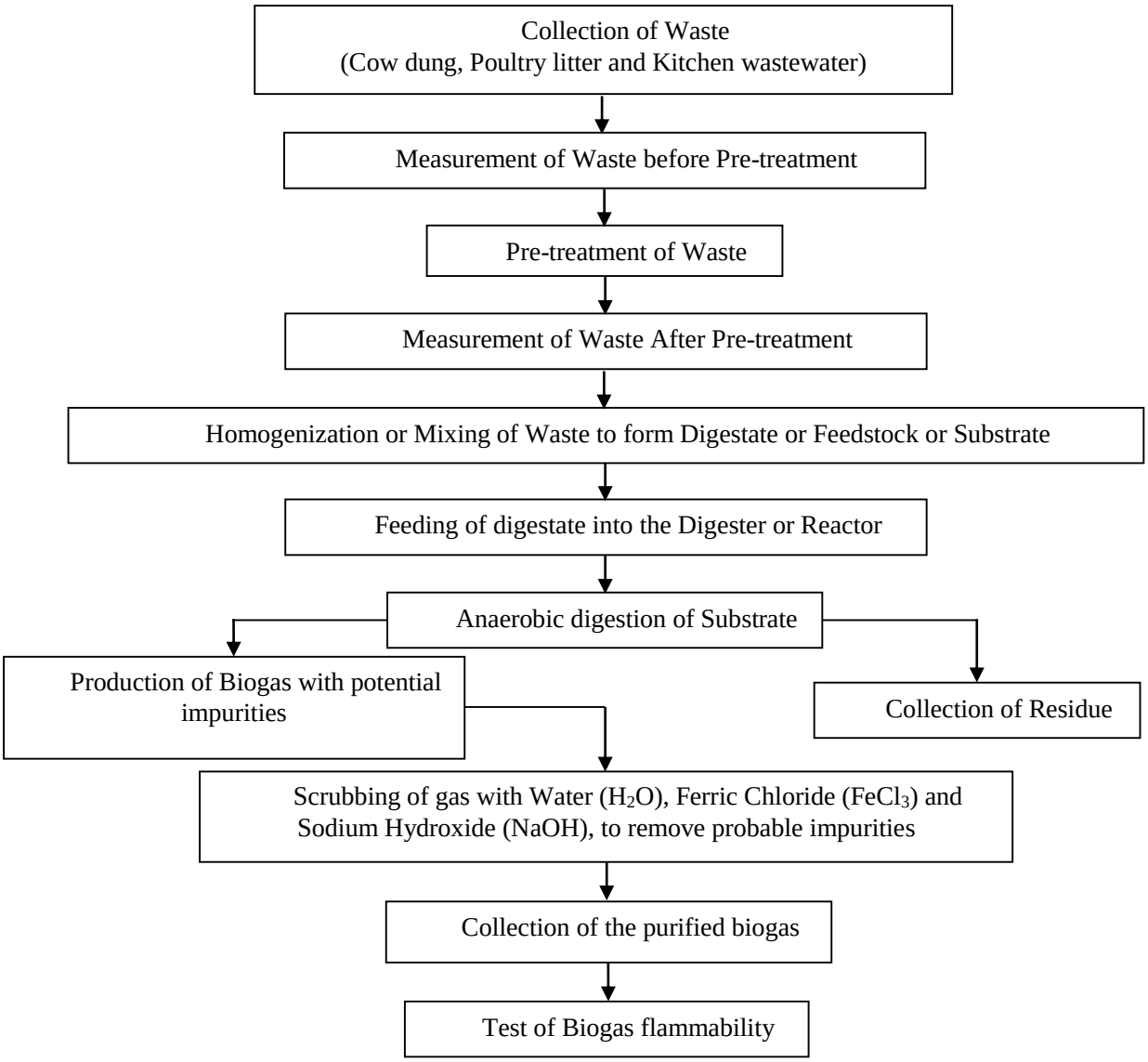

Figure 3.1: Biogas production flow chart

4. RESULTS AND DISCUSSION OF FINDINGS

4.1. The biogas production

The digestion process for the experiment was carried out under an ambient temperature range of 26 to 36°C, within a retention period of 20 days. The agitation of the culture inside the reactor was done every two days by shaking the reactor and this continue until the 6th

day, when the gas production commenced. The following readings were taken as shown in Table 6.1. The early gas yield shows that the nature of substrates used are non-lignocellulose, as they decompose faster due to high organic microbes.

Table 4.1: Gas yield from the experiment

S/no.	Days	Volume (ml)
1	6^{th}	1000
2	8^{th}	2000
3	10^{th}	2000
4	12^{th}	2000
5	14^{th}	1000
6	16^{th}	500
7	18^{th}	0

The raw gas collected totaled 8500ml. A summary of the experimental procedures for the generation of the biogas using cow dung, poultry litter and kitchen wastewater as substrate are tabulated below (Table 6.2).

Table 4.2: Final result of the experiment carried out

Cow dung Before/after treatment		Poultry litter Before /After Treatment		Kitchen Waste Water	Total volume of waste	Mix Ratio	Oven Drying	Total period of digestion	Total Volume of Biogas produced
3.5kg	3.2kg	3.5kg	3.3kg	5kg	11.5kg	1:1:1.6	90°C	20 days	8500ml

4.2. Flammability test before scrubbing

The raw biogas was tested for flammability; the result was that the produced biogas did not flame. The reason is not far-fetched as it was earlier established in literature that impurities such as carbon dioxide, water vapour, and hydrogen sulphide, when present in biogas, affect the flammability of the gas (Rincón, Heaven, Banks & Zhang, 2012). To decontaminate the gas of these combustion-inhibiting impurities, chemical scrubbing processes were applied to obtain pure methane that is very combustible.

4.3. The scrubbers

Ferric Chloride ($FeCl_3$) and Sodium Hydroxide (NaOH) were solvents used for the scrubbing of the raw biogas. Two 50Cl plastic bottles water containers were provided for scrubbing. The first bottle contained a solution of ferric chloride and the second held sodium hydroxide solution. Each scrubber had openings at the top for inlet and outlet, where rubber pipes were fixed for passage to each container from the pressure hose connected to the digester.

4.4. Scrubbing process

Scrubbing is the process of removing impurities from biogas in other to obtain pure methane. Two different scrubbing procedures were undertaken, ferric chloride solution was first used to remove H_2S and the second procedure was the use of sodium hydroxide solution to remove CO_2. These procedures follow the inference of Shah, et al. (2016) that removal of impurities in biogas, raises the methane content of the biogas, and primary methods of scrubbing biogas include the water and chemical methods. A diagrammatic representation of this is revealed as figure 6.1 below.

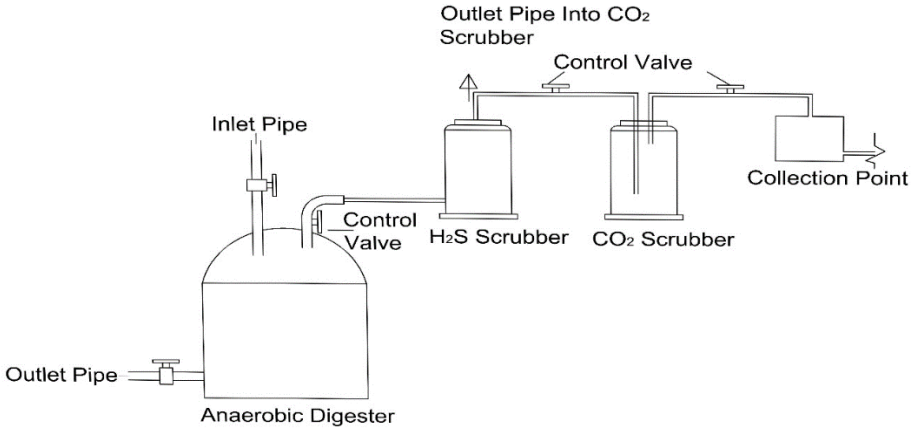

Figure 4.1: Schematic representation of the laboratory scale digester and it scrubbing system

The raw biogas was first passed through ferric chloride solution to remove H_2S through an upward delivery. This process produced heavy gas bubbles. The escape of the gas from the ferric chloride solution turned the solution dirty brown. The gas then entered the next chamber containing sodium hydroxide solution. The result of this also produced strong bubbles in the sodium hydroxide, turning it slightly milky.

4.5. Flammability test after scrubbing

The decontaminated biogas (after scrubbing with $FeCl_3$ and NaOH) was then retested for flammability and the result was a pressurized deep blue flame. The result confirmed that H_2S and or CO_2 must have been present in the earlier collected raw Biogas, which led to the failure of the flammability test. This highlights the need for biogas scrubbing after collection, to eliminate potential impurities.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

In this section, summary of the study efforts and deductions, conclusion and recommendations are succinctly presented.

5.1. Summary

A total of 11.5kg of waste (cow dung, poultry litter and kitchen wastewater) after pretreatment, was fed into the developed digester as substrate. On the 6th day of digestion, biogas was produced and the gas production lasted for 18 days until no gas was further generated. Findings also indicated that 8500ml of raw biogas was obtained from the 11.5kg

of substrate. The non-flammability of the raw biogas showed that it contained some impurities that had to be removed through a process called scrubbing. Two scrubbing agents - Ferric Chloride (FeCl3) and Sodium Hydroxide (NaOH) solutions, where used to remove hydrogen sulphide and carbon dioxide respectively. The flammability test after scrubbing showed a positive result as the biogas flamed deep blue.

5.2. Conclusion

This study explored the potential of biogas production, using locally available waste (cow dung, poultry litter and kitchen wastewater), as an alternative source of energy. Results obtained in this work demonstrate that it is possible to achieve the production of biogas through an anaerobic digestion process. The findings also establish that on a pilot scale, 8,500ml of raw biogas can be produced from 11.5kg of combined waste. To use the generated biogas, a process known as scrubbing is required to decontaminate the gas and make it flammable. The gas produced which burns deep blue flame can be used for heating purposes in the University Cafeteria and in other units of the Universities where heating is required. Been a clean source of energy for heating purposes, the process is considered to be eco-friendly and sustainable.

5.3. Recommendations

Based on the findings of this study, it is recommended that a bigger anaerobic digester be developed to take larger substrate, so that landfilling of University wastes would be greatly reduced and possibly eliminated. Also, if on a pilot scale, 8,500ml of raw biogas was produced from 11.5kg of combined waste, then there is need to explore the large amount of organic waste that are readily available within our septic tanks or sewage systems in the University. Lastly, Professionals in the built environment of University of Uyo should advance research on sustainable waste management systems in buildings. This is majorly achievable if the University of Uyo would give grants solely for the purpose of exploring the potential of biogas production using all available wastes on campus.

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APPENDIX

Figure 9.1: Cow dung littered along the road of University of Uyo Annex Campus

Figure 9.2: The developed anaerobic digester

Figure 9.3: Wastes for the experiment: cow dung, poultry litter and waste water

Figure 9.4: Poultry litter

Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

RELATIVE IMPORTANCE ANALYSIS OF VARIABLES INFLUENCING CONSTRUCTION SITE LAYOUT PLANNING FOR SECURITY AND CRIME PREVENTION

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ABSTRACT

Purpose: This paper investigated the variables influencing construction site layout planning for effective site security. Construction sites are fraught with security and crime risks. To secure the site decisions have to be made on the best layout option on the location of facilities, road network, and access and exit points. A proactive site layout planning can increase productivity, efficiency, security and profitability.
Design/methodology/approach: Survey research method was adopted for the study. Copies of questionnaire were administered on construction/site managers involved in various sizes of construction projects in Akwa Ibom State. A total of 15 variables identified in the literature were evaluated using relative importance index (RII). The analysis also involved the ranking of the values (highest to lowest) of the different variables according to the relative importance indices.
Findings: The results showed that grouped location of facilities, security evaluation, perimeter control measures, access control, positioning of objects for clear lines-of-sight and strategic lighting are the most important variables (ranks 1 – 6 respectively) in construction site layout planning for security and crime prevention.
Research limitations/Implications: The paucity literature on site layout planning for security was a limitation to the study. To overcome this, the study combined variables from Crime Prevention through Environmental Design (CPTED) with site layout planning variables to produce a set of variables for site layout planning for security and crime prevention.
Originality/value: The paper concluded that security and the efficiency and effectiveness of labour and materials management for optimum productivity could be compromise by wrong location and placement of materials laydown areas, plant and equipment, offices and storage facilities and poor access to materials and work areas. It recommended the use of rule-based design checking system to assist human judgement on decision making by designers and construction managers.

Keywords: Crime; crime prevention; planning; security; site layout

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1. INTRODUCTION

Worldwide, the construction industry is considered to be one of the most important sectors in the economy of every country. It has interaction with nearly all areas of human endeavour because most human activities take place within spaces created by construction. The construction industry consists of all works carried out for the physical development and improvement of the environment for the achievement of developmental programmes' goals and objectives. Statistics drawn from 50 largest and most influential construction markets in the world by Construction Intelligence Center indicate that the turnover of the global construction industry was about $7.4 trillion in 2010, $8.5 trillion in 2015 and is projected at $10.3 trillion in 2020 at a growth rate of 3.9% (PR Newswire, 2015). The report predicts that the construction industries in the Middle East and Africa region will be the fastest growing in 2016 - 2020 period. This growth also carries with it some risks and challenges that need to be addressed. For countries in developing nations like Nigeria, the construction industry plays a significant role in boosting the economy and in socio-economic development. Analysis of data from the National Bureau of Statistics (NBS) for 2016 reported that the contribution of Nigeria's construction to GDP was 4% (Samuel, 2017). In real terms, the construction industry's output value increased at a compound annual growth rate (CAGR) of 11.68% between 2011 and 2015, and is estimated to grow at a CAGR of 9.49% over the period 2016 - 2020 (Business Wire, 2016).

The key project objectives of time, cost and quality could be affected by issues relating to security. To a contractor a project is not considered successful if the objective of profit is not achieved. Incidences of theft and losses recorded at construction sites can be extremely costly in terms of time lost, accident induced expenditure, insurance, delays, replacement of damaged, destroyed or stolen materials, and damage done to company's image. This has a great impact and effect on project objectives. Severe loses could lead to abandonment of the project, bankruptcy or poor quality projects. Crime problems on site could result from poor site layout planning. Effective use of site space has a significant impact on safety and security on site (Sadeghpour and Andayesh, 2015). The inability to factor in security needs on construction sites, especially critical infrastructure projects, also leaves the site vulnerable to crime and other security problems. Site layout planning which is often overlooked by many contractors (Kumar and Bansal, 2015) can have a negative impact on security. Every activity and structure on site has the potential of attracting criminal elements. Plant, equipment and materials such as aggregate heaps not properly located can block lines-of-sight of security personnel thereby compromising security. They could constitute concealment and cover for potential offenders.

Issues of crime prevention and security should, therefore, be of prime consideration to construction site layout planners. Planning allows for successful and effective performance of the security functions of a construction site. It involves visualising, projecting, locating and validating proposed activities considered necessary to achieve desired project objectives. Planning bridges the gap between assumptions and action. It determines in advance the course of action to be taken. Studies on site layout planning generally focus on productivity and safety. Site layout planning for security of construction sites is a less explored area. There are many variables involved. This study identifies the variables that can be considered in site layout planning for security and crime prevention. The variables are drawn from crime prevention through environmental design (CPTED), physical security and defensible space models and mapped together with conventional site layout elements. It also identifies core elements and concepts that can be used to develop layout

plans for security of construction and critical infrastructure sites. A proactive site layout planning can increase productivity, efficiency, security and profitability. Contractors will spend more money and time to complete a project if the construction site is not adequately protected.

1.1. The problem

Elements of risk and uncertainty could jeopardise the achievement of project objectives if the contractor does not fully plan and control all aspects of the project. Site security problems can affect the success and the potential profitability of the project. To remain competitive and in business a contractor will generally do everything possible to manage the resources necessary to complete the project. Construction sites today face many of the same social issues and problems as do other institutions. Globally, theft on construction sites is rampant. British Security Industry Association (2012) notes that construction sites are targets of both the opportunistic and carefully planned crimes. The National Equipment Register and National Insurance Crime Bureau joint 2013 annual report on equipment theft indicates that an estimated $300 million to $1 billion worth of registered construction equipment were stolen in 2013 in the United States and only about 21% recovered (Verisks Crime Analytics, 2014). This was based on 11,846 reported cases and excludes theft of tools, building materials and loses due to vandalism. Site security is a major contribution to site theft. Research by Verisks Crime Analytics (2017) indicates that increase in construction works correlates with higher numbers of construction equipment in an area attracting attention from thieves thereby increasing the risk of theft. The site location that the equipment spends the most time and the level of site security are indicated, among others, as factors that increase equipment theft.

The 2012/2013 construction site theft report by Mobile Mini (2015) indicates that the construction industry in the UK loses hundreds of millions of pounds yearly due to construction site theft. According to the report, there were an estimated 6,000 cases of site theft between September 2012 and September 2013. An assessed 35% of the cases involved forced entry while 21% of the cases occurred in unsecure sites. It noted that plant equipment, metals and tools were commonly targeted. Others include building materials, diesel, electrical and plumbing fittings and fixtures, vehicles, scaffold, office equipment and cash. Data was compiled from the responses of 27 police forces.

In Nigeria and other developing nations, it is difficult to get acceptable estimates because of poor records and statistics. Most thefts are not discovered, and those uncovered are not reported or recorded. A study of 42 construction firms in Lagos, Nigeria by Farinloye, Odusami and Adewumi (2013) reveal that a particular construction firm experienced more than 50 cases of theft on her sites in five years and 7.3% loses of over N10 million. Badejo (2015), drawing from interviews with Nigerian construction industry professionals, reports on the growing concern over construction site theft in Nigeria resulting in shortage of materials, poor quality work, increase in project cost and site management conflicts. Nasarawa state police, Nigeria, arrested seven persons in connection with a hospital construction site theft of a Mikano generator, 600 bags of cement and other items worth millions on Naira (Emmanuel, 2016). The results of poor security measures on site include costly job delays, loss of production, disruption of the planned schedule of work, down time for operators, and higher insurance premium. These issues also negatively impact on effectiveness and efficiency of labour productivity on site, making construction site layout planning for security crucial for construction companies.

2. REVIEW OF RELATED LITERATURE

2.1. Site layout planning for security

Construction site layout planning refers to the arrangement and allocation of available, limited space within the boundaries of a site for placement of site objects (temporary facilities, materials, plant and equipment, storage areas, workshops and outdoor materials preparation areas, access roads, sidewalks and utilities). These objects should be identified, grouped, sized and optimally positioned. There is a distinction between conventional site layout planning and security site layout planning. The difference lies in the goals and objectives. The conventional layout planning focuses on productivity, safety, project cost and completion schedule (Kalafallah and El-Rayes, 2005; Sadeghpour and Andayesh, 2015) while security layout planning focuses on overall site protection issues. Poor or non-planning of sites can create problems that can seriously affect operational effectiveness. These problems include wrong location of plant and equipment, material stack, reduced work spaces and blocking of access to stores and warehouses (Elbeltagi, 2014). Construction site layout planning enhances site optimisation, work productivity, health and safety and security. Every project is unique and therefore should have a unique layout tailored to the constraints and planning variables of the site.

The aim of security site layout planning is to arrange the objects on site optimally to meet security operational efficiency. Research into construction site layout planning for security is still very limited. The ultimate goal of site planning to counter crime and other security threats, including terrorism, is to protect lives, property and operations (Federal Emergency Management Authority, 2012). Security site layout planning is to create an environment that makes it difficult for criminals to operate. But at the same time the environment should support legitimate site activities that lead to work productivity. In site planning for security two types of spaces should be considered. These are, used space for permanent structures and the unused space for temporary facilities, plant and equipment, materials, stores, workshops, work spaces, access roads and on-site paths. These spaces must be properly evaluated. When evaluating the site space one needs to ask how security can be compromised and what a criminal can get away with. Four issues need to be considered: (1) Defining facilities and operation that can affect security on site; (2) zoning of facilities on site in line with security and other site planning objectives; (3) location and placement of temporary facilities on the available site space, and (4) relating the location and placement of permanent and temporary facilities to security considerations.

The location of facilities on site is a critical element of site planning (Russ, 2009). Facility layout planning and material layout planning should be carried out concurrently. Site space as a construction resource is limited and restricts the construction activities that can take place. It determines the layout pattern. Therefore, a good layout plan must efficiently use the site space to accommodate all objects. Sadeghpour and Andayesh (2015) and Small and Baqer (2016) identify pre-determined space, grid system and continuous space as the three main approaches to site space utilisation. Sadeghpour and Andayesh (2015) in an overview of the constructs of site layout modelling indicate that three main approaches to assigning positions to objects on site have also been identified as rule-of-thumb, ad-hoc and first come-first serve basis. Objects are assigned in the space model as dimensionless representation, approximate dimensions and actual dimensions.

Site layout planning can also be grouped into two categories. These are formal and informal planning. Formal site layout planning is an articulated method of planning with

laid down objectives which allow little room for confusion. It is a well-structured document which allows for proper co-ordination, control and unity of actions of site activities. It involves the production of a comprehensive site layout plan or marking the proposed location of facilities using the rule-of-thumb method on the project site plan). Formal planning, like a standing plan, is a reference material for future site layout planning. Informal planning is undocumented, unstructured and ad hoc in nature. It involves location of facilities on an ad hoc basis as the project progresses and the guessed location of facilities on first come-first served basis. It addresses a specific set of challenges and is abandoned once the objective is accomplished. It is a single use plan suitable for small sites and projects. This type of plan depends on the experience and knowledge of the construction/site manager.

For comprehensive plans, the use of a rule-based design checking system allows real-time design of a construction site layout using pre-defined rules to minimise site conflicts (Zolfagharian and Irizarry, 2014). This is software that assesses a design based on how objects are configured into the design using a system of rules and constraints with a "pass" or "fail" result (Eastman et al, 2009). Eastman et al. (2009) identifies four stages in the rule-based design checking system as follows: (1) Rule interpretation, (2) Building model preparation, (3) Rule execution, and (4) Rule reporting. This software is best interfaced as a plug-in with other BIM models. The use of rule-based design checking system assists human judgement on decision making by designers and construction managers.

2.2. Adapting crime prevention design concepts to site layout planning

The main aim of construction site security layout planning is to achieve the following 7Ds of crime prevention: (1) Define the site security problem and carry out security evaluations as the basis for site layout planning. (2) Deter site crime by using design elements and physical security measures such as fencing, lighting, natural and mechanical surveillance. (3) Detect criminal activities by using natural and mechanical surveillance measures and installing intrusion detection systems (IDS) on fences to detect any security breach. (4) Delay the assailant by making it difficult for him to access the target through fencing, target hardening and hierarchy of spaces so that more time is spent to allow response by on-site security or law enforcement. (5) Deny access to target by applying target hardening measures to thwart the assailant's plan so that criminal action is aborted. (6) Defeat criminal tools, tactics and techniques by an integrated site design that applies security counter-measures and deterrence in different combination (7) Detain offender after containing the situation due to delay and detection and hand over the offender to law enforcement.

The planning and design of the site should address emerging security threats and changing space needs. Concepts from different crime prevention approaches such as physical security, crime prevention through environmental design, defensible space and situational crime prevention can help to guide construction site security layout planning. The major aim of these approaches is to reduce criminal opportunities, reduce crime and fear of it (Crowe and Fennelly, 2013). The concepts include management practices, territoriality, access control, surveillance and lighting. This is expected to address the 7Ds of crime prevention – Define, Deter, Detect, Delay, Deny, Defeat and Detain.

Management practices: An important aspect of site management practice for site security layout planning is security evaluation of the site. A major element of crime prevention is to recognise and acknowledge the existence of a threat, the vulnerability of a

site and users and the risk posed to the site, workers and visitors. These should be properly evaluated in order to know the acceptable level of risk and the proper protection and mitigation measures to apply. A threat could be defined as a situation, activity, action or event that can lead to or cause death, injuries, loss, damage and/or destruction of an asset or group of assets.

Management should also determine the target hardening measures to be used on site. Target hardening systems are physical protective actions aimed at protecting the workers, checking unauthorised access to the site and project documents, and safeguarding disruption of operations, vandalism and theft. It is aimed at preventing forced entry through the use of tools such as iron and steel cutter, blow torches and explosives aimed at creating man-passable access points to compromise the security of the site. Target hardening emphasises the use of architectural hardware such as locks, burglary proof fixed in openings, reinforced doors and windows. The use of these measures is necessary in different combination in stores, gates, and to protect completed facilities not yet handed over. Design features such as gates, fencing, technological systems such as CCTV, alarm, key control systems and other security technologies also reduce the risk of theft and vandalism on site. The level of the target hardening depends on the assessed threat, vulnerability and risk levels and the level of protection required.

Territorial reinforcement strategies are intended to create and/or extend areas or spheres of influence that help users to cultivate a sense of ownership and territorial control. Criminals can become aware of this as strangers are easily noticed. This becomes a criminal deterrence because offenders are discouraged from carrying out criminal activities. Defined property lines and clearly distinguished hierarchy of spaces promote this strategy. Materials and equipment left in the open could be removed or vandalised. One way of applying the principle of territoriality is to create fenced compounds on site with lockable gates. Fencing a construction site helps to create a general protectable area of security influence.

Access control strategies are intended to increase the effort and deny criminal access to targets by generating an awareness of risks to the intruder. Three levels of access control are required for site layout design and planning for security. These are (i) access into the site, (ii) access to material compounds and sensitive areas, and (iii) access to work areas by visitors and unauthorised personnel.

Surveillance strategies are aimed at making intruders easily observable and maximising visibility of people, building entrances, parking areas, and street zone. Crimes are rarely committed in places in which a criminal knows that can easily be recognised or observed (Bahti and Pearce, 2016). In site layout planning for security clear lines-of-sight for surveillance by security personnel is required. The layout of site facilities significantly affects natural surveillance and security targets (Said, 2010).

Activity support strategy clearly defines site activity areas and designates the purpose of defined spaces and structure. This can help to discourage illegitimate and problem activities. Lighting strategies when used in combination with other security strategies can lead to a reduction in crime. Even though lighting does not stop crime it acts as a deterrent helping to reduce the associated fear and also aid the protection of people and property. Good security lighting helps in enhancing surveillance. Glare that handicaps guards and CCTV should be avoided. Lighting should be designed to avoid deep shadows and dark corners which may give cover to criminals. A good lighting plan should take into consideration lighting arrangements and illumination targets.

3. RESEARCH METHODOLOGY

Copies of questionnaires were administered on 40 construction/site managers involved in various sizes of construction projects in Akwa Ibom state, Nigeria between 2010 and 2016. 31 respondents (77.50%) returned the questionnaire. The respondents indicated that they were involved in the management of projects of different types and sizes within the stipulated period. This indicates at least a seven-year experience in site and construction management which is an advantage to the study. The questionnaire was evaluated using descriptive statistics and the relative importance index (RII) to determine what the respondents considered important variables in construction site planning for security. Likert scale was used as the scale of measurement. The points were assigned as follows: Very important = 5, Important = 3, Unimportant = 1. The formula used is shown below:

$$RII = \frac{\sum_{j=1}^{5} \mathrm{L}_j \mathrm{n}}{5\mathrm{N}} \quad \text{(Carmichael et al., 2007)}$$

Where $L_j n$ is the product of Likert scale integer j and the number of respondents (n) selecting the integer; 5 is the number of integers on the Likert scale used; and N is the number of the respondent sample size. According to the authors, this formula will always return the same RII for a given proportion of respondents (n) scoring Likert integer (j) for any sample N. The analysis also involved the ranking of the different variables according to the relative importance indices. The range of the values (highest to lowest) for each variable provided a measure of how important the variables were to overall preference. The variables with greater importance ranges played a more significant role than those with smaller values. This revealed the variables that contribute most to construction layout planning for security in the study area. The group index value was used to determine the level of importance. This is the average value of the RII for the group of variables (Badu, et al., 2013; Somiah, Osei-Poku and Aidoo, 2015).

4. SURVEY RESPONSES

4.1. Training in security

The study investigated the respondents' training in security and crime prevention (threat, risk and vulnerability assessment, security planning and physical security) as this was considered important since specialised knowledge is required for effective site planning. 12 respondents representing 38.71% had received training in security while 19 respondents representing 61 29% had no training. The results showed that majority of the respondents were not trained in security affairs and therefore are likely to lack the knowledge of how to plan the site for security. Knowledge is an important resource in planning. Without knowledge aids sound decisions and comprises of data and information needed to conceive, develop, produce and implement an optimal construction site security plan. Relevant knowledge leads to informed site planning. Drukker (2012) posits that

planning is the continuous process of making present entrepreneurial decisions systematically and with best possible knowledge. The implication of the above result is that the construction/project managers will be hampered in effectively planning the construction site for security. Many industry operators claim to be project/construction manager without requisite training. Drawing on specialised knowledge from security experts is an option that can effectively help construction managers to plan the site layout for security.

4.2. The nature of construction site planning

Table 1 shows the results of the assessment of the nature of construction site planning. The objective was to find out how the respondents carry out site planning. Two categories of planning were used as follows: formal (comprehensive site planning as part of construction management and marking of proposed location of facilities on project site plan) and informal planning (location of facilities on ad hoc basis as the project progresses and guessed location of facilities on first come-first served basis). The respondents were also asked to indicate the type of planning in relation to project cost. The results indicated that 22.58% of the respondents on projects with cost above N500 million carry out comprehensive formal planning of the site as part of the construction management programme of the contractor while 77.42% did not. It showed that 29.03% of the respondents used formal methods of marking of proposed location of facilities on project site plan while 70.93% did not. It also revealed that 12.90% used the informal planning method of guessed location of materials on first come – first served basis. This results in a disorganised site as observed by Sadeghpour, Moselhi, and Alkass (2006). Informal planning based on guesswork often lead to materials wrongly placed on site (Zolfagharin and Irizarry, 2014). This could lead to blocked sight lines, hiding places for criminals and to the materials being re-located to more suitable position at additional cost, labour and time. On the other hand, Small and Baqer (2016) affirm that the ad-hoc and first-come approaches are useful in overcoming immediate task-related problems. The result also reveals that the bigger the project the better the planning method.

Table 1: Assessment of the nature of construction site planning

S/N	VARIABLE	YES	NO	PROJECT COST (Million Naira)			
				≤ 100	100 - 500	500 - 1 Billion	>1 Billion
1	Comprehensive site planning as part of project and construction management (Formal planning)	22.58%	77.42%			●	●
2	Use of project site plan to mark proposed location of facilities (Formal planning)	29.03%	70.97%		●	●	●
3	Location of facilities on ad hoc basis as the project progresses (Informal planning)	35.48%	64.52%	●	●		
4	Guessed location of facilities on first come – first served basis (Informal planning)	12.91%	87.09%	●			

4.3. Variables influencing construction site layout planning for security

Table 2 shows the result of the assessment of the level of importance of a group of 15 variables in construction site security layout planning for security. This table provided a degree of the relative importance of each variable known as an importance score or significance in descending order. The group index value was 1.47. The result showed 11 most significant variables. These are: (1) grouped location of facilities, (2) security evaluation, (3) perimeter control measures, (4) access control, (5) positioning of objects for clear lines of sight, (6) strategic site lighting, (7) size of site (8) management security and safety practices, (9) natural and CCTV surveillance, (10) site conditions and constraints, and (11) location of site. Group locations of facilities allow better security control and observation. To achieve clear lines-of-sight it important to create surveillance corridors in the layout design. Harris (2013) and Ebong (2017) affirm that strategic lighting plays an important role in security by creating deterrence and aiding surveillance at night. without sufficient lighting a building and its surroundings can attract criminal activities and become unsafe for legitimate users. This agrees with Zolfagharian and Irizarry (2014) that the size of the site and location (ranked 7 and 10 respectively) are important variables of site layout planning. They drive site logistics decision. The size and location of a project are prime considerations in security evaluation (threat, risks and vulnerability assessments) which is a critical aspect of security planning.

Table 2: Assessment of variables influencing construction layout planning for security

S/N	VARIABLES	RESPONDENTS' RANKING			RANK SUM	RII	RANK ORDER
		5	3	1			
1	Grouped location of temporary facilities, storage areas, materials laydown and work spaces	30	1	0	153	1.65	1
2	Security evaluation (identify security problem, assess threat and site vulnerability, analyse risks)	29	29	0	151	1.62	2
3	Perimeter control measures (fence at site boundary and around materials and storage facilities)	28	3	0	149	1.61	3
4	Access control	27	4	0	147	1.58	4
5	Positioning of objects for clear lines-of-sight	28	2	0	146	1.57	5
6	Strategic site security lighting	28	1	2	145	1.56	6
7	Size of site	26	4	1	143	1.54	7
8	Management security and safety practices	26	3	2	141	1.52	8
9	Natural and CCTV surveillance	24	5	2	140	1.51	9
10	Site conditions and constraints	24	6	1	139	1.49	10
11	Location of site	25	4	2	139	1.49	10
12	Dispersed location of temporary facilities, storage areas, materials laydown and work spaces	20	7	4	124	1.33	11
13	Location of permanent facilities	15	13	3	117	1.26	12
14	Location of parking spaces	20	2	9	115	1.24	13
15	Nature of Project	10	15	6	101	1.09	14

4.3. Considerations for construction site layout planning for security

Based on the study, the following should be taken into consideration when planning a construction site for security: (1) Determine security goals and objectives for the site. (2) Identify potential site security problems. (3) Carry out security evaluations: threat assessment, vulnerability assessment and risk analysis. (4) Determine optimal location of site objects: grouped or dispersed. (5) Determine best method to control access into and exit from site. (6) Determine best method to control the site perimeter. (7) Determine object boundaries and level of control. (8) Determine parking types and their locations. (9) Determine appropriate surveillance measures with clear line-of-sights. (10) Control site circulation: roads and on-site paths. (11) Determine type and best location of security lights. (12) Determine location of security posts.

5. CONCLUSION

Security site layout planning is a very important but neglected aspect of construction projects. As discussed in the paper, construction sites have security and site protection problems that affect the successful outcome of a project. The paper identified the variables that could significantly affect construction site security layout planning. Grouped location of objects on site for ease of security control and observation, security evaluation, perimeter control measures, access control, clear lines-of-sight and lighting ranked higher than others and therefore more important. These and the other variables when properly applied in layout design could help achieve the 7Ds of crime prevention. Insecure site layout design exposes the site and assets to successful criminal operations. Security and the efficiency and effectiveness of labour and materials management for optimum productivity could be compromise by wrong location and placement of materials laydown, plant and equipment, offices and storage facilities and poor access to materials and work areas. Site planning for productivity cannot be completely divorced from that for security. In order to avoid conflict a dynamic, multi-objective site layout plan should relate the location and placement of permanent and temporary facilities to integrate security and productivity considerations into an all-inclusive layout plan.

6. RECOMMENDATIONS

Because of the importance of security and site protection to successfully meeting project objectives the paper recommends the integration of simulation and rule-based design checking models into site layout planning for site security. The use of simulation models allows a clear and overall view of the location of site facilities, road network, utilities, infrastructure, work spaces, plant and equipment and materials laydown areas. Several models have been developed. Chau, Anson and Zhang (2004) developed a 3D model for site space utilisation. This model also incorporates work breakdown structure. Ma, Shen and Zhang (2005) developed a 4D simulation model to address site layout and location for facilities placement. This system takes into consideration work breakdown structure, scheduling, site resources and spaces. The use of artificial intelligence (AI) in site layout planning has been introduced by Elbeltagi and Hegazy (2001).

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

ORIENTATION OF HOTEL ROOM SPACES FOR ENERGY CONSERVATION IN HOT-DRY CLIMATE OF BIRNIN KEBBI, NIGERIA

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ABSTRACT

Purpose: Hotel buildings in the hot-dry climate were observed to be using heavily air conditioning units as a way of maintaining human comfort at desirable levels. This has led to increase in pollution and high electricity bills for the hotel owners. This study is therefore aimed at identifying an ideal room orientation for low energy consumption for hotel buildings in the hot dry climate of Birnin Kebbi.
Design/methodology/approach: The study employed a quasi-experiment approach using Autodesk Ecotect software to simulate a model selected from a typical hotel room grid of 3800mm length x 6000mm width and 3000mm height using Birnin Kebbi data files.
Findings: Results of the simulation show that the South-facing room consume less energy (269kWh/m^2) followed by North-facing (404kWh/m^2) and then the East-facing room layout (481kWh/m^2), while West-facing room layout (489kWh/m^2) having the highest energy consumption.
Originality/value: This research will serve as a guide to designers of hotel buildings trying to minimize energy. Adhering to these guidelines will help to substantially minimize the overall building energy consumption and also help in deciding the best materials suitable for use in remaining room orientations likely to have adverse effect.

Keywords: Building orientation; energy conservation; hot dry climate; severe weather condition.

1. INTRODUCTION

According to Sue et. al, (2009), severe weather conditions in Hot-dry climate which is exacerbated by climate change necessitates new measures in the form of adaptation in order to minimize this impact. To limit the negative consequences of this severe weather on societies, greenhouse gas emissions have to be reduced (mitigation) or humans have to develop ways of adapting to the effects of the Severe Weather conditions (adaptation) (Stephane et. al, 2011). However, these two options have not been given equal consideration as adaptation has long been neglected in the climate change debate

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(Stephane et al, 2011). This imbalance is indicative of the real difficulties inherent in adaptation, like the treatment of uncertainty on the future impacts of climate change or a certain number of methodological problems (Stephane et al, 2011).

Vulnerability to severe weather is considered to be high in developing countries, due to social, economic and environmental factors that amplify susceptibility to negative impacts and contribute to low capacity to cope with and adapt to climate hazards (Neil and Kulkarni, 2007). In addition, projected impacts of climate change are generally more adverse in low latitudes, where most developing countries are located, than in higher latitudes, because of the high level of vulnerability (Neil and Kulkarni, 2007). Thus, there is an urgent need for the developing world to understand the threats of Climate Change so as to formulate policies that will prompt actions that will lessen its risks.

According to the Intergovernmental Panel on Climate Change (IPCC, 2007), the forecasted a probable rise in temperature of between 1.8oC and 6.4oC and a possible rise in temperature of between 1.1oC and 4oC. It also forecasts that sea levels around the world will rise by 18 - 59 cm at the end of the 21 century due to thermal expansion, melting glaciers, ice caps and the polar ice sheets. From the joint study conducted by Climate Research Analysis Group, University of Cape Town, South Africa and the Institute of Ecology and Environmental Studies at Obafemi Awolowo University, Ile-Ife, Nigeria, (2011) the findings suggest a warmer climate in the hot-dry regions of Nigeria in the near future. The strongest scenario projects a temperature increase of 0.04oC per year from now till 2050. With respect to foregoing issues a good building orientation is one of the adaptation strategy that will help in mitigating the severe weather conditions caused by climate change. It is a method of positioning a building in relation to seasonal variations in the sun path as well as prevailing wind patterns, to take advantage of passive and active solar radiations, in order to heat or cool and illuminate the building spaces (Figure 1). The relative position of the sun is a major factor to be considered for reduction of heat gain in buildings. This makes accurate orientation of Buildings as fundamental factor for consideration in passive cooling design and energy conservation.

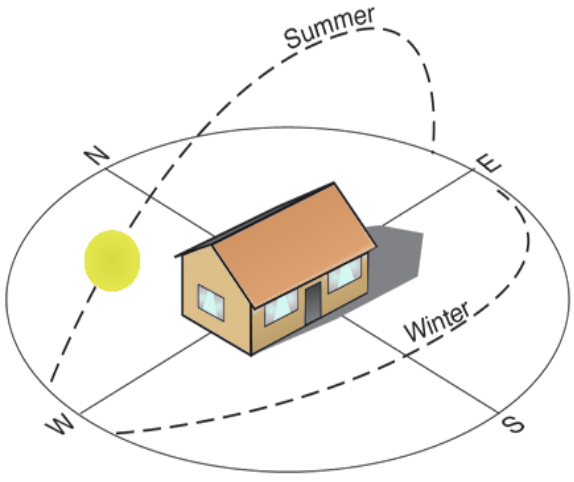


Figure 1: Building orientation in relation to sun path in winter and summer. (Ecowho.com, 2016)

With rising energy costs, it is becoming increasingly important to orient buildings in such a way that solar heat gain is reduced to the minimum in hot-dry climates. Thus, building orientation is a crucial consideration of passive cooling that can be incorporated

into virtually any new home design (echowho.com, 2016). A study conducted by Batagarawa, Musa, and Lawal, (2015), shows that Cooling in hotel buildings accounts for the highest energy consumption with an average of 51% of the total electricity consumed across six (6) hotel buildings within hot-dry and hot humid climate of Northern Nigeria followed by non-lighting appliances with 36% and finally lighting fixtures account for the lowest energy consumption of 13%. Another result by Batagarawa et al; (2015), also show that the average electricity consumed per meter square (m^2) in buildings is approximately 303kWh. Furthermore, epileptic power supply in Nigeria requires hotel building owners to resort to alternative power supply by using backup generators to meet the demand of their customers, this has negative impact on the environment as well as cost of operating of hotels in general (Batagarawa *et al;* 2015), Particularly in North-western Nigeria like Kebbi state.

Cities like Birnin Kebbi located in the northern part of Nigeria are particularly prone to severe weather because of its proximity to desert and increasing agricultural and industrial activities (Blessing, *et al*., 2012). Severe weather conditions in the above named area has caused many building materials to perform well below their intended purpose, hollow sandcrete block construction is among these affected materials, yet it gain popularity due to its structural stability than adobe wall construction (Progress, 2011).

2. REVIEW OF RELATED LITERATURE

The effect of Climate change has affected energy production, delivery and consumption in the World. The Increases in temperature has increase energy demand, as well as changes in the ability to produce electricity and deliver it reliably. Climate change has also caused significant variation in the outdoor/indoor design conditions, cooling and heating loads which impacts design and selection of the cooling equipment (Shahram, Karami and Pasdarshahri, 2010). A report by Wilbanks et al, (2008), shows that if a nation's climate warms by 1.8°F, the demand for energy used for cooling is expected to increase by about 5-20%. Statistics has shown that: 40% of the world energy is being consumed by buildings (World Sustainable Conference, 2008) and as a result, more techniques are required to be put in place that can reduce energy consumption to minimum. This has resulted in the emergence of numerous organizations with a mission to promote sustainability-focused practices in the building and construction industry such as World Green Building Council (WGBC), Intergovernmental Panel on Climate Change (IPCC) and Global Environment Facility (GEF).

Until recent years, energy conservation has been relatively low priority to building owners and investors. However, with dramatic increase in awareness of energy use, energy conservation is fast becoming part of real estate management design and operation strategies (Omer, 2008).

In line with sustainable development goals, it is critical for practitioners to develop sustainable building techniques, especially in climates where so much energy is required for cooling spaces (Monna & Masera, 2013). The analysis of the effect of orientation in the hot dry climate, underline the problem of overheating caused by excessive solar radiation which ‘facilitates’ heat gain and causes discomfort and often associated with heat related diseases in this type of climate (Monna & Masera, 2013).

Figure 2: Movement of heat through walls as result of solar radiation (Solar Energy Environment, 2016)

Birnin Kebbi like other cities within the hot-dry climate of Nigeria, has the problem of hot-dry air and very low relative humidity of less than 20% and a difference in air temperature of average high and average low is between 24ºC – 33 ºC (NIMET, 2012). The average solar radiation, air temperature and relative humidity for Birnin Kebbi is shown in Table 1.

Table 1: Average solar radiation, air temperature and relative humidity for Birnin Kebbi.

Month	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Average Solar radiation Wh/m^2	8580	8326	8205	8028	7802	7816	6785	6165	7037	7845	8485	8266
Min average air temp ºC	16.7	19.1	23.0	25.8	26.5	24.7	23.1	22.3	22.2	21.8	19.1	16.6
Max average air temp ºC	33.1	35.6	38.4	39.7	38.1	35.6	32.5	30.9	32.5	35.6	35.9	33.3
Average air temp ^{O}C (min/max)	24.9	27.3	30.7	32.7	32.3	30.1	27.8	26.6	27.3	28.7	27.5	24.9
Average relative humidity, %	< 20					> 20					< 20	

Source: weather.com, (2017)

The humidity level of Birnin Kebbi ranges from 16% to 40% (NIMET, 2012). Therefore, it is necessary to take adequate measures in designing for this type of climate, especially taking cognizance of orientation of room spaces to avoid overheating, which could result in excessive use of energy for cooling. To achieve thermal comfort in buildings, The American Society for Heating, Refrigerating and Air-conditioning Engineers (ASHRAE, 2015), proposed a suitable quality level for an indoor environment. This is represented in Table 2.

According to BSO (2007), an unventilated air layer is one in which the construction does not allow air flow through the air cavity into the building from the outdoor environment. The ability of a building element to prevent heat gain in to the building interior spaces is described in terms of its thermal transmittance (U-value) which is expressed as the transfer of heat in watts per square meter of area per degree difference in

temperature. Table 3 shows different thickness of air layers in cavity walls with their thermal resistance in different directions of heat flow

Table 2: Indoor environmental quality level according to ASHRAE

Season	Comfort temperature	Comfort temperature range	Relative humidity	Air velocity
Summer	24.5 °C	23 – 26 °C	30 – 65%	0.25 m/s
Winter	22 °C	20 – 23.5 °C		0.15 m/s

Table 3: Thermal resistance (m^2K/W) of unventilated air layers for high emissivity surfaces.

Thickness of air layer mm	Direction of heat flow		
	Upwards	Horizontal	Downward
0	0.00	0.00	0.00
5	0.11	0.11	0.11
7	0.13	0.13	0.13
10	0.15	0.15	0.15
15	0.16	0.17	0.17
25	0.16	0.18	0.19
50	0.16	0.18	0.21
100	0.16	0.18	0.22
300	0.16	0.18	0.23

Source: BSO (2007)

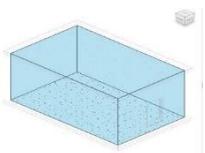
The thickness of a hollow sandcrete block cavity is within the range of 10mm to 100mm which gives a horizontal heat flow range of 0.15 to 0.18 through the air layer (stagnant air), represented in m^2K/W for an unventilated cavity space of sandcrete block.

3. METHODOLOGY

This study uses a hotel room space where a steady energy supply is required throughout the day for the comfort of occupants. It employed a quasi-experimental approach using Autodesk Ecotect software to simulate the effect of hotel room space orientation on energy consumption in a proposed 3D model. The model full description is stated in table 4. It is a single thermal zone.

Table 4: Specimen model description and input data

- Comfort temperature: 20 – 26 ^{O}C
- Thermal zone / Floor area: 3.8m x 6.0m = 22.8 m^2, height: 3m
- Cooling operations: 24 hours.
- Walling: 230mm hollow Sandcrete block wall.
- Relative humidity 50%
- Openings: 0.9mx1.5m single glazed window with aluminium frame
- 0.9mx2.1m wooden panel door
- Floor: suspended conc. Flr.
- Roof: 150mm concrete slab with asphalt.



Each of the four-room layout undergoes the processes of settings, in both zone management and material properties. In the zone management, the rooms were selected as 'zones' while in the material management, each zone is given a material property. Under the material property, the thickness, R-Value and the admittance properties of the walling material is imputed after which the simulation is ran in the Ecotect software which automatically calculates the solar absorption, thermal decrement, thermal lag and the weight of the materials. This process is shown in Figure 3, other data required for this analysis is the location weather file, (Birnin Kebbi weather file) in this case. This helped in determining an accurate result. The calculation is in accordance with BSO (2007) guidelines for calculating thermal resistance and thermal transmittance (shown in Table 3).

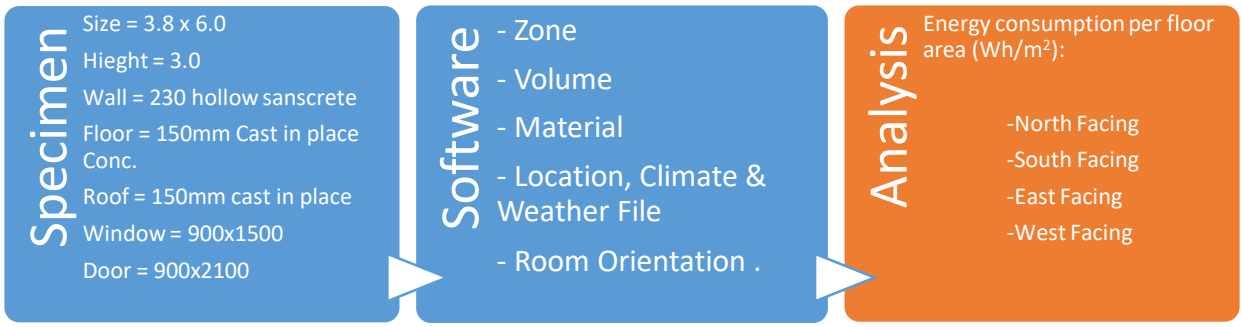


Figure 3: Analysis process / requirements, and results display

4. Results, Analysis and Discussion

The model was developed using Autodesk Revit Architecture with a typical hotel room grid described earlier in Table 4 as a minimum requirement by World Tourism Organization (WTO, 2007). The floor space was tagged and volume and also checked according to specified room height. It is then exported as gbxml format which is a recognizable format for Ecotect software as shown in Figure 4.

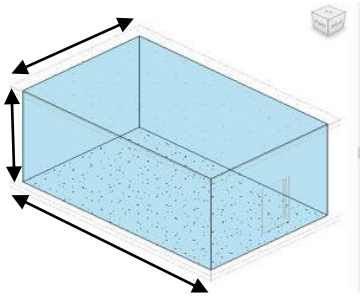


Figure 4: 3D model of a typical room space used for simulation in Autodesk Revit software

4.1. Model description

The room layout is named according to the direction in which its longer side faces on the cardinal points (Figure 5), and finally simulated using Autodesk Ecotect software; four orientation layouts were simulated:

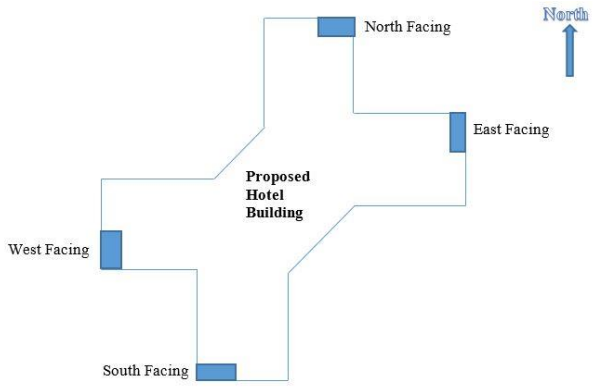


Figure 5: Room layout position on the proposed building prior to determining room orientation that consumes more energy

North facing room, South facing room, East facing room and West facing room. The solar radiation study performed in the Autodesk Ecotect software provided an early indication of the spaces optimal orientation with respect to the sun. The results show that the South-facing room layout consumes less energy followed by the North-facing. East facing room layout and West-facing consume more energy than the other two layouts. The South-facing has the total annual energy consumption of 268.53kWh; West-facing layout has 489kWh; North-facing has 404kWh as its annual consumption, and lastly East-facing layout has 481kWh as shown in Figure 6.

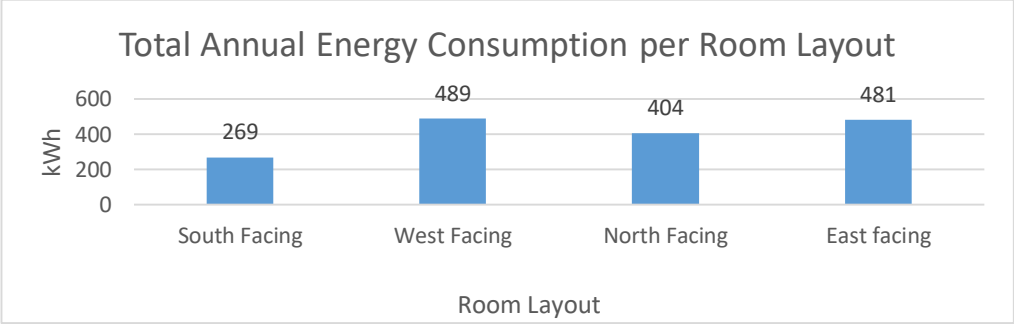


Figure 6: Determining the room layout that consumes less energy, south facing exhibits lower consumption than other room layout

Plotting the monthly comfort/discomfort chart further displays the monthly energy consumption pattern. South-facing layout recorded the lowest monthly consumption with its highest energy consumption recorded in the month of March as 435kWh/m^2 and the lowest is the month of September as 86kWh/m^2.

West-facing layout recorded the highest monthly consumption of all the four layouts: with the peak consumption of 687kWh/m^2 in the month of March and 198kWh/m^2 in August. East-facing layout is next to West-facing layout with 589kWh/m^2 in the month of March and 151kWh/m^2 in September. North-facing layout exhibits similar pattern with the south-facing layout where its peak consumption is 681kWh/m^2 during the month of March

and 196kWh/m^2 in September. See Figure 7.

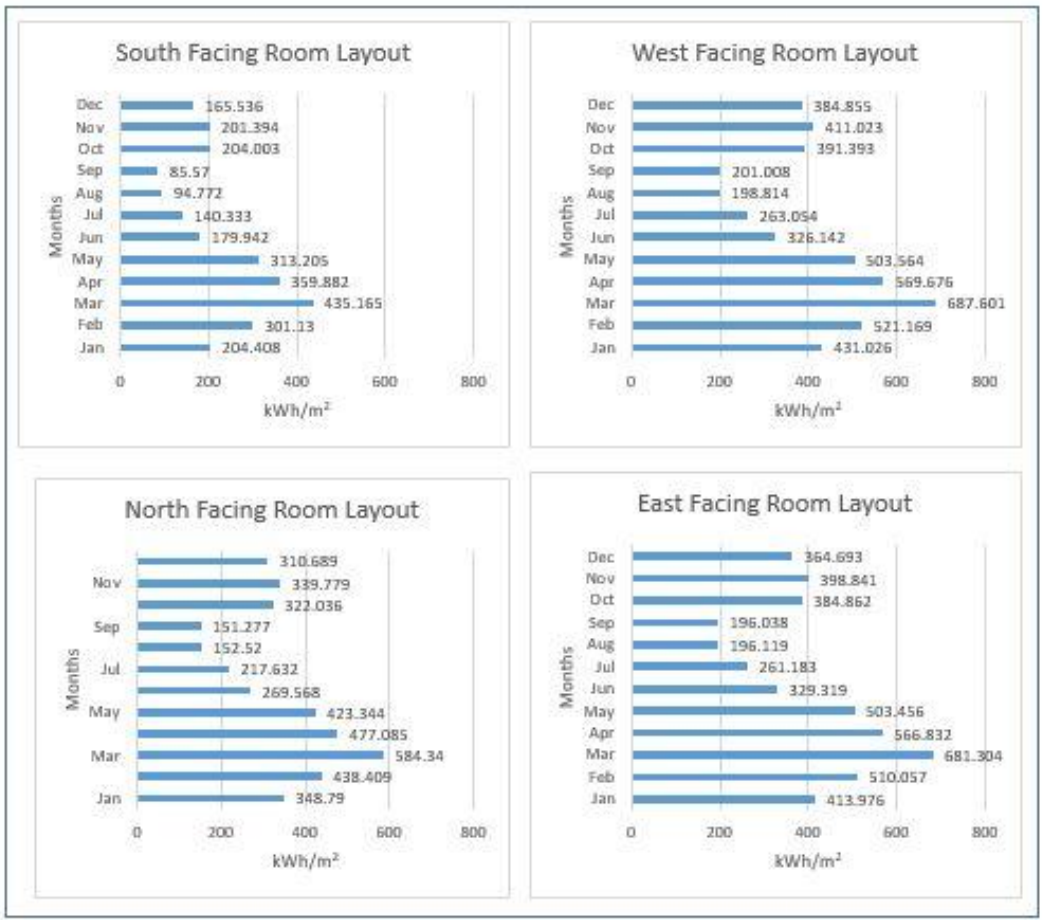


Figure 7: Monthly consumption pattern across the four room layouts

The results show that, there is a potential energy saving in orienting hotel rooms space when the longer side faces towards south direction, it will increase energy conservation up to 14.2%. When compared with the study conducted by Batagarawa *et. al.*, (2015), this recorded an average of 260.4KW within the range of 85.57kWh/m2 to 435.2kWh/m2 therefore considering this layout in the design of hotel rooms would enhance both energy conservation and cost of fixing and maintaining of mechanical air conditioning system, thereby minimizing emissions of Green House Gases (GHG) to the environment.

5. CONCLUSION

The paper presents result for ideal room orientation for low energy conservation in hotel buildings in the hot-dry climate of Birnin Kebbi. The study identified the ideal layout for energy conservation, by testing different orientation of four room spaces along the cardinal points. The research has suggested that orienting a room space along south-facing layout in hotel design will provide a potential energy savings in energy consumption of up to 14.2%. The South-facing room layout consumes less, followed by the North-facing, then East-facing room layout with West-facing room layout having the highest energy consumption. This serve as a guide to designers of hotel buildings trying to minimize energy consumption. The study is able to conclude that proper orientation of hotel room spaces

with South-facing layout will greatly reduce energy consumption, so long as it is to be sited within the hot-dry climatic region of Nigeria.

6. RECOMMENDATIONS

Hotels as an enterprise organization mainly for profit making, anything that can lead to profit loss need to be avoided, energy consumption by the use of electric energy for comfort within the building under study (Hotel) may affect the profit gain. In order to avoid foregoing issues, the study recommends as follows: The Government is advised to hasten the process of actualizing Green Building Council (GBC) in the country, this can go in-line with global environmental sustainability; Architects should lay more emphasis on hotel building orientation to avoid high energy consumption, specifically longer sides of the hotel room spaces should face southern direction as much as possible.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

IMPACT OF OIL AND GAS EXPLORATION ON PHASE II OF THE BUILDING LIFE CYCLE

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ABSTRACT

Purpose: The study was design to assess impact of oil and gas exploration on phase II of the building cycle with particular reference on the three oil producing communities of Akwa Ibom State- Estern Obolo, Ikot Abasi and Ibeno. The research became necessary because oil and gas exploration has greatly affected buildings and environment in the region. Nigeria as a nation is blessed with abundant natural resources and crude oil contributes about 80% to Nigeria's government revenue. However, oil exploration, despite its contribution to government revenue, has some consequential environmental implications on buildings and environment of the host communities.

Design/methodology/approach: For the purpose of collecting data, a survey research design involving observation and assessment of structures was adopted for the research. A five point Likert scale was used in assessing building conditions using structural and environmental indicators as drawn from literature. A numeric figure of Very Poor =1, Poor =2, Partially Good =3, Good =4 and Very good=5. The assessment was carried out on buildings that are within 1m radius of the oil exploration site which thus constitute the population of the study. The buildings were further categorized into residential and commercial buildings. The sample size was drawn using 50% of the total building within the study area. The relative important index method was used in the study to determine perception of the level of impact of oil exploration on building.

Findings: The study reveals that there is a strong impact between emissions from the flare and buildings. Oil spillage and gas flaring are the causes of attendant problems the people of the area and that the most visible consequences of oil and gas exploration on buildings was corrosion of roof tops which resulted in changes in colour of roof tops and leakage of roof tops. This is caused by emissions of SO_2, NO_2 and PM_{10} during gas flaring and oil spillage.

Originality/value: The findings from the study would serve as a useful tool not only to make informed decision on how to mitigate air pollution levels among the local population, but also justify the need for further research on the growing problem of oil and gas spillage and flaring in the oil and gas producing areas in the Niger Delta Region of Nigeria.

Keywords: Environmental pollution; oil spillage; gas flaring; building life cycle.

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1. INTRODUCTION

The Niger Delta Region of Nigeria is a resource rich- environment which produces 95% of the GNP of the Nigerian nation. However, the region has witnessed industrial pollution due to oil exploration activities and the inadvertent discharge of petroleum hydrocarbon into the environment has posed threats to buildings in terms of life cycle performance due to concrete loosening its strength as a result of contamination of sand and water used in building production in the oil and gas producing areas (Snowden and Ekweozor, 2002). The discovery and extraction of oil and gas world over has contributed to ecological degradation and environmental pollution, which have adversely affected the quality of life in these regions (UNDP, 2006). These ecological problems range from environmental pollution, gas flaring, competition for space, urbanization, climate and ecological changes. The most worrisome aspect is that constructed buildings which was to serve as a cover against the physical attack from the environment is now a bane as a result of unfriendly exploration of natural resources. Houses with zinc roof that are close to the location of the flare stack do not last for two years compared to houses outside the flared locations. This is why Bassey, (2000) posited that the zinc corrosion has added another dimension to the increasing socio-economic cost to the burden of the Niger-Delta people.

Performance of concrete structural frame building life cycle is classified into three main phases according to BS EN 15804 (2012). Phase 1 takes into account aspects and impacts related to product manufacture and building construction (on-site construction). Phase II includes aspects and impacts arising from the maintenance and repair of the building structure. Phase III of the life cycle encompasses end of life and corresponding destination of disassembled or demolished material. During building construction, the developers take into consideration standards as enshrined in the building code, architectural designs and specifications, environmental and other physical quality in order to maintain quality construction that is sustainable. However, during maintenance and repairs, the developers neglect certain environmental requirement which make the quality of construction below acceptable standard. The most worrisome aspect is that major stakeholders like Architect, planning agency, project managers are sidelined during maintenance and repairs of buildings which the result is poor quality of work. Usually, in such buildings there are applicability mistakes as a result of lack of knowledge, poor quality of construction work due to inexperience labourers. This study, therefore, seeks to investigate the Phase II (aspects and impact arising from the maintenance and repair of the building structure using its indicators and assessing how oil and gas exploration activities have affected the performance of building in the study area. This is sequel to the observation by Abolore (2012) that, unsustainable development has been attributed to poverty, inequalities, discrimination and socio-cultural exclusion, insecurity, human rights, abuse, corruption as well as environmental disaster and inappropriate resource management.

2. REVIEW OF RELATED LITERATURE

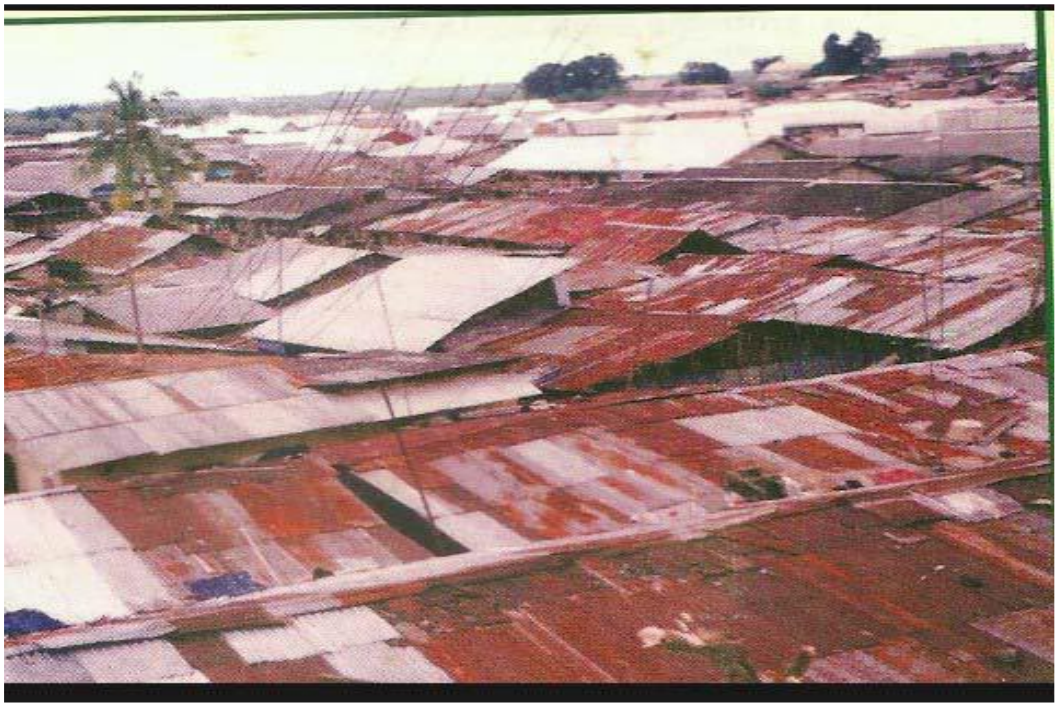
The Niger Delta ecosystem is under threat from pollutants generated by a multiplicity of oil and gas related installations, including flow stations, oil well heads loading terminals and tank farms (Egborge et al, 1986; Onwudinjo, 1990). Similarly, Eteng 1997, has argued that, ‘oil exploration/exploitation has over the last forty years (40) impacted negatively on

the socio-physical environment of the Niger Delta oil bearing communities, massively threatening the subsistent peasant economy, the environment and hence the entire livelihood and basic survival of the people. Jimoh and Aghalino (2000), concurred to the report of UNDP (2006), which asserts that 'the Niger Delta is a region suffering from administrative neglect, crumbing social infrastructure and services, high unemployment, social deprivation, abject poverty, filth and squalor and endemic conflict. The most profound and adverse impact of oil pollution in the Niger Delta with far-reaching implications on all other aspects of our traditional lifestyles and livelihoods, had been the total loss of biodiversity and destruction of the Ecosystem and its habitats largely due to soil degradation. The results of the unchecked oil pollution have been the complete destruction of ecosystems. This is why Bisina, (2004) agreed with Idumu, (2008) by asserting that the effects of oil on the Niger Delta community is very detrimental to human life as it has affected their main source of livelihood. It has further corroborated what Essien (2005), said that the oil producing area has largely become a cynosure because of widespread social unrest generated by neglect, environmental degradation and mindless spoliation among others. Moller (2005) also agreed that social unrest and pervasive youth restiveness in the area is the result of soil degradation, environmental pollution, water contamination, inequality in resource allocation and deliberates under development spanning over three decades

The impact of pollution is felt on human health, environment and ecosystem. Studies have shown that the rise of certain ailment that were previously unknown in the area is as a result poorly managed ecosystem. According to the report made by Bassey, (2002) that Multinational Company operating in Niger Delta flare more gas than their counterpart in other climes which has contributed to the several ailments witnessed in the area. This confirms the assertion that many residents within the oil exploration area complain of asthma, breathing difficulties, headaches, nausea, and throat irritation as well as chronic bronchitis (Amaize, 2012).

Another impact of oil pollution is the rapidity of which zinc roofs are easily corroded. This is a common trend that is observed in the parts of the Niger Delta where oil extraction is presently taking place. Houses with zinc roofs that are close to the location of the flare stacks do not last for two years before they become corroded. This is different from other areas where zinc roofs last for at least ten years. This is why Essien, (2002) posited that the corroded Zincs added another dimension to the increasing socio-economic costs to the burden of the people of the area. It is a common knowledge that acid rain oxidizes zinc through the process of oxidation to form zinc oxides. This oxidation process is responsible for the corrosion which has led homeowners to resort to roofing their houses with expensive asbestos as an alternative of abating potential health hazards. Corrugated roofs in the oil and gas producing communities have been corroded by the composition of the rain that falls as a result of oil and gas exploration (Gbadegesin, 2000). The primary causes of acid rain are emissions of (SO2) and (NO) which combined with atmospheric moisture to form sulfuric acid respectively. Size and environmental philosophy in the industry have very strong positive impact on the oil and gas exploration related CO2 emission (Amadi and Tamuno, 2001).

Acid rain acidifies lakes and streams and damages buildings (mostly roofing materials). In addition, acid rain accelerates the decay of building materials and paints. Prior to falling to the earth, SO2 and NO2 gases and their particulate matter derivatives, sulfates and nitrates, contribute to visibility degradation and harm building structures. This will late manifest in corrosion of roofs tops (changes in the colour of roofing materials), leakage of roofs tops, etc. due to toxic properties associated with oil and gas exploration.



P**late 1**: Rusted zinc roofs in atabrikang community in Ibeno local government area of Akwa Ibom State

2.1. The concept of building life cycle

Building life cycle refers to entire course of a building which takes into cognizance the design, construction, operation, demolition and waste treatment (Kotaji, 2003). It is useful to use this concept when attempting to improve operational feature of a building which is related to how a building was designed. The life cycle of a building begins with the Product Phase where raw materials are obtained and transported to factories for manufacturing. Secondly, all construction products (including admixtures, formwork, etc) are transported or distributed and end up at the building site. At the construction phase, all installations are undertaken onsite (Bengt, 2003).

At the third stage, it is known as Use Phase where maintenance, repair, replacement and refurbishment involving periodic site activities and replacement of components are done (these stage usually instigate more extracting, transporting and manufacturing). .

Fourthly, there are the on-site activities to demolish the building, process all waste, and transport them to where it will be reused, incinerated, or disposed into a landfill. This is the 'end of life' phase. All of the waste generated during transporting, manufacturing, constructing and replacing components must also be managed. (Bengt, 2003).

Figure 1 is life cycle assessment and analysis as well as their potential uses help construction professionals make environmentally friendly decisions. The life cycle assessment recognizes that all stages from raw materials extraction to waste management have environmental and economic impacts. It is a tool which assesses the environmental aspects and potential impacts associated with a product or service. Life cycle assessment can be applied to the environmental life cycle of buildings

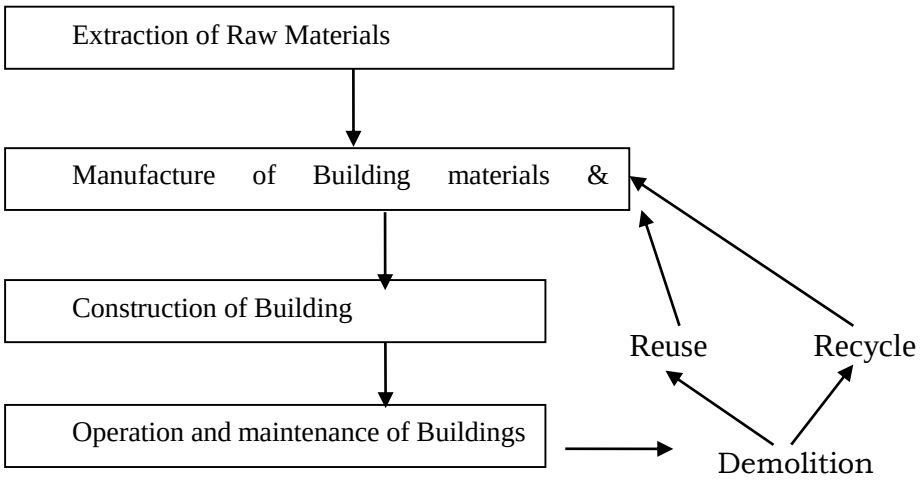


Figure1: Environmental Life Cycle of a Building
Source: www.esru.strath.ac.uk/EandE/web accessed February, 2019

3. RESEARCH METHODOLOGY

To collect data, a survey research design involving observation and assessment of structures was adopted for the research. A five point likert scale was used in assessing building conditions using structural and environmental indicators as drawn from literature. A numeric figure of Very Poor =1, Poor =2, Partially Good =3, Good =4 and Very good=5. In this work, Phase II of the building cycles represents rehabilitation. To investigate the Phase II (aspects and impact arising from the maintenance and repair of the building structure) eight Structural indicators and nine environmental indicators were assessed to ascertain the performance of building in oil and gas environment.

The assessment was carried out on buildings that are within 1m radius of the oil exploration site which thus constitute the population of the study. The buildings were further categorized into residential and commercial buildings. The sample size was drawn using 50% of the total building within the study area. At Eastern Obolo Local Government Area, 43 buildings were identified as residential while 28 were commercial. In Ikot Abasi Local Government 45 buildings were identified and categorized into residential while 15 buildings were categorized into commercial. In Ibeno Local Government Areas 57 buildings were identified and categorized into residential and 18 building was categorized into commercial. The sample size was drawn using 50% from the population of buildings as shown in Table 1.

Table 1: Sample size

	Sample Size		
Study Area	**Residential**	**Commercial**	**Total**
Eastern Obolo	22	14	36
Ikot Abasi	23	8	31
Ibeno	28	9	37
Total	73	31	104

Data on perception of impact of oil exploration on building using structural and environmental indicators were measured on five-point Likert scale namely Very Poor =1, Poor =2, Partially good =3, Good =4 and Very Good =5. The relative important index

method was used in the study to determine perception of the level of impact of oil exploration on building in line with the formula used by Ugwu and Haupt, (2007) and Enshassi, Mohamed and Abushaban (2009) as shown in equation 1

$$RII = \frac{\sum W}{\text{A x N}} \quad \text{……. (1)}$$

Where W is the weight given to each variable by the respondents and ranges from 1-5; A- the highest weight =5; N – the total number of respondents. The RII were then classified as 0-0.359 Very Strong Impact (VHI); 0.36- 0.529 Strong Impact (HI); 0.53-0.679 Moderate Impact (MI); 0.68-0.839 Low Impact (LI) and 0.84 – 1.0 Very Low Impact (VLI).

4. DATA ANALYSIS AND DISCUSSION

Table 2 examines the characteristics of buildings assessed which shows that buildings within the 1m radius were identified and categorized into residential and commercial buildings. However, a total of 73 buildings were residential representing a percentage of 70.2 while commercial were 31 representing 29.8% .it can be deduced that there are more residential buildings located within the oil producing site. The increase in residential buildings is predicated on the demand for housing close to production site. It can also be an opportunity for prospective land owners to reap the economics of scale were they build more residential houses as there will be likelihood of oil producing staff living close to the exploration site. Ages of building ranges from less than 5years, 6-15years and more than 16years. The survey indicates that 19 respondents representing 18.3% renovate their building every 5 years, 41 respondents representing 39.4% renovate their buildings every 6-15 years while 44 respondents representing 42.3% renovate their buildings after 16 years. The materials used for roofing as observed indicates that zinc materials were mostly used as roofing materials in the study area. The study indicates that 51 respondents representing 49% used Zinc as roofing materials. Aluminum comes second with 35, representing 33.7%, Asbestos is third with 12, representing 11.5% and Thatch roof came last with only 6, representing 5.8%.

Table 2: Characteristics of buildings assessed

Characteristics of Respondents	Sub Characteristics	Frequency	%
Nature of Building	Residential	73	70.2
	Commercial	31	29.8
	Total	104	100
Age of Building	>5years	19	18.3
	6-15 years	41	39.4
	>16years	44	42.3
	Total	104	100
Material used	Zinc	51	49.0
	Aluminium	35	33.7
	Abestos	12	11.5
	Thatch	6	5.8
	Total	104	100

For the purpose of assessing the impact of oil and gas exploration on building, eight structural indicators and nine environmental indicators were identified from literature and used for assessment to ascertain the conditions of buildings within this locale as shown in Table 3. The result in Table 3breveals that nature of road, drainage, environmental aesthetics and pollution recorded very strong impact which implies that the activities of oil and gas exploration had affected the operation and condition of these facilities. This therefore corroborates what Afinotan & Ojakorotu (2009), rightly asserted that "obtuse neglect by successive governments and massive degradation in the region, occasioned by oil production and export activities contributes to the bane of the oil producing communities. The multinationals companies operating in these regions repatriate natural resources of the region with their allies to the detriment of the environment and its people. This is why Jimoh and Aghalino (2000), concurred to the report of UNDP (2006), that 'the oil producing communities are region suffering from administrative neglect, crumbing social infrastructure and services, high unemployment, social deprivation, abject poverty, filth and squalor and endemic conflict. This development has produced significant and far-reaching consequences in which industrial establishments and their staff has been the target of restive youth. It is therefore pertinent for oil producing companies to reducing gas emission and provides infrastructures that will better the lots of the citizenry.

Table 3: Perceptive assessment of the impact of oil and gas exploration on building

	N = 104							
Indicators	**1**	**2**	**3**	**4**	**5**	**Sum**	**R.I**	**Rank**
Structural								
Roof (leakage, colouring)	37	54	54	48	50	243	0.47	7th
Wall (weathering, cracks, colouring)	34	46	42	72	70	264	0.51	5th
Foundation (exposed)	16	36	69	68	150	339	0.65	4th
Beams	11	54	54	80	140	347	0.67	2nd
Columns	12	56	114	48	120	350	0.67	2nd
Facial board	38	56	33	56	65	248	0.48	6th
Floor finishing	9	36	93	96	110	344	0.66	3rd
Ceiling (caved)	19	52	87	72	60	290	0.56	5th
Environmental								
Nature of road	47	74	48	8	10	187	0.36	10th
Drainage	58	66	24	12	10	170	0.33	11th
Toilet facilities	32	54	48	44	90	268	0.51	5th
Public Sanitation	49	44	24	68	40	225	0.43	8th
Waste disposal	36	44	45	56	85	266	0.51	5th
Environmental aesthetics	53	66	24	20	25	188	0.36	10th
Air quality	47	52	48	32	35	214	0.41	9th
Water quality	12	28	63	96	165	364	0.70	1st
Pollution reduction	79	24	9	20	15	147	0.28	11th

The second indicators had high impact which includes roof, wall, facia board, toilet facilities, public sanitation and waste disposal which suggests that the activities of oil and gas affected the performance and state of these indicators. To a greater extent, the environment of the region is not healthy as emission of flare stack stares residents in the

face. However, inhaling these emissions have serious health challenges on the resident of the region which confirms the assertion made by Amazi, (2012) that many residents within the oil exploration area complain of asthma, breathing difficulties, headaches, nausea, and throat irritation as well as chronic bronchitis. As opined by Essien, (2002) that houses with zinc roofs that are close to the location of the flare stacks do not last for two years before they become corroded. The corroded zinc makes the area an eye saw and further increase the socio-economic burdens of the residents. This is the situation of the study area which most houses are mostly corroded due to the exploration

5. CONCLUSION AND RECOMMENDATIONS

This study has assessed the impact of oil and gas exploration on building life-cycle in oil producing areas of Eastern Obolo, Ikot Abasi and Ibeno Local Government Areas. From the study, it is seen that oil and gas exploration has grave effects on the life span of buildings and environment especially in the area of study. The study has also revealed that life cycle assessment recognizes that all stages from raw materials extraction to waste management have environmental and economic impacts.

Results revealed a strong impact between emissions from the flare and buildings. Oil spillage and gas flaring are the causes of attendant problems the people of the area are facing which ranges from environmental degradation, oil conflict. The situation is worsened by the lack of commitment in rectifying the anomaly

The results showed that most houses located within the flare stack do not last for two years before becoming corroded. This is perhaps the most visible consequences of oil and gas exploration on buildings which usually result in changes in colour of roof tops and leakage of roof tops. This is caused by emissions of SO2, NO2 and PM10 during gas flaring and oil spillage.

The result obtained in this study would serve as a useful tool not only to informed decision on how to mitigate air pollution levels among the local population, but also to justify the need for further research on the growing problem of oil and gas spillage and flaring in the oil and gas producing areas in the Niger Delta Region of Nigeria.

Based on the study, it is recommended that:

- Special courts or tribunals should be set up to adjudicate on environmental disputes arising from the activities of oil and gas companies and its effects in the environment (buildings).
- Special attention and special rehabilitation measures should be carried out frequently in the host communities to check the negatives effect.
- The Nigerian Oil and Gas Emergency Response Agency (NOERA) should be empowered by the Federal Government of Nigeria financially so that the core mandate of ensuring pollution free oil producing areas of the Niger Delta can be achieved.
- Promotion of environmental awareness and consciousness not only amongst the oil operators but in the general public through the organization of the Biennial Seminar on the Petroleum Industry and the Nigerian Environment should be encouraged.
- Oil Operators in the region should adopt and promote the use of existing environmentally friendly technologies as recommended by World Environmental Safety Standard.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

APPRAISAL OF DISPUTE RESOLUTION STRATEGIES FOR CONSTRUCTION PROJECTS IN NIGERIA

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ABSTRACT

Purpose: The study evaluated dispute resolution approaches for construction disputes with a view towards exploring their applicability and effectiveness in achieving a long lasting resolution for construction disputes in Nigeria.
Design/methodology/approach: An exploratory questionnaire survey approach was adopted in which 55 valid responses were received from 120 target respondents which included Builders, Architects, Quantity Surveyors, and Engineers. This gave an overall response rate of 46%. Data collected were analysed using frequency counts, mean score, standard deviation and Mann Whitney U test.
Findings: Findings reveal that poor communication and interpersonal skills, delay in payment, and poor workmanship in that order were the three top rated factors responsible for disputes in the construction industry; while cultural differences, project uncertainty, and error in contract documents were the least three rated factors in that order. Additionally, negotiation, mediation, and adjudication were the three most effective strategies for resolving disputes in the industry.
Research limitations/implications: This study had one obvious limitation. It was carried out in two cities rather than the whole country. Although, it can be generalised to other parts of the country, it may only serve as triangulation to studies in other parts of the globe.
Practical implications: The study recommended that mutual trust and understanding among all project participants at all project stages should be encouraged to create a forum for resolving conflicts at an early stage. The study notes that with increasing complexity of construction projects in Nigeria, disputes occur as a result of factors identified. However, there are very effective dispute resolution strategies or mechanisms for those construction disputes.
Originality/value: The study established key factors responsible for disputes in the Nigerian construction industry and level of effectiveness of strategies for resolving conflicts in the construction industry from Nigeria's perspective.

Keywords: Conflicts; Nigeria; project management; resolution approaches.

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1. INTRODUCTION

Construction contracts have been marred by disputes and these have taken a toll on time, efforts, and human resources. The success of a building project depends on a number of variables; one of which is the way the building team approach disputes on the project. Construction contracts contain a set of conditions, organisational and logistic efforts that attempt to cover all unforeseen occurrences and ambiguities that may lead to disagreement or disputes during a construction project, yet not all eventualities are prepared for in the original contract. Disputes are therefore likely to arise under the best circumstances, even where every possibility has been potentially eliminated (Maggi and Staiger, 2015). Construction process is a function of many interwoven and complimenting variables resulting in a large and complex contractual framework. Complex construction can likewise often result in contractual ambiguities giving rise to complex disputes. According to Williamson (2007), all complex contracts are unavoidable and do not necessarily provide sufficient contingencies for events that may happen in the course of contract execution. The author argued that notion of incomplete contracts suggests that when circumstances arise which are not accounted for in the original agreement, individuals will need to negotiate revised terms which address the newly uncovered contingency. These renegotiations may lead to calculated effort by one party to take advantage of the vulnerabilities of the other's trading partner in the hopes of achieving a more favourable bargain that could lead into disputes.

The concept of Alternative Dispute Resolution (ADR) which many see as alternative to the traditional court-based system is used to describe the use of a third party to assist parties to a conflict in arriving at a voluntary, consensual, negotiated settlement (Gould, 1998). According to Raji, Mohamed, and Oseni (2015), its entry into Nigerian construction industry can be traced to the provisions for dispute resolution processes as provided for under the Constitution of the Federal Republic of Nigeria, 1990 (as amended) and the Arbitration and Conciliation Act 1990 (now Arbitration and Conciliation Act Cap A18 Laws of Federation of Nigeria (LFN, 2004 as amended). Be that as it may, and despite the availability of dispute resolution mechanism as enshrined in the constitution of Nigeria, majority of construction projects in Nigeria have ended in disputes severing parties' cordial relationship painstakingly built up over a period of time and have equally impacted the supply chain and substantially adding to the cost of contracts (Ogunsanmi, 2013).

Although several works (Aniekwu, 1995; Adams, 1997; Ogunsemi and Aje, 2006; Oyesola and Odeku, 2014) have all established the need for dispute resolution in Nigeria, very little exists on empirical diagnosis of factors responsible within the Nigerian construction industry as well as effectiveness of dispute resolution strategies for construction disputes. This is the intent of this study. The aim of this study is therefore to evaluate the existing dispute resolution approaches available for construction disputes with a view towards exploring their applicability and effectiveness in achieving a long lasting resolution for construction disputes in Nigeria. The specific research objectives are to: (1) assess factors responsible for disputes within the construction industry; and (2) examine effectiveness of dispute resolution strategies for construction disputes in Nigeria.

2. REVIEW OF RELATED LITERATURE

2.1 The Nigerian construction industry

The economic performance of any nation can be rated by the provision of basic infrastructure through its construction industry. For most developing economies like Nigeria, the construction industry has been a major contributor to the nation's gross domestic products (GDP) providing infrastructure that drives the economy and jobs for the teeming populace. Its dominance in Nigeria's economy from post- independence years of 1960s to 1980s contributing over 70% to GDP (Planning Committee on the Nigerian Construction Policy, 1989) made it one of the nation's strategic assets in national development (Oladapo and Onabanjo, 2009). However, its contribution to GDP has remained consistently low shrinking from 5.8% in 1981 to a mere 1.4% in 2011 (VETIVA, 2011) resulting in low productivity, job loss, and poor performance. Moreso, it is reported that more than 70% of construction projects executed in Nigeria suffers from cost and time overruns irrespective of whether the client is private or public and regardless of the project size (Oke and Ogunsami, 2011). Clearly these had ultimately induced low satisfaction rates among clients and concerned stakeholders and exacerbated cases of disputes in the industry.

2.2 Causes of disputes in construction industry

The term "conflict" and "dispute" have been used interchangeably in the literature. However, it needs to be pointed out that they are two distinct concepts. According to Kumaraswamy (1997), conflict is a serious disagreement between two or more parties. It can however be prevented from degenerating into dispute which is characterised by protracted disagreements or unsettled claims. From the perspective of the construction industry, Kilian and Gibson argued that dispute is seen as a problem or disagreement between the parties that cannot be resolved by on-site construction project managers. The emphasis on 'jobsite' or 'on-site' carries the inherent assumption that disputes firstly are seen as occurring on site then escalating upwards through the organisational hierarchy.

Many authors have examined the causes of dispute in construction projects execution. Mitropoulos and Howell (2001) stated that contractual dispute stem from a combination of uncertainty and the limited ability of people to think and communicate. They suggested that, there are three basic factors that drive the development of disputes. First is the high degree of uncertainty arising from complexity of projects, second are imperfect contracts, and third is the opportunistic behaviour of many parties who try to take advantage of one another in the competitive market place. The study by Diekmann, Girald, and Abdul-Hadi (1994) outlined three groups of factors responsible for disputes in the industry. The first comprises project uncertainty, uncertainty arising from pre-existing conditions, outside forces and their complexities, which cause change beyond the parties' expectations. The second which are process problems include problems in the contracting process including incomplete scope definitions, unrealistic operations (with regard to cost or completion date) and poor performance in the execution of work. The third is peoples' issues and comprise issues and problems that arise between people as a result of poor interpersonal skills, poor communications, lack of responsiveness and unethical or opportunist behaviour. Agu (2012) had argued that disputes can be to be traced to failure of one of the parties to a contract, one of the professional advisers or some other party connected with the contract to do their work efficiently, to express themselves clearly or to understand the full

implication of instructions issued or received by them. Against this background, it is perhaps unfortunate to argue construction related disputes exacerbated by projects disruptions and delays have brought unimaginable cost and negative impact to the nation's economy.

Other factors responsible for disputes in the construction industry include; variations problems, negligence in tort, and delays (Semple, Hartman, and Jergas,1994); contract terms, payments, variations, extension of time, nominations, and availability of information (Heath, Hills, and Berry, 1994); poor management, poor communication, inadequate design, unrealistic tendering, adversarial culture, and inadequate contract drafting (Rhys Jones, 1994). Others are unrealistic expectations, ambiguous contract documents, poor communication, lack of team spirit, and failure to deal with changes and unexpected conditions (Bristow and Vassilopoulos, 1995).

2.3 Classification of dispute resolution strategies

ADR involves methods of resolving disputes other than litigation. It a non-binding process beneficial for the disputing participants and the industry because they produce acceptable results in a cost efficient and timely manner. A number of ADR strategies are found in the literature. Below is a briefly review of some of them.

2.3.1 Negotiation

Negotiation is one of the most common forms of dispute resolution. Fisher and Ury (1991) define negotiation as a basic means of getting what you want from others. It is a back and forth communication designed to reach an agreement when you and the other side have some interest that are shared and others that are opposed. Finlay (1998) states that direct negotiation is the original, most cost effective and most reliable form of dispute resolution. Fisher and Loraleigh, (1990) maintained that negotiation would be the first port of call when a dispute occurs. Additionally, Blake, Browne and Sime (2012) opined that the process is nonbinding unless the participants produce a legally binding contract at the conclusion of the negotiation. However, negotiation needs no intervention unless the dispute is escalated to other dispute resolution processes. Direct negotiation between parties without third party assistance allows the disputants to retain their privacy and independence. Agu (2012) emphasized that the success of negotiation depends on interpersonal communication skills of the parties during the entire process. Additionally, negotiation may not be the ideal process where parties are displaying hostility between each other as it has the ability to amplify differences and confrontation. If a negotiation collapse, the next stage would be mediation (Fisher and Loraleigh, 1990).

2.3.2 Conciliation

According to the Administrative Appeals Tribunal (AAT) (2018), Conciliation is a process in which the parties to a dispute, with the assistance of a tribunal member, officer of the tribunal or another person appointed by the tribunal (the conciliator), identify the disputed issues, develop options, consider alternatives and endeavour to reach an agreement. In other words, the conciliator is the organiser but gets the disputants to agree on a procedure for conciliation. According to Agarwal (2001), conciliation is a process similar to mediation except that the conciliator can express an opinion on the merits of the case and is required to recommend a solution if the parties fail to agree. The process is likened to mediation and in some instances the definitions of both can be used comparably

with each other. However as with both process the third party (conciliator) does not make a binding decision. In the construction industry, the scope of conciliation is also much broader than mediation as the conciliator does not necessarily meet together with the disputing parties, and can provide the likely solution or advice through private conferencing (Fenn, Lowe, and Speck, 1997).

2.3.3 Mediation

According to Gould (2004), mediation is a "private, informal process in which parties are assisted by one or more neutral third parties in their efforts towards settlement" According to him, a further important factor is that the mediator does not decide the outcome; settlement lies ultimately with the parties. The author asserted that the mediator tries to reopen communication between parties and explores options for settlement. The mediator does not openly express his or her opinions on issues. Corroborating this, Folberg and Taylor (2003) had earlier opined that mediation is the process by which the participants, together with the assistance of a neutral person or persons, systematically isolate disputed issues in order to develop options, consider alternatives, and reach a consensual settlement that will accommodate their needs. However, if on the other hand, the mediator is called upon to state his or her opinion on any particular issue then he/she is clearly making an evaluation of that issue. The mediator is trained to help people settle conflicts collaboratively and has no decision-making power. The mediation takes place in a private, informal setting with a non-confrontational atmosphere. The dispute is settled only if all the parties agree to the settlement. In other words, mediation, offers a third neutral party the opportunity to facilitate negotiation between the disputants. If a settlement cannot be reached between the parties, the mediator provides his or her written, reasoned opinion.

2.3.4 Mini-trial

According to Edelman (1989), a Mini-Trial is a judicially-supervised, non-binding proceeding where counsel for parties in a pending dispute conduct limited discovery and then present a summary of their case before the judge and representatives of each party. After the initial representation, experts of facts may be called following which the management enters with a view towards coming to consensus. It is mostly applied in very complex construction and infrastructure projects where the client or its representatives may not be aware of the real situation on ground and the consultants may not be aware of the needs and priorities of the parties to the dispute on ground (Dighello, 2000). It is to be noted as asserted by that it is purely a voluntary and non-judicial process whereby the top management team of each party meets to resolve a disputes. It combines evaluative and elements which includes involving top management in the settlement process, limiting the time of the mini-trail, conducting an informal hearing, holding non-binding discussions, and receiving comments from a neutral adviser (Edelman, 1989). The duration of minitrails is usually short and completed within one to three months. The hearing is informal and lasts only one or two days. This aims to inform the top management executives of each party about issues and positions underlying the dispute quickly.

2.3.5 Dispute resolution boards

According to Peña-Mora, Sosa, and McCone (2003), the Dispute Resolution Board (DRB) is a panel of three standing neutral advisors chosen by both the client and the contractor prior to initiation of construction. Usually, the panel would conduct routine site visits to monitor progress of work, while at the same time assists in the resolution of any outstanding thorny issues. This is to avoid possible escalation to a dispute level that might

have adverse effects on the project schedule, budget and quality. According to Gould (2006), this is a major challenge and one that is key to success as opposed to waiting for a dispute to arise. Potential candidates for the board must be identified and appointed. Establishing the board can take some considerable time and therefore cannot be left until the project is underway. Board members must be impartial and have wide ranging expertise with excellent communication and management skills. It is also imperative that board members are available for the duration of the project to deal with matters promptly. A dispute board should be appointed at the commencement of a project and stay in place until its conclusion. The function of the Board should be to 'nip in the bud' problems before they develop into disputes.

2.3.6 Arbitration

According to Levin (1998), arbitration is the ADR technique most similar to litigation. The author added that instead of presenting a case to a judge or jury, summary presentations are made by both sides to one or a panel of neutral arbitrator(s) which is selected by the contract parties. The arbitrators will have a good knowledge and experience in construction management principles, and this is considered one of the major benefits of arbitration (Levin, 1998). It is to be noted however that many of the same procedures used in litigation, such as discovery and preliminary motions, are used in arbitration. Agu (2012) also found that the rules of evidence used in arbitration depend on the prior agreement between the parties. It may take a long time, same as for a litigation process, and may even be costlier. What makes it attractive is the mutual agreement by the parties, appointment of the arbitrator; privacy and confidentiality (Boulle, 1996).

Arbitration has obvious benefits over litigation. For instance, successful arbitration can offer advantages over court action such as confidentiality as the hearings are a private determinative process and the findings are not published. Other benefits include flexibility and convenience while process is final, binding and heard by a single or panel of experts in the relevant field. However, there are some who believe it is quickly losing its appeal as an informal, fair, and swift process. Researchers such as Harmon (2004) indicates that arbitration is becoming a slow laborious process akin to litigation in terms of procedure and cost without the safeguard of litigation. In addition, Hobbs (1999) had argued that some of the challenges in arbitration include the fact that it is associated with prolonged delays in selecting arbitrator panels, hearing dates and places, and in getting ready for arbitration hearings. As such, researchers are of the opinion that hearing times are increasing and discovery procedures are becoming much like litigation.

2.3.7 Adjudication

Adjudication refers specially to a procedure by which a neutral adjudicator is empowered and required by contract to make summary binding decisions about disputes arising under that contract without following litigation or arbitration procedures (Brown and Marriott, 1993). Agu (2012) supported this by saying that disputants agree beforehand that they will be bound by the opinion of the expert and that this decision is binding on the parties in the interim, until a further decision by a court of law or arbitration is reach. In comparison with mediation and conciliation, adjudication is a better means to resolve disputes on site by speedy decision (Latham, 1994). It is because mediation or conciliation requires the parties to reach their own settlement which takes relatively longer time. Plunkett (1995) has referred the adjudicator as 'expert adjudicator' and adjudication as 'expert adjudication'. The author had examined the role of expert adjudicators and made comparison between adjudication and arbitration. Expert adjudication is a quicker and less

expensive means of resolving disputes than a conventional arbitration. However, expert adjudication involves a less thorough investigation than the normal form of arbitration. In addition, the parties who agree to accept the opinion of an expert adjudicator may subject to the risk that the expert adjudicator can be wrong. Since the adjudicator owes a duty to the parties to act with reasonable care and skill in making a decision, he or she may require the parties to expressly agree to immune him or her from breach of duty in the appointment agreement.

This study investigates the effectiveness of these dispute resolution strategies in resolving disputes in the Nigerian construction industry.

3. METHODOLOGY

In line with the purpose of this research which focused on investigation of construction disputes in the Nigerian construction industry, exploratory and survey design approaches were adopted for the study. This involved an in-depth review of related literature on the concept of dispute and its resolution strategies; and the use of structured questionnaire to solicit opinion from target respondents in the Nigerian construction industry in two strategic cities of Abuja, the nation's administrative capital and Port Harcourt, the oil capital. Sixty (60) on-going construction projects (Abuja=30, PH=30) were purposively identified for the survey. One representative of both the contractor and the consultant for each project was purposively selected to give a total of 120 sample units. Target respondents were mainly Builders, Quantity Surveyors, Architects and Engineers. Efforts were made to ensure that all respondents are professionally registered with their respective professional bodies. This was to ensure that they are professionally qualified with adequate experience in dispute matters in the construction industry.

A copy of the questionnaire was first drafted and scrutinised by industry experts and academics before 120 copies of the questionnaire were distributed to respondents. Respondents were asked questions relating to factors responsible for dispute in the industry as well as effectiveness of measures in place for resolving disputes. Fifty-five (55) valid responses were received giving a response rate of 46%. A five point Likert scale of 1=strongly disagree, 2=disagree, 3=slightly agree, 4=agree and 5=strongly agree was to use measure respondents' rating of factors responsible for disputes; while the scale of 1= very low, 2 = low, 3 = moderate, 4 = high, 5 = very high was used to measure the level of effectiveness of disputes resolution strategies. Data collected were analysed using descriptive and inferential statistics. Accordingly, frequency count was used to analyse the respondents' demographics while mean and standard deviation were used to analyse the two objectives of the study. Mann Whitney U test was used to analyse the hypothesis postulated for the study. The mean score (MS) for each variable was established and ranked to determine significant variables.

4. PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Sample characteristics

As noted earlier, 55 valid responses out of 120 copies of the structured questionnaire distributed were received. A cross tabulation analysis of location of projects and categories

of respondents is shown in Table 1.

Table 1: Distribution of respondents into categories

Location	Category of respondents		
	Contractors	Consultants	**Total**
Abuja	24	10	**34**
Port Harcourt	14	7	**21**
Total	**38**	**17**	**55**

It shows that out of 60 copies distributed to each of the two strategies cities, 34 responded from Abuja, while 21 responded from Port Harcourt. It however shows that 24 respondents or 71% of copies received from Abuja were from representatives of contractors while 14 or 67% of respondents from Port Harcourt were from the consultants. This is expected as there are usually more workers from the contractor's components of the project team than the consultants.

Table 2 however shows the breakdown of respondents in terms of job description. It indicates that architects were the highest number of respondents at 16, followed by Quantity Surveyors at 14, Builders at 13 and Engineers at 12. It is safe to conclude from the result that construction professionals were evenly and proportionately represented in the survey. It is also observed that there were more respondents across the professional divide that participated from Abuja. This is expected as there are arguably more projects and the corresponding construction professionals in the nation's capital on account of the massive construction activities going on in the city.

Table 2: Job description of respondents

Job description	Port Harcourt	Abuja	**Total**
Builders	4	9	**13**
Architects	6	10	**16**
Engineers	4	8	**12**
Q/Surveyors	7	7	**14**
Total	**21**	**34**	**55**

4.2 Factors responsible for disputes in Nigerian construction industry

In order to assess factors commonly responsible for disputes in the Nigerian construction industry, a taxonomy of factors was generated from the literature. Respondents were then asked to rate the factors using a five point Likert scale of 1=strongly disagree, 2=disagree, 3=slightly agree, 4=agree and 5=strongly agree. Results of analysis of the rankings are shown in table 3.

Based on an average benchmark of 3 [1+2+3+4+5/2=3] for a 5 point Likert scale, 11 out of 20 factors used for the survey were significantly responsible for disputes in the Nigerian construction industry. Similar approach was adopted by Chileshe and Kikwasi (2014) and Ikediashi, Ogunlana, Boateng, and Okwuashi (2012). However, poor communication management (MS=3.400), payment delay (MS=3.309), and poor workmanship (MS=3.273) were the top three rated factors by respondents. This tallied with the findings of Rhys Jones (1994), Thompson, Vorster, and Groton (2000) and Semple, Hartman and Jergas (1994). The lackadaisical attitude towards information dissemination between consultants and contractors as well as between contractors and subcontractors has

more often than not led to protracted disputes that have caused the country millions of dollars due to project delays and abandonment. On the other hand, project uncertainty, cultural difference, and error in contract documents were the least three rated factors in that order. Plausibly, there is no recorded dispute in the Nigerian industry on account of cultural difference. However, error in contract documents as well as project uncertainty have been known to results to disputes. The outcome may be due to the fact that only two cities out of many across Nigeria were used for the survey.

Table 3: Results of ranking of factors responsible for disputes in the Nigerian construction industry

Code	Causes of dispute	MS	SD	Rank	MWU	P-value
PCM	Poor communication management	3.400	0.915	1	524.0	0.066
PDL	Payment delay	3.309	0.821	2	225.2	0.115
PWK	Poor workmanship	3.273	0.977	3	441.7	0.124
CCL	Contractual claims	3.200	0.729	4	348.5	0.078
IIP	Incompatibility of interests among project team	3.146	0.938	5	440.1	0.099
DSE	Design error	3.127	0.912	6	337.1	0.223
DPD	Delay in project delivery	3.091	0.899	7	442.0	0.088
ISD	Incomplete scope definitions	3.091	1.262	8	472.4	0.055
ICD	Inadequate contract drafting	3.018	0.988	9	338.0	0.028
LTS	Lack of team spirit	3.011	0.876	10	408.1	0.057
FCU	Failure to deal with changes & unexpected conditions	3.005	1.222	11	178.2	0.140
PIS	Poor interpersonal skills	2.994	0.851	12	145.0	0.087
AOI	Availability of information	2.927	0.917	13	309.2	0.127
UOB	Unethical or opportunist behaviour	2.882	0.990	14	228.0	0.001
NPB	Nominations problem	2.112	1.114	15	415.8	0.059
NIT	Negligence in tort	1.997	0.855	16	376.8	0.091
PIT	Public interruption	1.958	0.928	17	441.8	0.244
ECD	Error in contract documents	1.944	0.883	18	225.0	0.071
CDF	Cultural difference	1.928	1.184	19	587.0	0.064
PUC	Project uncertainty	1.886	1.223	20	502.4	0.083

Note: MS =mean score; SD=standard deviation; MWU=Mann Whitney U value; P-value= significant @ >0.05

A null hypothesis was postulated to test the level of agreement between contractors and consultants on the causes of disputes in the Nigerian construction industry. The hypothesis stated that there is no significant difference in the ranking of causes of disputes within the Nigerian construction industry by contractors and consultants. Mann Whitney U test was adopted to test the hypothesis. According to Laerd Statistics (2018), it is a ranked-based non-parametric test used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed. The result of the analysis is also indicated in table 3. The hypothesis is accepted for all values of $p > 0.05$ while it is rejected for all values of $p < 0.05$. The result shows that the hypothesis is accepted for the 20 factors which is an indication there is a general agreement in the ranking of the factors.

4.3 Ranking of level of effectiveness of dispute resolution strategies

To examine the level of the various dispute resolution strategies for construction related disputes in the Nigerian construction industry, a list of 10 strategies were identified from literature and first piloted to determine their levels of applicability. Seven of them were found to be common in the Nigerian constriction industry. They were therefore subjected to the views of respondents. Results of analysis is shown in Table 4.

Table 4: Results of ranking of level of effectiveness of dispute resolution strategies

Code	Approach	Contractors		Consultants		Average	
		mean	rank	mean	rank	mean	rank
RS01	Arbitration	3.725	1	3.845	1	3.785	1
RS02	Mediation	3.191	2	3.156	2	3.174	2
RS03	Adjudication	3.121	3	3.110	4	3.116	3
RS04	Conciliation	3.088	4	3.118	3	3.103	4
RS05	Negotiation	3.002	5	3.005	5	3.004	5
RS06	Mini-trial	2.441	7	2.952	6	2.697	6
RS07	Dispute resolution board	2.652	6	2.002	7	2.327	7

Results indicate that arbitration is the most effective strategy in the Nigerian construction industry as it is ranked first by both contractors and consultants. As noted earlier, arbitration almost follows all the procedures of litigation, the only difference being that, instead of presenting cases to a judge or jury, summary presentations are made by both sides to one or a panel of neutral arbitrator(s) which is selected by the contract parties. Mediation was ranked second by both groups while adjudication was rated overall third, even though it was rated third by contractors and fourth by consultants. However, use of dispute resolution boards, mini-trial, and negotiations were the three least rated strategies in that order by respondents. This may not be unconnected with the fact that the recommendations from these are not binding on parties. For example, where negotiation fails, parties are encouraged to go to arbitration.

5. CONCLUSION AND RECOMMENDATIONS

Construction contracts are complex; disputes are therefore likely to arise under the best circumstances, and even where every possibility has been potentially eliminated. This study examined factors responsible for disputes in the industry as well as the level of effectiveness of resolution strategies using Nigeria's perspective. Data collected from 55 respondents in two major cities of Abuja and Port Harcourt were analysed using descriptive statistics and Mann Whitney U test.

Finding reveal that poor communication management, payment delay and poor workmanship were the top rated factors commonly responsible for disputes in the Nigerian construction industry while project uncertainty, cultural difference, and error in contract documents were the least three rated factors in that order. Besides, it was also discovered that arbitration, mediation and adjudication were the most effective resolution strategies for disputes while use of dispute resolution boards, mini-trial, and negotiations were the three least rated strategies in that order by respondents. Meanwhile, the result of hypothesis postulated for the study showed that there is no significant difference in the ranking of the causes of disputes in the construction industry by respondents when grouped under consultants and contractors.

The study has noteworthy contributions to theory and practice. For instance, more is now known about the most common factors that trigger disputes in the industry. Besides, since disputes are inevitable, stakeholders can intensify the use of arbitration, mediation and adjudication since according to this study, they are the most effective in the resolution of disputes in the industry. It is therefore to be noted that resolving dispute more quickly will mean higher productivity in the construction industry. This is because construction disputes generally cost money, take time and ultimately bog down parties' cordial relationship painstakingly built up over a period of time and impacts the supply chain.

This study has one obvious limitation. It was carried out in two cities rather than the whole country. Although, it can be generalised to other parts of the country, it may only serve as triangulation to studies in other parts of the globe.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

FACTORS INFLUENCING THE ADOPTION OF SUSTAINABILITY PRACTICES AMONG SMALL, MEDIUM AND LARGE CONSTRUCTION FIRMS IN NIGER - DELTA, NIGERIA

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ABSTRACT

Purpose: The need to improve the adoption of sustainability practices among construction firms cannot be over- emphasized. This study assessed the factors influencing the adoption of sustainability practices among small, medium and large construction firms in Niger- Delta, Nigeria.

Design/methodology/approach: Survey design approach was adopted in this study. Data were obtained using 1179 copies of structured questionnaire, administered by the researcher and research assistants. The research data were collected on a five-point scale of 1, 2, 3, 4 and 5 and were assigned to the options of very low influence, low influence, moderate influence, high influence and very influence respectively. Methods of data analysis were simple percentage, and mean score and Kruskal Wallis test.

Findings: The finding from the study indicated that there is no significant variation in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in Niger-Delta, Nigeria. In line with this result, the study affirmed that the first three drivers that have high influence on the adoption of sustainability practices among small, medium and large construction firms in Niger-Delta are organisation's cultural values, amount of resources allocated to sustainability and organisation's structure and system. The study also assessed the enablers of adoption of sustainability among the firms and concludes that capacity building and development has very high influence on the adoption of sustainability practices among small, medium and large firms while lack of education and lack of training are the barriers that have very high influence on the adoption of sustainability practices among small, medium and large firms. The study concluded that lack of top management support highly influenced the adoption of sustainability practices among small, medium and large construction firms in Niger-Delta, Nigeria.

Originality/value: The outcome of this article will help construction firms and construction stakeholders at large to know the drivers, enablers and barriers influencing the adoption of

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sustainability practices among small, medium and large construction firms in Niger Delta, Nigeria.

Keywords: Construction firms; factors; Niger-Delta; small, medium and large; sustainability practices.

1. INTRODUCTION

There is great concern all over the world about the negative impacts of the operations of construction firms on the natural environment. Suliman and Abdelnaser (2009) stated that construction is responsible for an estimated forty percent of all resources consumption and produces about forty percent of all wastes including greenhouse gas emissions. Similarly, Saroop and Allopi (2014) opined that, the construction industry globally, is one of the main contributors to the depletion of natural resources and a major cause of unwanted side effects such as air and water pollution, solid waste, deforestation, health hazards, global warming, and other negative consequences.

The Nigerian construction industry comprised of construction firms ranging from the small and medium enterprises, to the big, technically competent multinational construction firms. Abdullah *et al*. (2012) and Thwala, Ajagbe, Enegbuma, Bilau and Long, (2012) posited that firms in the Nigerian construction industry have been grouped such that small and medium firms (SMFs) are found to be the majority.

Niger-Delta region of Nigeria is severely affected by environmental degeneration as a result of economic activities and oil exploration over the years. According to Kadafa (2012), oil exploration and exploitation which has been on- going for several decades in the Niger- Delta, has had disastrous impacts on the environment in the region and has adversely affected people inhabiting that region. The study noted that the region has been rendered one of the five most severely petroleum damaged ecosystems in the world. Similarly, Ite, Ibok, Ite, and Petters (2013) observed that the bulk proven oil reserves of the region have encouraged the influx of visitors and multinational oil corporations whose operations have created serious threats to the livelihood of the coast communities in the Niger- Delta region. Destruction of habitats, loss of biodiversity, ecosystem destruction, destruction of farmland to access onshore sites and marine resource areas, and water pollution all have extensive implications on the people's livelihood in the region.

Apart from the environmental degeneration suffered due to oil exploration, the fact that several construction activities which have been on to accommodate the activities and growing population, also add to the degeneration of the environment. Asad and Khalfan (2007) reported that construction has a significant effect on people's quality of life; construction outputs affect the nature, function and appearance of the towns and countryside in which people live and work.

The rising global campaign for sustainable construction demands that the challenges be addressed to promote environmentally friendly, social responsibility and economic support. The poor attention being paid to sustainable development agenda in the developing countries poses great danger to present and future generations. According to Oni (2015), the plan of actions or the direction of the stakeholders in the construction industries of developing countries regarding sustainable construction is not known.

Dania, Larsen, and Yao, (2013) stated that Nigeria is lagging behind world developments associated with sustainability within the construction sector and beyond.

Waziri, Yusof and Osmadi (2015) stated that the level of sustainability practices' adoption in Nigeria falls below international standard. This assertion was supported by Ekung, Ujene and Ebong (2014), and Ijaiya (2014). Low adoption of sustainability practices in Niger Delta could lead to violent agitations and restiveness that could also impede oil exploration and cause negative impacts on the socio - economic activities of the Nigerian state. This therefore poses a serious concern to the developmental stakeholders in the Niger-Delta region (Sunjka and Jacob, 2013). The big question is that what are the factors influencing the adoption of sustainability practices among small, medium and large construction firms? Another question is what is the level of influence of these factors on the adoption of sustainability practices? There is also the need to know if the influence of these factors varies according to the size of the firms.

1.1. Objective of the study

The objective of the study is to assess the factors influencing the adoption of sustainability practices among small, medium and large construction firms in Niger-Delta.

1.2. Research hypothesis

In order to achieve the objective of the study, this study tested the hypothesis which states that there is no significant variation in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in Niger Delta, Nigeria.

2. REVIEW OF RELATED LITERATURE

This section comprises of the drivers, enablers of adoption of sustainability practices in construction firms and barriers to adoption of sustainability practices among small, medium and large construction.

2.1. Drivers of adoption of sustainability practices in construction firms

Bansal and Roth (2000) identified four main drivers of sustainability adoption in organisations: legislation, stakeholder pressures, economic opportunities, and ethical motives. Linnenluecke and Griffiths (2010) and Epstein (2008) grouped these factors into internal drivers and external drivers. External drivers of sustainability adoption include factors such as environmental regulation and standards set by governments, or pressures resulting from customer groups and the community. Internal organisational drivers include factors such as top management support, human resource management, environmental training, employee empowerment and the amount of financial resources allocated to sustainability. Majority of the researches that were carried out focused on the drivers of adoption or implementation of sustainability practices among construction firms in developed countries where context are different from developing countries. *(*Chowdhury *et al*., 2015). Also many of these studies did not consider the drivers of sustainability practices based on the size of the firms. These necessitated the need to assess the drivers of

sustainability practices among small, medium and large construction firms in Niger- Delta region of Nigeria.

2.2. Enablers of adoption of sustainability practices in construction firms

Lee and Klassen (2008) distinguished between drivers and enablers. Drivers are factors that initiate a process while enablers help in implementing the process. Drivers help develop commitment towards sustainability among firms while enablers help implement sustainability practices. There are a variety of activities that may enable sustainability practices adoption by construction firms. For example, incentives by different agencies such as the government, focal firm, and NGOs can enable sustainability adoption by construction firms (Seuring and Muller, 2008; Matos and Hall, 2007). Other enablers can be categorised as: External - support from focal firm, top management and government, Mutual - collaboration, integration of resources, sharing of knowledge, joint development activities to enhance mutual trust and commitment (Rocha, Searcy, and Karapetrovic, 2007; Zhu and Sarkis, 2004). Controlling and monitoring the practices of firms to prevent deviations from sustainability standards can be achieved by developing new auditing standards. In addition, disseminating knowledge about sustainability, providing training, and developing technological knowledge will facilitate the implementation of sustainability. Many of the studies predominantly focussed on the drivers and barriers to the implementation of sustainability practices among construction firms without giving adequate attention to the enablers of sustainability practices in literature. This study filled this gap in literature by assessing the drivers and enablers of sustainability practices separately. This will help the firms to take decisive actions when and where application in the course of implementing sustainability practices.

2.3. Barriers to adoption of sustainability practices

A lack of knowledge and expertise within the organisation is the main barrier to adoption of sustainability practices (Elkington, 1994; Zutshi and Sohal, 2004). Vachon (2007) found that the lack of knowledge transfer and cooperation, and organisational resistance towards the adoption of environmental technologies for green practices are barriers to sustainability. Florida (1996) and Zutshi and Sohal (2004) studied resistance from employees and firms towards the development of an environment friendly firms. Hall (2000) highlighted lack of interest on the part of firms as a barrier. Besides, cost related issues also affect greening of the supply chain (Rao, 2002). Cai *et al*. (2008) reported higher investment and uncertainty of return as significant barriers to going green. Majority of companies assume that sustainability will increase cost and negatively affect overall profit (Fortes, 2009; Salloum, Azoury, and Azzi, 2011). Vermeulen and Ras (2006) identified lack of expertise in the firms and pressure of lowering cost as major challenges. Lack of government support is also one of the causes for slower adoption of sustainability (Zutshi and Sohal, 2004).

Other barriers to sustainability adoption in the building industry include the lack of knowledge of professionals in the building industry and the lack of awareness and understanding by the general public. Goddard and Knott (2007) suggested that awareness is minimal among the public. Few people understand the term sustainable development and this is due to the broad subject area and the complexity of the issue. Despite the fact that some studies have identified some barriers to the adoption of sustainability practices, the empirical evaluation and prioritization of these factors so as to mitigate them is limited in

literature in the developing countries and in Niger-Delta region of Nigeria in particular. The evaluation and prioritization of barriers to e adoption of sustainability practices become imperative because firms' capability and resources differ based on their size. By prioritizing the most significant barriers, organisations can select appropriate mitigation approaches based on their capability. This study filled this gap in literature by evaluating the barriers to the adoption of sustainability practices among small, medium and large construction firms in Niger- Delta region of Nigeria.

3. METHODOLOGY

Survey design approach was adopted in this study. Data were obtained using 1179 copies of structured questionnaire, administered by the researcher and research assistants. The data were collected on a five-point scale of 1, 2, 3, 4 and 5 and were assigned to the options of very low influence, low influence, moderate influence, high influence and very influence respectively. The decision rule is that any factor whose mean falls between 1.0 – 1.8 is of very low influence, 1.8 – 2.6 is of low influence, 2.6 – 3.4 is of moderate influence, 3.4 – 4.2 is having high influence and 4.2 – 5.0 is regarded as having very high influence. Methods of data analysis were simple percentage, mean score and Kruskal Wallis test.

3.1. Sample frame and sample size

Table 1 shows the sample frame and sample size of this study. The Sample size was determined using the Yamane (1967) equation as shown below

$$n = \frac{N}{1 + N(e)^2}$$

where n = Sample size
N = Finite population
e = Level of significance (0.05)
1 = Unity

This study adopted Yamane (1967) equation for determining sample size because of its simplicity, reliability and validity. These have encouraged its wider acceptance and usage among researchers over a long period of time.

Table 1: Sample frame and sample size of construction firms in Niger Delta

State	**Sample Frame**	**Sample Size**
Abia	165	117
Akwa Ibom	214	139
Bayelsa	128	97
Cross River	223	143
Delta	200	133
Edo	237	149
Imo	143	105
Ondo	221	142
Rivers	250	154
Total	**1781**	**1179**

4. DATA PRESENTATION AND DISCUSSION OF RESULTS

This section contains results of the analysis of data collected for the study. It contains the descriptive results of the response rate of questionnaire, and firm characteristics. This section also contains the result of evaluation of level of adoption of sustainability practices among small, medium and large construction firms in the Niger- Delta, region of Nigeria and the result of the hypothesis.

4.1. Questionnaire distribution and response in the study

One of the research instruments used in this study was structured questionnaire. The questionnaire was administered among the construction firms operating in Niger- Delta, region of Nigeria. The results of analyses are presented in Table 2.

Table 2 shows that the number of questionnaire administered to the construction firms in the Niger – Delta, region of Nigeria are 117, 139, 97, 143, 133, 149, 105, 142, and 154 in Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, and Rivers state respectively. From the questionnaire distributed, the response rate ranges between 76.1% and 94.7%. Delta state received the highest response rate of 94.7% while Abia State got the least rate of 76.1 %. In all, an overall response rate of 83.2**%** was achieved. Groves (2006) noted that a response rate of at least 50 percent is considered adequate for analysis and reporting, a response of 60 percent is good and a response rate of 70 percent is very good. As a guide, researchers typically seek response rates of at least 70% to feel confident that their sample is representative of the sample frame. Hence, the overall response rate of 83.2% in this study is considered very good and adequate.

Table 4.2: Questionnaire distribution and response rate

S/N	States	Number of questionnaire administered on construction firms (NO)	Number of questionnaire returned (NO)	Percentage of questionnaire returned (%)	Average of the Response Rate (%)
1	Abia	117	89	76.1	
2	Akwa Ibom	139	113	81.3	
3	Bayelsa	97	85	87.6	
4	Cross River	143	112	78.3	
5	Delta	133	126	94.7	
6	Edo	149	114	76.5	
7	Imo	105	92	87.6	
8	Ondo	142	109	76.8	
9	Rivers	154	140	90.1	
10	TOTAL	1179	980		83.2

4.2. Firm characteristics

Firms' characteristics comprised of location of construction firms and size of construction firms.

4.2.1. Location of construction firms

Table 3 shows the distribution of construction firms in each state in the Niger- Delta, region of Nigeria. The percentages of firms in Abia, Akwa Ibom, Bayelsa and Cross river states are 9.1%, 11.5%, 8.7% and 11.4%. Others are Delta, Edo, Imo, Ondo and Rivers with percentages of 12.9%, 11.6%, 9.4%, 11.1% and 14.3% respectively. Table 3 shows a good distribution of the construction firms among the states in the Niger –Delta, region of Nigeria. This implies that the results from this study represents the situation in Niger-Delta, region of Nigeria and can be relied on.

Table 3: Location of construction firms

States	**Frequency**	**Valid Percent**	**Cumulative Percent**
Abia state	89	9.1	9.1
Akwa Ibom state	113	11.5	20.6
Bayelsa state	85	8.7	29.3
Crossriver state	112	11.4	40.7
Delta state	126	12.9	53.6
Edo state	114	11.6	65.2
Imo state	92	9.4	74.6
Ondo state	109	11.1	85.7
Rivers state	140	14.3	100.0
Total	980	100.0	

4.2.2. Size of construction firms under study in Niger – Delta region of Nigeria between 2007- 2016

Analysis on Table 4 shows the average percentage distribution of construction firms in Niger Delta according to their sizes over a period of ten years (2007-2016). The analysis shows that small firms account for 84.7%, medium firms account for 11.61 and large construction firms account for 3.73%. This reveals that small and medium construction firms are of the majority. This result is in consonance with the findings of Abdullah etal, (2012) and Thwala etal, (2012) in the construction industry Small and Medium Firms (SMFs) were found to be in the majority.

Table 4: Size of construction firms under study in Niger - Delta between 2007- 2016

S/N	YEAR	1-50		50-250		250 AND ABOVE	
		FREQ	PER	FREQ	PER	FREQ	PER
1	2007	857	87.4	88	9.0	35	3.6
2	2008	790	80.6	155	15.8	35	3.6
3	2009	842	85.9	103	10.5	35	3.6
4	2010	821	83.8	120	12.2	39	4.0
5	2011	813	83.0	129	13.2	38	3.9
6	2012	754	76.9	188	19.2	38	3.9
7	2013	811	82.8	131	13.4	38	3.9
8	2014	870	88.8	75	7.7	35	3.6
9	2015	868	88.6	77	7.9	35	3.6
10	2016	874	89.2	71	7.2	35	3.6
AVERAGE			84.7		11.61		3.73

4.3. Factors influencing the adoption of sustainability practices among small, medium and large construction firms in Niger Delta, Nigeria

Table 5 shows the factors affecting the adoption of sustainability practices based on the size of firms. The decision rule is that any factor whose mean falls between 1.0 – 1.8 is of very low influence, 1.8 – 2.6 is of low influence, 2.6 – 3.4 is of moderate influence, 3.4 – 4.2 is having high influence and 4.2 – 5.0 is regarded as having very high influence. Three external drivers that have high influence on the level of adoption of sustainability practices among small firms are society/ community, competitors' pressures and consumer groups. Competitors' pressure, trade association and consumer groups are revealed to have moderate influence on the adoption of sustainability practices among medium construction firms. In the same vein, focal company influence, competitive pressure, consumer groups, civil society, media and NGO are the external driver that have high influence on the adoption of sustainability practices among large construction firms in the Niger- Delta region of Nigeria.

Internal drivers that have high influence on the adoption of sustainability among small, medium and large construction firms in Niger Delta include organisations' cultural values, amount of resources allocated to sustainability, environmental training, and organisations' structure and system. Others include employee empowerment, human resource management and top management support.

Table 5 also shows the enablers that have high influence on the adoption of sustainability practices among small, medium and large constructions firms in Niger- Delta. These include sharing of resources, capacity building and development, joint effort and planning, monitoring and auditing of supply chain partners, competitive and marketing advantage. Others are information sharing, trust and commitment among partners, cost reduction and long- term partnership, external pressure, incentives and support by various agencies, demand of customer and other stakeholders, awareness and top management commitment and support. However, it was also revealed that external pressure, incentives and support by various agencies, level of awareness of sustainability practices and top management commitment and support have very high influence on the adoption of sustainability practices among large construction firms in the Niger- Delta region of Nigeria.

Barriers to adoption of sustainability practices among the construction firms were evaluated across the three sizes of construction firms. The result shows that lack of awareness of sustainability practices among the construction firms, increased cost of production, focus on short term profitability, perception of low economic return, lack of money, lack of integration and no support from government are the barriers that highly influenced the adoption of sustainability practices among small and medium construction firms. Other barriers that have high influence on the adoption of sustainability practices among small and medium construction are resistance from suppliers, poor supplier commitment, lack of trust, cultural difference, lack of human resources capability, lack of knowledge, lack of resources, no capability and no technology sharing. Also, medium construction firms revealed that lack of top management commitment to the adoption of sustainability practices and lack of education have very high influence on the adoption of sustainability practices.

Having evaluated the perceptions of small, and medium construction firms on the barriers to adoption of sustainability practices at firm level, the perceptions of large construction firms were also evaluated. The results show that lack of awareness of sustainability practices, increased cost of product, perception of low economic return and lack of money are barriers that have very high influence on the adoption of sustainability

practices. Other barriers that also have very high influence include lack of partners' trust, lack of top management commitment, no capability, lack of training and lack of education. Large construction firms also revealed another set of barriers that have high influence on the adoption of sustainability practices. These include focus on short- term profitability, lack of integration, no support from government, resistance from suppliers, and poor suppliers' commitment. Others are cultural differences, and lack of human resources capability.

Table 5: Factors influencing the adoption of sustainability practices based on size of firms

Factors Influencing the Adoption of Sustainability in Construction Firms	Small Firms 1-50 N=874				Medium Firms 50-250 N=71				Large Firms 250 And Above N=35				COMBINED N=980			
	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark
External Drivers of Sustainability Adoption																
Trade union	2399.00	2.74	12	M.I	194.00	2.73	12	M.I	100.00	2.86	12	M.I	2693.00	2.75	12	M.I
Media	2691.00	3.08	10	M.I	198.00	2.79	11	M.I	122.00	3.49	4	H.I	3011.00	3.07	10	M.I
Industry norms	2655.00	3.04	11	M.I	202.00	2.85	10	M.I	115.00	3.29	10	M.I	2972.00	3.03	11	M.I
Regulatory bodies(Law and Regulation)	2958.00	3.38	4	M.I	222.00	3.13	6	M.I	116.00	3.31	9	M.I	3296.00	3.36	4	M.I
Employee unions	2727.00	3.12	9	M.I	210.00	2.96	8	M.I	107.00	3.06	11	M.I	3044.00	3.11	9	M.I
NGO	2779.00	3.18	8	M.I	212.00	2.99	7	M.I	119.00	3.40	6	H.I	3110.00	3.17	8	M.I
Society/ Community	3219.00	3.68	1	H.I	204.00	2.87	9	M.I	117.00	3.34	8	M.I	3540.00	3.61	1	H.I
Focal company influence	2847.00	3.26	5	M.I	223.00	3.14	5	M.I	130.00	3.71	1	H.I	3200.00	3.27	5	M.I
Civil society	2814.00	3.22	7	M.I	230.00	3.24	4	M.I	122.00	3.49	4	H.I	3166.00	3.23	7	M.I
Trade association	2831.00	3.24	6	M.I	236.00	3.32	1	M.I	118.00	3.37	7	M.I	3185.00	3.25	6	M.I
Consumer groups	2972.00	3.40	3	H.I	231.00	3.25	3	M.I	124.00	3.54	3	H.I	3327.00	3.40	3	H.I
Competitor's pressure	3029.00	3.47	2	H.I	236.00	3.32	1	M.I	129.00	3.69	2	H.I	3394.00	3.46	2	H.I
Internal Drivers of Sustainability Adoption																
Top management support	3280.00	3.75	7	H.I	273.00	3.85	5	H.I	139.00	3.97	6	H.I	3692.00	3.77	7	H.I
Human resource management	3419.00	3.91	6	H.I	266.00	3.75	7	H.I	142.00	4.06	4	H.I	3827.00	3.91	6	H.I
Environmental training	3509.00	4.01	3	H.I	269.00	3.79	6	H.I	147.00	3.94	7	V.H.I	3925.00	4.01	4	H.I
Employee empowerment	3450.00	3.95	5	H.I	280.00	3.94	3	H.I	144.00	4.11	3	H.I	3874.00	3.95	5	H.I
Amount of resources allocated to sustainability	3525.00	4.03	2	H.I	293.00	4.13	2	H.I	138.00	4.17	2	H.I	3956.00	4.04	2	H.I
Organisations' cultural values	3598.00	4.12	1	H.I	278.00	3.92	4	H.I	142.00	4.06	4	H.I	4018.00	4.10	1	H.I
Organisations' structure and systems	3487.00	3.99	4	H.I	296.00	4.17	1	H.I	146.00	4.20	1	H.I	3929.00	4.01	3	H.I
Enablers of Sustainability Adoption																
External pressure	3581.00	4.10	3	H.I	294.00	4.14	3	H.I	150.00	4.29	2	V.H.I	4025.00	4.11	3	H.I
Incentives and support by various agencies	3456.00	3.95	11	H.I	287.00	4.04	8	H.I	149.00	4.26	3	V.H.I	3925.00	4.01	7	H.I
Demand of customer and other stakeholders	3427.00	3.92	14	H.I	286.00	4.03	10	H.I	142.00	4.06	7	H.I	3855.00	3.93	14	H.I
Awareness	3528.00	4.04	4	H.I	291.00	4.10	4	H.I	148.00	4.23	4	V.H.I	3967.00	4.05	4	H.I
Top management commitment and support	3655.00	4.18	2	H.I	297.00	4.18	1	H.I	151.00	4.31	1	V.H.I	4095.00	4.18	2	H.I
Sharing resources	3504.00	4.01	5	H.I	290.00	4.08	6	H.I	142.00	4.06	7	H.I	3936.00	4.02	5	H.I
Capacity building and development	4086.00	4.68	1	V.H.I	290.00	4.08	6	H.I	146.00	4.17	5	H.I	4522.00	4.61	1	V.H.I
Joint effort and planning	3500.00	4.00	6	H.I	285.00	4.01	12	H.I	137.00	3.91	12	H.I	3922.00	4.00	8	H.I
Monitoring and auditing supply chain partners	3455.00	3.95	12	H.I	291.00	4.10	4	H.I	135.00	3.86	13	H.I	3887.00	3.97	10	H.I
Competitive and marketing advantage	3467.00	3.97	9	H.I	286.00	4.03	10	H.I	134.00	3.83	14	H.I	3887.00	3.97	10	H.I
Information sharing	3492.00	4.00	8	H.I	286.00	4.03	10	H.I	143.00	4.09	6	H.I	3921.00	4.00	9	H.I
Trust and commitment among partners	3463.00	3.96	10	H.I	278.00	3.92	14	H.I	142.00	4.06	7	H.I	3883.00	3.96	12	H.I
Cost reduction	3436.00	3.93	13	H.I	283.00	3.99	13	H.I	138.00	3.94	11	H.I	3857.00	3.94	13	H.I
Long term partnership	3498.00	4.00	7	H.I	295.00	4.15	2	H.I	139.00	3.97	10	H.I	3932.00	4.01	6	H.I
Barriers to Sustainability Adoption																
Lack of awareness	3608.00	4.13	6	H.I	286.00	4.03	14	H.I	150.00	4.29	7	V.H.I	4044.00	4.13	6	H.I
Increased cost of adoption	3621.00	4.14	5	H.I	297.00	4.18	7	H.I	153.00	4.37	2	V.H.I	4071.00	4.15	4	H.I

Table 5: (*Contd.*)

Factors Influencing the Adoption of Sustainability in Construction Firms	Small Firms 1-50 N=874				Medium Firms 50-250 N=71				Large Firms 250 And Above N=35				COMBINED N=980			
	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark	Sum	Mean	Rank	Remark
Focus on short term profitability	3602.00	4.12	7	H.I	296.00	4.17	9	H.I	146.00	4.17	11	H.I	4044.00	4.13	6	H.I
Perception of low economic return	3565.00	4.08	10	H.I	288.00	4.06	13	H.I	149.00	4.26	8	V.H.I	4002.00	4.08	11	H.I
Lack of money	3580.00	4.10	9	H.I	294.00	4.14	10	H.I	152.00	4.34	4	V.H.I	4026.00	4.11	9	H.I
Lack of integration	3559.00	4.07	12	H.I	298.00	4.20	5	H.I	145.00	4.14	14	H.I	4002.00	4.08	11	H.I
No support from government	3537.00	4.05	15	H.I	284.00	4.00	15	H.I	142.00	4.06	17	H.I	3963.00	4.04	16	H.I
Resistance from suppliers	3552.00	4.06	14	H.I	303.00	4.27	2	V.H.I	153.00	4.37	2	H.I	4008.00	4.09	10	H.I
Poor supplier commitment	3460.00	3.96	17	H.I	277.00	3.90	19	H.I	145.00	4.14	14	H.I	3882.00	3.96	17	H.I
Lack of partner trust	3559.00	4.07	12	H.I	284.00	4.00	15	H.I	147.00	4.20	10	V.H.I	3990.00	4.07	14	H.I
Lack of top management commitment	3625.00	4.15	4	H.I	303.00	4.27	2	V.H.I	156.00	4.46	1	V.H.I	4084.00	4.17	3	H.I
Cultural difference	3122.00	3.57	19	H.I	279.00	3.93	18	H.I	130.00	3.71	18	H.I	3531.00	3.60	19	H.I
Lack of training	3672.00	4.20	2	H.I	299.00	4.21	4	V.H.I	149.00	4.26	8	V.H.I	4120.00	4.20	2	V.H.I
Lack of education	3705.00	4.24	1	V.H.I	309.00	4.35	1	V.H.I	151.00	4.31	5	V.H.I	4165.00	4.25	1	V.H.I
Lack of human resources capability	3559.00	4.07	12	H.I	297.00	4.18	7	H.I	146.00	4.17	11	H.I	4002.00	4.08	11	H.I
Lack of knowledge	3627.00	4.15	3	H.I	282.00	3.97	17	H.I	146.00	4.17	11	H.I	4055.00	4.14	5	H.I
Lack of resources	3599.00	4.12	8	H.I	292.00	4.11	11	H.I	143.00	4.09	16	H.I	4034.00	4.12	8	H.I
No capability	3530.00	4.04	16	H.I	298.00	4.20	5	H.I	151.00	4.31	5	V.H.I	3979.00	4.06	15	H.I
Outdated auditing standards	2668.00	3.05	21	M.I	243.00	3.42	21	H.I	110.00	3.14	22	M.I	3021.00	3.08	21	M.I
Poor demand forecasting	2491.00	2.85	22	M.I	235.00	3.31	22	M.I	111.00	3.17	21	M.I	2837.00	2.89	22	M.I
No information sharing	2760.00	3.16	20	M.I	262.00	3.69	20	H.I	117.00	3.34	20	M.I	3139.00	3.20	20	M.I
No technology sharing	3359.00	3.84	18	H.I	290.00	4.08	12	H.I	126.00	3.60	19	H.I	3775.00	3.85	18	H.I
Valid N (listwise)																

4.4. Kruskal Wallis test for comparing the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in the study area

Table 6 shows the result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant variation in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in the Niger- Delta region of Nigeria. The P-value of 0.142 is greater than 0.05 significance level, hence the hypothesis was accepted. This implies that there is no significant variation in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in Niger Delta, Nigeria. It also implies that the firms have common opinion about the factors influencing the adoption of sustainability practices.

Table 6: Kruskal Wallis test for comparing the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in the study area

Perception of Small, Medium and Large Construction Firms on Factors Influencing the Adoption of Sustainability Practices in the Niger - Delta, Nigeria	Mean Rank	Decision @ 0.05 Sig lev.
SMALL FIRMS	79.66	
MEDIUM FIRMS	85.17	
LARGE FIRMS	97.67	
Chi-Square	3.898	
D.F	2	
P- Value	.142	Accept

4.5. Discussion of findings

The external drivers that have high influence on the level of adoption of sustainability

practices among small, medium and large construction firms in Niger Delta, Nigeria are society/ community, competitors' pressures and consumer groups, focal company influence, media and non- governmental organisations (NGO). This shows that the people living in the society or community where the construction firms operate can be a driving force that makes the firms to implement sustainable construction practices in the immediate environment. This is not unconnected with the various agitations in Niger Delta by the people, demanding that the construction firms should implement sustainability practices in the course of their operation in the Niger- Delta region of Nigeria. The media and various non- governmental organisations also play crucial roles in ensuring that the environment and the people are not over exploited by the firms in the course of carrying out their construction activities. This study is in agreement with Linnenluecke and Griffiths (2010), and Epstein (2008) who stated that external drivers of sustainability adoption include factors such as regulations and standards set by government or pressures resulting from consumer groups and the community.

Internal drivers that have high influence on the adoption of sustainability among small, medium and large construction firms in the Niger –Delta region of Nigeria include organisations' cultural values, amount of resources allocated to sustainability, environmental training, and organisations' structure and system. Others include employee empowerment, human resource management and top management support. Organisation cultural values play key roles in the way different organisations carry out their operations. The act of doing the right things is dependent on the cultural values of the firms. The amount of resources allocated to sustainability is another driver that has high influence. Implementation of sustainability practices requires adequate allocation of resources to sustainability by the firms. The willingness of the top management to support adoption of sustainability is also very important because this will drive the construction firms to incorporate sustainability into the plans and activities of the firms. This study agrees with Bansal and Roth (2000) that stressed the role of organisations top management. According to them, top management team members are instrumental in encouraging firms to evaluate their role in society, since they are the principal determinants of ethical sustainability decisions, the values they espouse will impact the organisations' sustainability orientation. This study aligns with Epstein (2008), who noted that the resources of an organisation is an important driver that enhances the adoption of sustainability practices because organisations need financial resources to implement the various sustainability programmes, pay and train sustainability staff. Also, the amount of financial and human resources allocated to sustainability, significantly impacts the ability to adopt sustainability practices among the construction firms.

This study also shows the enablers that have high influence on the adoption of sustainability practices among small, medium and large constructions firms in Niger Delta. These include sharing of resources, capacity building and development, joint effort and planning, monitoring and auditing of supply chain partners, competitive and marketing advantage. Others are information sharing, trust and commitment among partners, cost reduction and long- term partnership, external pressure, incentives and support by various agencies, demand of customer and other stakeholders, awareness and top management commitment and support. However, it was also revealed that external pressure, incentives and support by various agencies, level of awareness of sustainability practices and top management commitment and support have very high influence on the adoption of sustainability practices among large construction firms in Niger Delta, Nigeria. This study agrees with Bansal and Roth (2000) who stressed the role of organisations top management. According to them, top management team members are help to encourage firms to evaluate

their role in their societies, since they are the principal determinants of ethical sustainability decisions, the values they espouse will impact the organisations' sustainability orientation. This study also concurs with Seuring and Muller (2008); and Matos and Hall (2007) that posited that incentives by different agencies such as the government, focal firm influence, enable the adoption of sustainability practices among the construction firms. This study also agrees with another group of scholars such as Rocha, Searcy, and Karapetrovic (2007); Zhu and Sarkis (2004) who opined that external support from focal firm, top management and government, mutual collaboration, integration of resources, sharing of knowledge, and joint development activities to enhance mutual trust and commitment enable the adoption of sustainability practices among construction firms. Furthermore, this study agrees with Markley and Davis (2007); and Ageron *et al.* (2011) who revealed that capacity building and development is an important factor that enhances the adoption of sustainability practices among construction firms.

This study also evaluated the barriers inhibiting the adoption of sustainability practices among small, medium and large construction firms operating in Niger-Delta region of Nigeria. The study reveals that Lack of awareness of sustainability practices among the construction firms is one of the inhibitors that have very high influence on the adoption of sustainability practices. Other barriers that have very high influence on the adoption of sustainability practices among small, medium and large construction firms in Niger-Delta region of Nigeria are increased cost of production, focus on short term profitability, perception of low economic return, lack of money, lack of integration and no support from government. This shows that more awareness on sustainable development and sustainable construction in particular has to be created among the firms. The results in this study indicate that the fear of incurring extra production cost discourages the construction firms from implementing sustainable construction practices. Another concern is the extreme concentration on short term profitability by the firms. Majority of the firms want to make profit within the shortest possible time without considering the long term benefits of implementing sustainability practices. Some of the firms also have the notion that they will have low economic return when they implement sustainable construction practices. It is also of great importance that government shows support by creating an enabling environment for implementation of sustainable construction practices.

Furthermore, this study reveals that lack of top management commitment to the adoption of sustainability practices and lack of education also have very high influence on the adoption of sustainability practices among small, medium and large construction firms. Lack of top management commitment to the adoption of sustainability practices is a critical issue because the level of adoption of sustainability practices is greatly influenced by the discretion, willingness and commitment of the top management of the construction firms to sustainable construction practices. This study shows that resistance from suppliers, poor supplier commitment, lack of trust, cultural difference, lack of human resources capability, and no technology sharing have high influence on the level of adoption of sustainability practices among small, medium and large construction firms operating in Niger- Delta region of Nigeria. This study is in agreement with Pennell, Suresh, and Chinyio (2013) who identified problems of supply chain management, problems of adaptation to innovation, lack of top management commitment, lack of knowledge of sustainability among stakeholders and undue focus on cost as barometer of success as factors inhibiting the adoption of sustainability practices.

5. CONCLUSION

This study concludes that there is no significant difference in the perception of small, medium and large construction firms on factors influencing the adoption of sustainability practices in the Niger- Delta region of Nigeria. This implies that the firms have common opinion about the factors influencing the adoption of sustainability practices. In line with this result, this study concludes that the first three drivers that have high influence on the adoption of sustainability practices among small, medium and large construction firms in the Niger- Delta region of Nigeria are organisation's cultural values, amount of resources allocated to sustainability and organisation's structure and system. This study also assessed the enablers of adoption of sustainability practices among the firms and concludes that capacity building and development is a critical factor that has very high influence on the adoption of sustainability practices among small, medium and large firms. Furthermore, it concludes that top management support and external pressure have high influence on the implementation of sustainability practices among small, medium and large firms include. This study also concludes that lack of education and lack of training have very high influence on the adoption of sustainability practices among small, medium and large firms. It is concluded by this study that lack of top management support for sustainable construction practices and no technology sharing with regards to sustainable construction practices among firms highly inhibit the adoption of sustainability practices among small, medium and large construction firms in the Niger- Delta region of Nigeria.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

CONCEPTUALISATION OF BUILDING INFORMATION MODELING (BIM) TECHNIQUE IN REAL ESTATE DEVELOPMENT

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ABSTRACT

Purpose: In consideration of the modernity in the trend of real estate development projects, this paper purposed to introduce Building Information Modeling (BIM) approach to the professionalism of estate surveying and valuation as a tool to bridge the gap in attaining international best practices in real estate development.
Design/methodology/approach: The study adopted a qualitative approach to the presentation. It is a conceptual paper involving literature reviews and explanations of concepts, graphics, and models. The study did not involve field observations of collation of numeric data. The functions carried out by Estate Surveyors and Valuers were compared with the components of BIM such as 3-D, 4-D, etc., to show the relevance of the concept in real estate development.
Findings: Building Information Modeling (BIM) was noted to be an emerging trend in the construction industry amidst the third world nations and Nigeria in particular. This is not the same with advanced countries such as the United Kingdom (UK) and the United States of America (USA). The advanced countries are implementing the technetronic of BIM to match the advancement in the construction industries. The development of 3-D, 4-D, 5-D, 6-D and 7-D with their specialties are great attributes of this modeling. This is profitable for shared knowledge resource for information about a facility forming a reliable basis for decisions during property life cycle from inception to conclusion.
Research Limitations/Implications: The limitation of the study was on the poor awareness of the parts of Estate Surveyors and Valuers who were conversed with, to find out if they know about BIM. The situation was not peculiar to the estate surveyors alone but even to some professionals in practice in the construction industries. The limited awareness was majorly on theory not on practicum.
Practical Implications: It is pertinent to develop inclusive theoretical enlightenment supported with realistic practical exercises. This can be achieved with a good knowledge base in computer and software applications like AutoCAD, CADD and other related computer software. There should be a knowledge bridge linking theory and practice by organizing seminars, workshops, and conferences.
Originality/value: The work is original. It is not copied, presented elsewhere or published. It is very valuable to Estate Surveyors and participants of the Architecture, Engineering and Construction industry. The need to conceptualize BIM in real estate development accounts for inestimable benefits in advancing the profession to match with global best practices.

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Keywords: Building information modeling; Estate Surveyors and Valuers; global best practices; real estate development.

1. INTRODUCTION

This paper examines the need to conceptualize building information modeling (BIM) technique in carrying out real estate development in Nigeria. Real estate development is encompassing and involves several professionals in real estate related fields such as estate surveyors, town planners, architects, builders, etc. Real estate development is part of an activity carried out by estate surveyors, in synergy with builders and other professionals. Estate surveyors undertake critical roles in real estate development from the conceptual stage of the development to the completion and letting stage of the property. The traditional approach to real estate development at the preconstruction stage which involves architectural depictions is usually with 2D plans. This system is presently giving way to a more digitalized approach known as Building Information Modeling (BIM) with its unique 3D, 4D, 5D, 6D, and 7D modeling. BIM is not very popular in developing nations including Nigeria but it is extensively in use in developed nations. This study explores the benefits of this technique to estate surveyors by reviewing its applications as adopted in some developments. The study adopts a qualitative approach to the presentation. It is a conceptual paper involving literature reviews and explanations of concepts, graphics, and models. The study did not involve field observations of collation of numeric data. The functions carried out by estate surveyors and valuers were compared with the components of BIM such as 3-D, 4-D, etc., to show the relevance of the concept in real estate development.

2. CONCEPT AND EMERGENCE OF BUILDING INFORMATION MODELLING

Debasis and Raj (2015) explain Building Information Modeling (BIM) as a process involving the generation and management of digital representations of physical and functional characteristics of a building or a facility. It was further explained as a holistic documentation process for operational visualization, design coordination, estimation, and project scheduling. Dana (2008) and US National Building Information Model Standard Project Committee revealed that BIM serves as a shared knowledge resource for information about a building forming a reliable basis for decisions during its life cycle from inception onward. Dana further maintained that the basic premise of Building Information Modeling is a collaboration by different stakeholders at different phases of the life-cycle of a facility to insert, extract, update or modify information in the Model to support and reflect the roles of that stakeholder.

Debasis and Raj also adduced that BIM is an integrated 3D model containing data relevant to all participants of the investment process, including investors, designers, contractors, managers, and owners of the facilities. It provides almost unlimited possibilities in terms of presentation and analysis of the project, for instance, identifying collisions or change management. This could be possible through the use of BIM software which defines objects parametrically and it is a tool for virtual reality. Debasis and Raj pointed that basic advantage of implementing BIM is the visual coordination of the building

structure and systems such as Mechanical, Electrical and Plumbing (MEP) and it also identifies the possible conflicts between the building systems. The explanation here emphasized on digitalization as distinguishing attribute of BIM. Prior to the emergence of BIM, the traditional approach to real estate development was not digitally implemented.

Eastman, *et al*. (1974, 2008 and 2011) disclosed that the building information model emerged from the term 'building model.' Ruffle (1986) confirmed that the idea of building model has been a subject of discourse: it was first discussed in a paper presented by Ruffle (1986), and later discussed again in another paper by Aish (1986) then at Gollins Melvin Ward (GMW) Computers Ltd, the developer of RUCAPS software (Laiserin, 2008). Van-Nederveen and Tolman (1992) consented that the term 'Building Information Model' and 'Building Information Modelling' (including the acronym "BIM") did not become popular in use until some decade later. Autodesk (2002) drew the attention of some software vendors who began to assert their participation in the field. Laiserin (2002 and 2003) observed that contributions from Autodesk, Bentley Systems and Graphisoft, including other industry observers, helped to popularise and standardize the term BIM as a common name for the digital representation of building process.

3. IMPORTANCE OF BUILDING INFORMATION MODELING (BIM) TO REAL ESTATE DEVELOPMENT

The desire to own real estate has to be purpose driven. The purpose could be based on either investment or owner-occupied. When this decision is settled, then the planning, design, and construction takes off. The initial activity of real estate development is at the conceptual stage and demands the attention of an estate surveyor and valuer. An estate surveyor/valuer is an expert in land matters and plays a key role in land acquisition for development. BIM is a landless digital concept of a virtual development of a building and requires the ingenuity of an estate surveyor to realize. Eastman, et. al (2011) agree that BIM is designated at pre-construction stage by designers for conceptual design, sketching, space planning, orientation on site, and ensuring program compliance with regards to site-related factors. Lincoln and Syed (2010) buttressed that BIM is also identified to help in predicting building performance and also helps in reducing construction wastes. It can also reduce the adverse impact of construction and helps to integrate analysis, simulation, and visualization into workflow primarily to make informed decisions throughout the project life cycle. Debasis et al. (2015) stated that BIM is an intelligent model-based process that provides insight for creating and managing building and infrastructure projects with faster speed, economy, and quality.

Jim (2011) argued that prior to the advent of BIM; traditional building design was largely reliant upon two-dimensional technical drawings (plans, elevations, sections, etc.). Thus, Building Information Modeling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. Cinti and Garagnani (2012) observed that building information models (BIMs) are files (often but not always in proprietary formats and containing proprietary data) which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset. Current BIM software is used by individuals, businesses and government agencies that plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, railways, bridges, ports, and tunnels. As a rule, the use of 3D models: improves the ability for the project presentation, significantly improves the communication between the participants of the

investment process and reduces the amount of work. Kiziltas, et. al. (2009) asserted that building information modeling extends beyond 3D modeling, augmenting the three primary spatial dimensions (width, height, and depth) with time as the fourth dimension (4D). 3D modeling (or three-dimensional modeling) is the process of developing a mathematical representation of any three-dimensional surface of an object via specialized software.

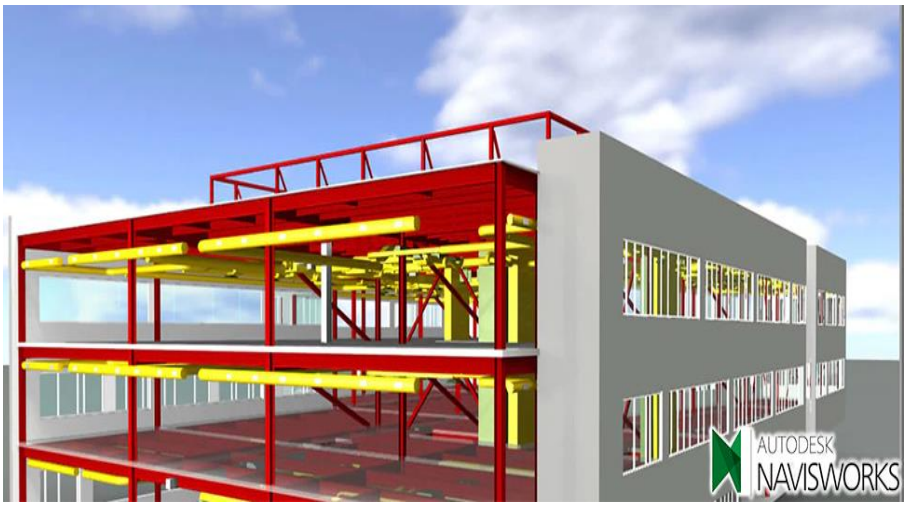

Fig. 1: Actual Structural Model that represents the 3D view of the structural framework of the building.
Source: AUTODESK - NAVISWORK

4. THE GROWTH OF THE BUILDING INFORMATION MODELING FROM 3D – 7D AND ITS APPLICATION IN REAL ESTATE DEVELOPMENT

Figure 1 shows a resulting model of a three-dimensional (3D) representation of the constructed facility. The 3D model thus generated is a virtual model which is digitally constructed to simulate planning, design, construction, and operation. It works on parametric rules and supposed to contain data attributes pertaining to different fields. 4D BIM refers to the intelligent linking of individual 3D CAD components or assemblies with time- or schedule-related information. The use of the term 4D is intended to refer to the fourth dimension: 4D = 3D + schedule. The construction of the 4D models enables the various participants of the construction process (designers, contractors, investors) to visualize the entire duration of a series of events and display the progress of construction activities through the lifetime of the project. This BIM-centric approach towards project management technique has a very high potential to improve the project management and delivery of construction project, of any size or complexity. The use of BIM 4D allows you for better control over the implementation of the investment process. This involves the ability to detect conflicts before proceeding to execute the task, effectively managing change and risk, or to support communication between the participants of the whole process. Schedule, as a rule, is fully compatible with the 3D model.

McKinsey (2015) identified 5D-BIM as one of five trends that will change the future of the global construction industry. McKinsey says “Combining 5D-BIM and augmented-reality devices will transform construction, maintenance, and operations. To get the full

benefit of BIM technology, project owners and contractors need to incorporate its use right from the design stage, and all stakeholders need to adopt standardized design and data-reporting formats compatible with BIM. In addition, owners and contractors need to dedicate resources for BIM implementation and invest in capability building. 5D-BIM is an evolving segment in the construction industry, comprehending the customary three-dimensions of a BIM with the schedule as the fourth dimension and cost estimates as the fifth dimension. The 5D-BIM approach offers an exceptional opening to unite practices in design, cost and construction approaches. On the other hand, it should be noted that 5D BIM approaches call for a significant change in the way construction companies work.

ASHRAE (2012) reveals that recently there are also references to a sixth dimension (6D) representing building environmental and sustainability aspects, and a seventh dimension (7D) for through-life facility management, although there are conflicting definitions (6D BIM). BIM covers more than just geometry. It also covers spatial relationships, light analysis, geographic information, and quantities and properties of building components (for example, manufacturers' details). 6D BIM facilitates the implementation of energy analysis for buildings. Use of 6D allows for more accurate and comprehensive energy analysis of the building already at an early stage of the design process. It also allows you to measure and verify the data on the stage of use of the building in such areas as real energy demand for the building. Based on the simulation model created on the basis of collected data we raise the relevance and quality of the projects, which translates into reduced power consumption.

BIM 7D is used by managers in process of the object management on the stage of its operation. 7D allows participants of the process to extract and store data assets, such as the state of the object/component, technical specifications, required maintenance schedule and technical reviews, manuals or applicable warranty period. Such an approach to the facility management process not only improves the whole process but also improves the quality of services in this area.

5. THE USE OF BUILDING INFORMATION MODELING (BIM) AS A REAL ESTATE PRE-INVESTMENT TOOL

Odudu (1991) argues that Estate Surveyors and Valuers should be engaged at every stage of the development process of a real estate development; from the conceptual stage to the delivery stage. Odudu's argument is that estate surveyors and valuers cannot be avoided in the property development processes. The skill of estate surveyor and valuer in the collective analysis of every stage of the property development process cannot be overemphasized. The basic premise of Building Information Modeling is a collaboration by different stakeholders at different phases of the life-cycle of a facility to insert, extract, update or modify information in the Model to support and reflect the roles of that stakeholder (Dana, 2008). A careful examination of the nitty-gritty of building information modeling reveals that BIM can be used as a tool for feasibility and viability study of real estate development.

Fundamentally, any real estate development that would be sustainable has to pass through feasibility assessment and viability test. Ogbuefi (2002) observed that in many developing countries, feasibility and viability studies were usually not accorded its critical position in overall development equation. He construed that this had led to disastrous effects on the overall performance and the final outcome of projects. Every development takes place on land and requires an expert on land matters to analyze the economic

propensity of the land so that the development may not fail. Ring and Dasso (1985) argued that judging a site suitable for development is the most basic decision of an investor-developer. They further argued that most other decisions in the development process flow from the site selection decision. They maintained that acquisition of the site or even committing resources to study a site and its potential for development is the first decision. BIM can be used as a maintenance evaluation tool in the area of property management. It can be used to assess defects in building to decide how it can be repaired. BIM is a veritable tool in property management. Property management is the operation, control, and oversight of real estate. This is much akin to the role of management in any business. It is also the management of physical capital assets that are acquired and used to build, repair, and maintain end item deliverables. It involves the processes, systems, and manpower required to manage the life cycle of all acquired property including acquisition, control, accountability, responsibility, maintenance, utilization, and disposition.

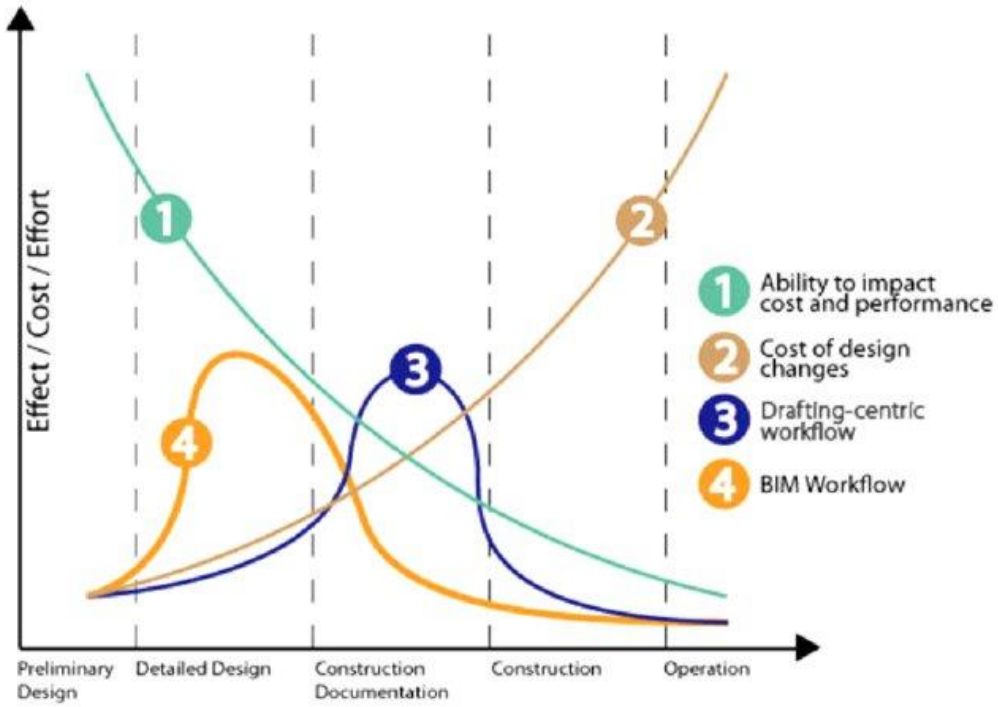

Figure 2: Comparing different distributions for design services. Copyrights: Marcatects

Figure 2 above compares different distributions for design services. This is a model developed by Marcatects. The graph is adopted in this study to illustrate the design service of a building project. The vertical axis represents effect/cost/effort of design services and the horizontal axis represents four levels of activities which are preliminary design, detail design, construction documentation, construction, and operation. The graph (curve) labeled one (1) shows the ability to impact cost and performance. The Curve two (2) shows the cost of design changes, Graph (curve) three (3) shows drafting-centric workflow and the fourth (4) curve or graph shows the BIM workflow. From the graph, the areas where estate surveying and valuation profession are most needed are at the preliminary design and operation. At the preliminary design; feasibility and viability studies, estate agency, public lands administration and land use planning & management are the responsibility areas where the services of estate surveyors may be required. The operation in figure 2 above represents the last stage in the design service of the project. In this case, the operation stage

could be referred to as the handing over or use stage of the completed project for services. The operation stage is the takeover stage when the building is given to estate surveyors and valuers to manage for the service life of the facility. It is at this stage that property management function comes into play for the sustainability of the property. Valuation of the property may be useful to determine the value of the property in case of related financial transactions such as investment decisions, borrowing, sales, etc.

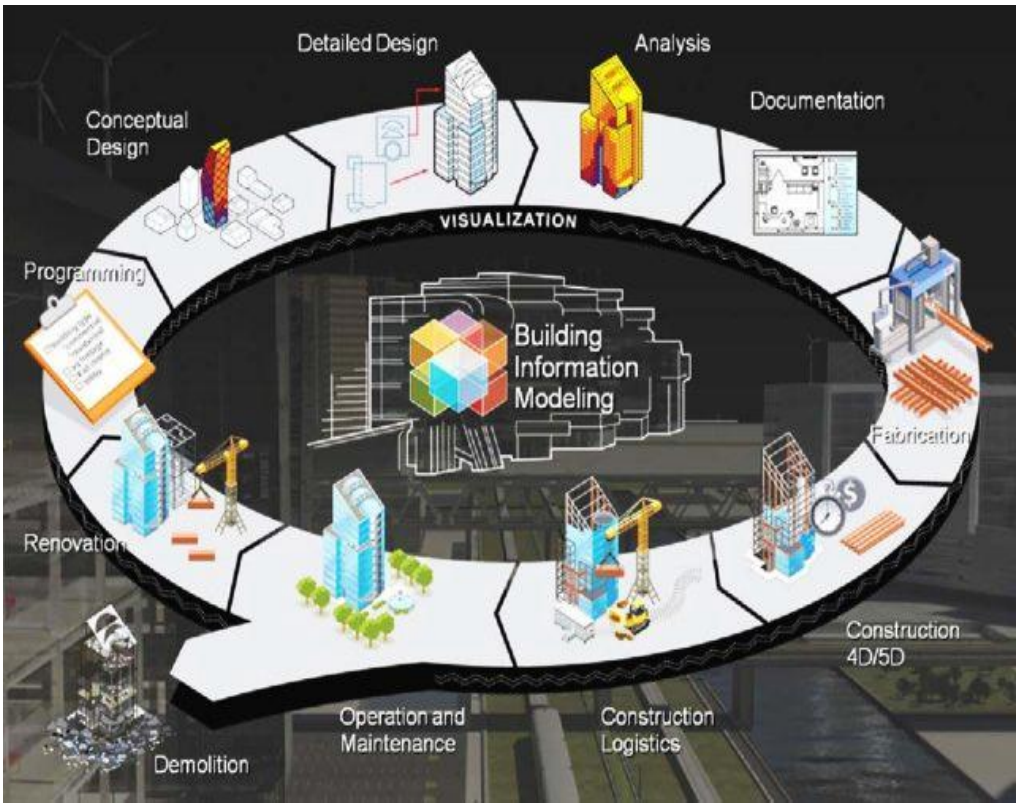

Figure 3: Concept of BIM.

Figure 3 above displays eleven (11) activity areas of building information modeling. The activities in the concept of BIM model above show different roles by various stakeholders who are experts in different disciplines. Estate surveyors' role is obvious in terms of operation and maintenance. The operation is the stage that precedes demolition and it is also regarded as the use stage after construction is completed and the building is ready for occupation. Maintenance stage begins at the inception of taking over for use. Maintenance is a process involved in taking care of the building in a way that depletion in value or quality of the building is avoided. According to Defense Logistics Agency (2016), the technical meaning of maintenance involves functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations.

Yuseni (2013) stressed that building maintenance management (BMM) is essential to prolong the building life cycle and reduce the owner's loss. When buildings are neglected, defects can occur which may result in extensive and unavoidable damage to the building fabric or structure (European Federation of National Maintenance Societies, 2016). Over time, this has come to often include both scheduled and preventive maintenance as cost-effective practices to keep equipment ready for operation at the utilization stage of a system lifecycle (Wu & Zuo, 2010). From AAP-6 (Glossary of terms and definitions), maintenance

is strictly connected to the utilization stage of the product or technical system, in which the concept of maintainability must be included. In this scenario, maintainability is considered as the ability of an item, under stated conditions of use, to be retained in or restored to a state in which it can perform its required functions, using prescribed procedures and resources (Commercial Electrical Contractor and Domestic Electrician Leeds, 2017). The role of estate surveyor in maintenance is not necessarily carrying out masonry, carpentry or plumbing works but to identify the defect areas that require maintenance and coordinate the various experts to do the job to satisfaction point.

6. INTERNATIONAL PERSPECTIVES OF BIM DEVELOPMENT

Several nations of the world are enrolling in the technique of Building Information Modeling as modernity in advancing the construction industry through virtual design. Countries including India have an expanding construction market and yet BIM usage was reported by only 22% of respondents to a 2014 survey (Sawhney, Anil et al. 2014). BIM Association in Iran (IBIMA) was founded in 2012 and while it was not active, IBIMA aimed to share knowledge resources to support construction engineering management decision-making (Hosseini, 2016). In Malaysia, BIM implementation was led by the Construction Industry Development Board (CIDB Malaysia) under the Construction Industry Master Plan 2016-2020 and emphasized on technology adoption across the project life-cycle to induce higher productivity. Lee, et al. (2012) accounts that small BIM-related seminars and independent BIM effort existed in South Korea even in the 1990s. It was not until the late 2000s that the Korean industry paid attention to BIM. Since 2010, the Korean government has been gradually increasing the scope of BIM-mandated projects.

BIM Summit (2015) calls for greater co-operation as reported in ConstructionWeekOnline.com which accounted that Dubai Municipality issued a circular (196) in 2014 mandating BIM use for buildings of a certain size, height or type. The one-page circular initiated strong interest in BIM and the market responded in preparation for more guidelines and direction. In 2015 the Municipality issued another circular (207) titled 'Regarding the expansion of applying the (BIM) on buildings and facilities in the emirate of Dubai' which made BIM mandatory on more projects by reducing the minimum size and height requirement for projects requiring BIM. This second circular drove BIM adoption further with several projects and organizations adopting UK BIM standards as best practice. In 2016, the United Arab Emirates (UAE's) Quality and Conformity Commission set up a BIM steering group to investigate statewide adoption of BIM.

In France, a Building transition digital plan - French acronym PTNB – was created (mandated from 2015 to 2017 and under several ministries). There was also the French arm of building SMART, called Mediaconstruct (existing since 1989). White (2015) conveyed that in December 2015, the German minister for transport Alexander Dobrindt announced a timetable for the introduction of mandatory BIM for German road and rail projects from the end of 2020. Speaking in April 2016, he said digital design and construction must become standard for construction projects in Germany. In April 2016, Italy included into its own legislation several European directives including 2014/24/EU on Public Procurement. The decree states among the main goals of public procurement the "rationalization of designing activities and of all connected verification processes, through the progressive adoption of digital methods and electronic instruments such as Building and Infrastructure Information Modelling (Department of Public Expenditure and Reform, 2017).

UK Government organized BIM Task Group for BIM programme and requirements, including a free-to-use set of UK standards and tools that define level 2 BIM. The BIM Task Group continues to develop BIM adoption within the government departments. Outside of government, industry adoption of BIM from 2016 has been led by the UK BIM Alliance, formed to champion and enable the implementation of BIM Level 2 by 2020 and to connect and represent organizations, groups, and individuals working towards a digital transformation of the UK's built environment industry. The April 2016 survey of 1,000 UK construction professionals revealed that BIM adoption had increased from 13% in 2010 to 54% in 2015 (NBS National BIM Report, 2016). Several organizations support BIM adoption and implementation in Canada: The Canada BIM Council (CANBIM, founded in 2008), the Institute for BIM in Canada and building SMART Canada (the Canadian chapter of building SMART International). The Associated General Contractors of America and US contracting firms developed various working definitions of BIM that describe it generally as an object-oriented building development tool that utilizes 3-D modeling concepts, information technology, and software interoperability to design, construct and operate a building project, as well as communicate its details. Unlike some countries such as the UK, the US has not adopted a set of national BIM guidelines, allowing different systems to remain in competition (Shapiro, 2014).

The South African BIM Institute, established in May 2015, aims to enable technical experts to discuss digital construction solutions that can be adopted by professionals working within the construction sector. Its initial task was to promote the SA BIM Protocol. There are no mandated or national best practice BIM standards or protocols in South Africa. Organizations implement company-specific BIM standards and protocols at best (there are isolated examples of cross-industry alliances).

7. NIGERIA PERSPECTIVES OF BUILDING INFORMATION MODELLING (BIM)

Nigeria is one of the nations of the world where the concept of BIM is pictured despite the resistance in implementing the idea. Utiome et al (2014) argued that BIM could play a vital role in the Nigerian Architectural Engineering Construction (AEC) sector, adding that its potential clarity and transparency can help to promote standardization across the development industry. They buttressed that, in conceptualizing a BIM-based knowledge transfer framework from industrialized economies to urban construction projects in developing nations, generic BIM objects can benefit from rich building information within specification parameters in product libraries, and used for efficient, streamlined design and construction. In an agreement, Kori (2013) observed that medium and large firms were leading the adoption of BIM in the industry. Smaller firms were less advanced with respect to process and policy adherence. There is little or less adoption of BIM in the built environment due to the resistive nature of the construction industry to changes or new ways of doing things. Till now, the Nigerian construction industry is still working with the 2D conventional CAD system in services and structural designs, although the production could be in the 3D system. There is virtually 0% utilization of 4D and 5D systems.

8. THE IMPLICATIONS OF THE RESEARCH

The BIM concept if fully adopted in the professional practice of any discipline with its technological resourcefulness; it will definitely add value to the growth of the sector. This study identifies poor awareness of the technological trend of BIM in Nigeria as revealed in the literature reviewed (Kori, 2013 and Utiome, 2014). This is implicated on poor development of AEC sector of the real estate industry which affects the economy. Real estate industry is a major resource base of nation's economy. It is therefore pertinent to develop inclusive theoretical enlightenment supported with realistic practical obligations. This can be achieved with a good knowledge base in computer and software applications like AutoCAD, CADD and other related computer software. There should be a knowledge bridge linking theory and practice by organizing seminars, workshops, and conferences.

9. CONCLUSION

Building information modelling (BIM) is a new approach to building an industry that can be useful in real estate development. The study concludes that conceptualization of the use of BIM in the real estate development process will be an advancement in the professional practice of estate surveyors and valuers. The application of BIM in real estate practice especially in projects development will draw specialists in allied professions together to solve knotty issues relating to real estate development. BIM can serve as a pre-analytical tool for real estate development and post-analytical tool at use stage of the real property management.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

ECONOMIC PERFORMANCE OF SMALL, MEDIUM AND LARGE CONSTRUCTION FIRMS IN NIGER - DELTA, NIGERIA

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ABSTRACT

Purpose: The call for the sustainability of construction firms in Niger Delta, Nigeria cannot be over emphasized. This study assessed the economic performance of small, medium and large construction firms in Niger Delta, Nigeria.

Design/methodology/approach: Survey design approach was adopted in this study. Data were obtained using 1179 copies of structured questionnaire, administered by the researcher and research assistants. The Data were collected on a five-point scale of 1, 2, 3, 4 and 5 and were assigned to the options of very low growth, low growth, moderate growth, high growth and very high growth respectively. Methods of data analysis were simple percentage, and mean score, Kruskal Wallis test and Bonferroni dunnett test.

Findings: This study revealed that the overall level of employment growth among construction firms in Niger-Delta is moderate. The result of the study also showed that the level of employment growth among large construction firms is higher than the level of employment growth among small and medium construction firms in Niger- Delta. Further, the overall level of financial turnover growth of construction firms in Niger Delta is moderate. The level of financial turnover growth of small, medium and large firms is also moderate. This study also revealed that the level of financial turnover growth of large construction firms is higher than the level of financial turnover of small, and medium construction firms in Niger- Delta. This study evaluated the net income growth of construction firms in Niger Delta, Nigeria and found out that there is moderate level of net income growth among the construction firms in Niger- Delta. Finally, the study showed that the level of net income growth of large construction firms is higher than the net income growth of small, and medium construction firms in Niger- Delta.

Research Limitation: This study adopted subjective measure to evaluate annual employment growth, annual financial turn-over and net-income growth of construction firms in Niger- Delta, Nigeria over a period of ten years (2007-2017) on a five-point scale.

Originality/value: The outcome of the article will help constructions firms and construction stakeholders at large to know the level of economic performance of small, medium and large construction firms and make better decisions as far as construction activities are concerned in Niger- Delta, Nigeria.

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Keywords: Construction firms; economic performance; Niger-Delta; Nigeria; small, medium and large.

1. INTRODUCTION

The construction industry is an important industry for the development of every society but it takes up a lot of non-renewable resources and contributes to natural resources depletion as well as responsibility for high levels of pollution, climate change and other environmental threats (Klang etal, 2003). According to Chambers (1993), sustainability is defined as "that which is capable of being sustained; in ecology, the amount or degree to which the earth's resources may be exploited without deleterious effects. Sustainability at the firm level refers to meeting social and environmental needs in addition to the firm's profitability (Porter, 2008).

The Niger Delta which is located in the southern part of Nigeria has some peculiar characteristics ranging from the climate, terrain, vegetation, culture, economic activities and value system. The Niger Delta Region of Nigeria produces a significant portion of the aggregate oil wealth of Nigeria. Since 1956 when oil was first discovered in Oloibiri in Southern Nigeria, the Niger Delta region has accounted for over 90 per cent of Nigeria's oil income (Ujene, 2014). However, the region has perennially suffered from environmental neglect, crumbling infrastructures and services, high unemployment, social deprivation, abject poverty and endemic conflict. This has led to calls for firms operating in the Niger- Delta to demonstrate the value of their investments to Nigeria by undertaking increased community development initiatives that provide direct social benefits such as local employment, new infrastructure, schools, and improved health care delivery (Ijaiya, 2014).

Tam (2008) and Lilja (2009) stated that in the construction industry, sustainability is generally interpreted as environment oriented or focused. In contrast, Shen etal (2010) stated that a greater concern is given to economic and social issues. According to Ekundayo etal (2011), the construction industry has often explored the economic dimension which explains why most of the times projects are awarded to the contractor with the lowest tender (Fotwe and Price, 2009).

Many researches were conducted to determine key performance indices but most of them were project specific. They concentrated on the performance measurement at the project level. Existing research, which has been conducted for performance evaluation and comparison at the company level, is limited in the literature (Ali etal, 2012). To bridge this gap, this research evaluated a set of economic performance indicators (EPIs) that can be implemented by construction executives in measuring the construction performance at the firm level in Niger Delta in particular and Nigeria in general.

1.1. Objective of the study

The objective of this study is to assess the economic performance of small, medium and large construction firms in Niger Delta, Nigeria.

1.2. Research hypothesis

Some researchers claim size influences firms' economic performance and some claim it does not. In view of this debate, this study tested three hypotheses in order to establish if there is significant difference in the economic performance of construction firms based on firm size. The hypotheses are as follows:

i. There is no significant difference in the level of annual employment growth among small, medium and large construction firms in Niger- Delta, Nigeria
ii. There is no significant difference in the level of annual financial turnover growth among small, medium and large construction firms in Niger- Delta, Nigeria
iii. There is no significant difference in the level of net income growth among small, medium and large construction firms in Niger- Delta, Nigeria.

2. REVIEW OF RELATED LITERATURE

This section comprises of the measurement of firm performance and the influence of firm size on the performance of construction firms.

2.1. Measurement of firm performance

Highly competitive and profound changes in the construction industry are forcing construction executives to continuously improve the performance of their firms. According to Luu *et al.* (2008), performance measurement is the heart of ceaseless improvement. The main objective of performance evaluation is to assist managers and members of the organization in developing the direction, and speed of their organization (Cokins, 2006). Firm's growth can be measured by several attributes such as turnover/sales, annual employment, return on assets, return on investment, market shares, annual financial turnover, profits and net income. However, in the context of this study, employment growth, financial turnover and net income were used as indicators of firm performance. This is because employment has been considered as an alternative measure for performance and with the public interest in new employment, there are arguments that employment growth is an important dimension to capture (Wiklund, 1999). The choice of annual financial turnover is also significant because it reveals the volume of work done by the firms within the period under study. It also reveals the level of survival and competitiveness of the firms in the study area. Superior financial performance is a way to satisfy investors (Chakravarthy, 1986) and can be represented by profitability, growth and market value (Venkatraman and Ramanujam, 1986; Cho and Pucik, 2005). These three aspects complement each other. Profitability measures a firm's past ability to generate returns (Glick *etal*, 2005). Growth demonstrates a firm's past ability to increase its size (Whetten, 1987). Increasing size, even at the same profitability level, will increase its absolute profit and cash generation. Larger size also can bring economies of scale and market power, leading to enhanced future profitability.

2.2. Influence of organizational size on the performance of construction firms

Organization size (as defined by the number of employees) has received substantial attention from researchers and management writers as a fundamental component affecting organizational design, structure and shape. Shaheen and Malik (2012) stated that firm size is the quantity and array of production capability and potential a firm has or the quantity and diversity of services a firm can concurrently make available to its clients. Some researchers claim size influences organizational effectiveness and efficiency and some claim it does not (Amah *et al*., 2013). Hofler (2010) stated that organisational size has been identified as an important variable that influences organizational performance. Babalola (2013) stated that larger firm has more influence on its stakeholders, therefore larger firms tend to outperform small firms.

Akinlo (2010) evaluated the long-run relationship and causality issues between the size of firm size and profitability in Nigeria. The result revealed that there was a long-run steady state relationship between firm size and profitability. Anila *et al.* (2011) investigated the determinants of profitability of Pakistani firms, in which size is a major determinant. The study showed a positive but insignificant impact of firm size on profitability. Halil and Hasan (2012) examined the effect of firm size on profitability, with evidence from Turkish manufacturing companies. The results of the study showed that firm size has a positive impact on the profitability of Turkish manufacturing companies. Bayyurt (2007) opined that large firms have more competitive power than small firms. This is because large firms have a bigger market share, as well as the opportunity to make more profit. Furthermore, large firms have high capital rates since they have larger resources, and this situation gives them the opportunity to work in more profitable fields with little competition. Majority of the studies in literature were carried out in the manufacturing industry. Hence the need for this study which evaluated the economic performance of construction firms based on firm size. Also, there is limited study in the Niger- Delta area of Nigeria that have evaluated the economic performance of construction firms using annual employment growth, annual financial growth and net- income growth.

3. RESEARCH METHODOLOGY

Survey design approach was adopted in this study. Data were obtained using 1179 copies of structured questionnaire, administered by the researcher and research assistants. The Data were collected on a five-point scale of 1, 2, 3, 4 and 5 and were assigned to the options of very low growth, low growth, moderate growth, high growth and very high growth respectively. This is in consonance with Santos and Britos (2012). Methods of data analysis were simple percentage, and mean score, Kruskal Wallis test and Bonferroni dunnett test. Simple percentage was used to analyze the questionnaire distribution and response rate and firm characteristics. Kruskal Wallis test was used to test three hypotheses which state that there is no significant variation in the economic performance (annual employment growth, annual financial turn-over and net-income growth) among small, medium and large construction firms in Niger- Delta, Nigeria. The three hypotheses were tested and the result of Kruskal Wallis test showed that there is significant difference in annual employment growth, annual financial turn-over and net- income among small, medium and large construction firms. Bonferroni dunnett test was carried out to know the

source of the difference in economic performance among small, medium and large construction in Niger- Delta, Nigeria.

3.1. Sample frame and sample size

The population of this study comprises of small, medium and large construction operating in Niger- Delta, Nigeria. Table 1 shows the sample frame and sample size of this study. The Sample size was determined using the Yamane (1967) equation as shown below:

$$n = \frac{N}{1 + N(e)^2}$$

where n = Sample size
N = Finite population
e = Level of significance (0.05)
1 = Unity

This study adopted Yamane (1967) equation for determining sample size because of its simplicity, reliability and validity. These have encouraged its wider acceptance and usage among researchers over a long period of time.

Table 1: Sample frame and sample size of construction firms in Niger Delta

State	**Sample Frame**	**Sample Size**
Abia	165	117
Akwa Ibom	214	139
Bayelsa	128	97
Cross River	223	143
Delta	200	133
Edo	237	149
Imo	143	105
Ondo	221	142
Rivers	250	154
Total	**1781**	**1179**

4. DATA PRESENTATION AND DISCUSSION OF RESULTS

This section contains the results of the analysis of data collected for the study. It contains the descriptive results of the response rate of questionnaire, and firm characteristics. This section also contains the result of evaluation of economic performance of small, medium and large construction firms in Niger- Delta, Nigeria and the result of the hypothesis.

4.1. Questionnaire distribution and response in the study

One of the research instrument used in this study was structured questionnaire. The questionnaire was administered among the construction firms operating in Niger Delta, Nigeria. The results of analysis were presented in Table 2.

Table 2 showed that the number of questionnaire administered to the construction firms in Niger Delta were 117, 139, 97, 143, 133, 149, 105, 142, and 154 in Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, and Rivers state respectively. From the questionnaire distributed, the response rate ranges between 76.1% and 94.7%. Delta state received the highest response rate of 94.7% while Abia State got the least rate of 76.1 %. In all, an overall response rate of 83.2**%** was achieved. Groves (2006) noted that a response rate of at least 50 percent is considered adequate for analysis and reporting, a response of 60 percent is good and a response rate of 70 percent is very good. As a guide, researchers typically seek response rates of at least 70% to feel confident that their sample is representative of the sample frame. Hence, the overall response rate of 83.2% in this study is considered very good and adequate.

Table 4.2: Questionnaire distribution and response rate

S/N	States	Number of questionnaire administered on construction firms (NO)	Number of questionnaire returned (NO)	Percentage of questionnaire returned (%)	Average of the Response Rate (%)
1	Abia	117	89	76.1	
2	Akwa Ibom	139	113	81.3	
3	Bayelsa	97	85	87.6	
4	Cross River	143	112	78.3	
5	Delta	133	126	94.7	
6	Edo	149	114	76.5	
7	Imo	105	92	87.6	
8	Ondo	142	109	76.8	
9	Rivers	154	140	90.1	
10	TOTAL	1179	980		83.2

4.2. Firm characteristics

Firms' characteristics comprised of location of construction firms and size of construction firms.

4.2.1. Location of construction firms

Table 3 shows the distribution of construction firms in each state in Niger Delta, Nigeria. The percent of firms in Abia, Akwa Ibom, Bayelsa and Cross river states are 9.1%, 11.5%, 8.7% and 11.4%. Others are Delta, Edo, Imo, Ondo and Rivers with their percents of 12.9%, 11.6%, 9.4%, 11.1% and 14.3% respectively. Table 3 shows a good distribution of the construction firms among the states in Niger Delta. This implies that the results from this study represents the situation in Niger Delta and can be relied on.

4.2.2. Size of construction firms under study in Niger – Delta region of Nigeria between 2007- 2016

Analysis on Table 4 shows the average percentage distribution of construction firms in Niger Delta according to their sizes over a period of ten years (2007-2016). The analysis shows that small firms account for 84.7%, medium firms account for 11.61 and large construction firms account for 3.73%. This reveals that small and medium construction

firms are of the majority. This result is in consonance with Abdullah *etal*, (2012); and Thwala *et al.* (2012) who posited that firms in the construction industry have been grouped such that Small and Medium Firms (SMFs) were found be the majority.

Table 3: Location of construction firms

States	**Frequency**	**Valid Percent**	**Cumulative Percent**
Abia state	89	9.1	9.1
Akwa Ibom state	113	11.5	20.6
Bayelsa state	85	8.7	29.3
Crossriver state	112	11.4	40.7
Delta state	126	12.9	53.6
Edo state	114	11.6	65.2
Imo state	92	9.4	74.6
Ondo state	109	11.1	85.7
Rivers state	140	14.3	100.0
Total	980	100.0	

Table 4: Size of construction firms under study in Niger - Delta between 2007- 2016

S/N	YEAR	1-50		50-250		250 AND ABOVE	
		FREQ	PER	FREQ	PER	FREQ	PER
1	2007	857	87.4	88	9.0	35	3.6
2	2008	790	80.6	155	15.8	35	3.6
3	2009	842	85.9	103	10.5	35	3.6
4	2010	821	83.8	120	12.2	39	4.0
5	2011	813	83.0	129	13.2	38	3.9
6	2012	754	76.9	188	19.2	38	3.9
7	2013	811	82.8	131	13.4	38	3.9
8	2014	870	88.8	75	7.7	35	3.6
9	2015	868	88.6	77	7.9	35	3.6
10	2016	874	89.2	71	7.2	35	3.6
AVERAGE			84.7		11.61		3.73

4.3. Annual employment growth of small medium and large construction firms in Niger- Delta, Nigeria

Table 5 shows the annual employment growth of small, medium and large construction firms in Niger Delta. The decision rule is that any employment growth whose mean falls between 1.0 – 1.8 is of very low growth, 1.8 – 2.6 is of low growth, 2.6 – 3.4 is of moderate growth, 3.4 – 4.2 is having high growth and 4.2 – 5.0 is regarded as having very high growth. The result analysis showed that small size (1-50 employees) construction firms experienced low employment growth in 2007 and 2008. The mean scores ranging between 2.6018 and 3.2860 showed that the small construction firms experienced moderate employment growth from 2009 to 2015. It was also revealed that the employment growth among small construction firms declined from moderate level to low level in 2016 as indicated by the mean score of 2.51. The average mean score of 2.83 showed that the overall level of employment growth among small (1-50 employees) construction firms in Niger Delta was moderate.

The mean score of 2.25 indicated that medium size (50-250 employees) construction firms in Niger Delta experienced low employment growth in 2007. However, mean scores ranging between 2.63 and 3.21 showed that there was moderate employment growth among medium size construction firms from 2008 to 2016. The average mean score of 2.84 implied that the overall level of employment growth among medium size construction firms in Niger Delta was moderate. Furthermore, it was revealed that the employment growth of the large size (above 250 employees) construction firms was moderate in 2007, 2008, 2009, 2010 and 2011. There was an improvement on the employment growth of large size construction firms in 2012 and 2013 as the firms recorded high employment growth.

However, the employment growth declined from high growth level in 2013 to moderate growth level in 2014. The large construction firms also experienced moderate employment growth in 2015 and 2016 respectively. The mean score of 3.23 showed that the level of employment growth among large construction firms in Niger Delta is moderate. The average mean score of 2.84 showed that the overall level of employment growth according to the three firm sizes was moderate.

Table 5: Annual employment growth of small medium and large construction firms in Niger-Delta, Nigeria

Size of Firms /Year	**Small Firms (1-50) N=874**		**Medium Firms (50-250) N=71**		**Large Firms (Above 250) N=35**		**Combined N=980**	
	M.S	Remark	M.S	Remark	M.S	Remark	M.S	Remark
2007	2.27	L.G	2.25	L.G	2.91	M.G	2.29	L.G
2008	2.53	L.G	2.63	M.G	3.11	M.G	2.56	L.G
2009	2.60	M.G	2.75	M.G	3.20	M.G	2.63	M.G
2010	2.82	M.G	3.03	M.G	3.34	M.G	2.86	M.G
2011	2.97	M.G	3.04	M.G	3.31	M.G	2.99	M.G
2012	3.18	M.G	3.08	M.G	3.40	H.G	3.18	M.G
2013	3.29	M.G	3.21	M.G	3.49	H.G	3.29	M.G
2014	3.13	M.G	2.92	M.G	3.34	M.G	3.13	M.G
2015	2.97	M.G	2.93	M.G	3.23	M.G	2.98	M.G
2016	2.56	L.G	2.51	L.G	2.97	M.G	2.53	L..G
Overall Level of Employment Growth in Niger Delta	2.83	M.G	2.84	M.G	3.23	M.G	2.84	M.G

L.G=Low Growth, M.G = Moderate Growth, H.G = High Growth

4.3.1. Kruskal Wallis test for comparing the annual employment growth among small medium and large construction firms in Niger- Delta, Nigeria

Table 6 shows the result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant difference in the level of annual employment growth among small medium and large construction firms in Niger- Delta, Nigeria. The P-value of 0.001 is less than 0.05 significance level, hence the hypothesis was rejected. This implies that there is a statistically significant difference in the level of employment growth of firms based on size of the firms in Niger Delta. In other word, the size of construction firms affects the level of employment growth of construction firms in Niger Delta. The mean ranks showed that large construction have higher annual employment growth than small and medium construction firms in Niger Delta, Nigeria.

Table 6: Kruskal Wallis test for comparing the annual employment growth among small medium and large construction firms in Niger- Delta, Nigeria

Level of Employment Growth of Firms based on Size of the Firms in Niger Delta	Mean Rank	Decision @ 0.05 Sig lev.
SMALL FIRMS	12.77	
MEDIUM FIRMS	12.64	
LARGE FIRMS	25.59	
Chi-Square	13.03	
D.F	2	
P- Value	.001	Reject

4.3.2. Post Hoc test on level of employment growth of small medium and large construction firms in Niger Delta

Table 7 shows the results of Post Hoc Test on Level employment growth of firms based on size of the firms in Niger Delta. The result of Bonferroni's multiple comparisons shows that large construction firms contributed to the significant difference in the level of employment growth of firms in Niger Delta. This was validated by Dunnest test result which showed that small and medium construction firms have the p- values of 0.002 and 0.003 respectively. These P- values are less than the 0.05 significant level. This implies that that the level of employment growth of firms among small and medium construction firms are significantly different from large construction firms in Niger Delta.

Table 7: Post Hoc test on level of employment growth of small medium and large construction firms in Niger Delta

	(I) SIZE OF CONSTRUCTION FIRMS	(J) Size of Construction Firms	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	SMALL FIRMS	MEDIUM FIRMS	-.0079	.11335	1.000	-.2953	.2795
		LARGE FIRMS	-.4041*	.11335	.004	-.6915	-.1167
	MEDIUM FIRMS	SMALL FIRMS	.0079	.11335	1.000	-.2795	.2953
		LARGE FIRMS	-.3962*	.11335	.004	-.6836	-.1088
	LARGE FIRMS	SMALL FIRMS	.4041*	.11335	.004	.1167	.6915
		MEDIUM FIRMS	.3962*	.11335	.004	.1088	.6836
Dunnett (2-sided)	SMALL FIRMS	LARGE FIRMS	-.4041*	.11335	.002	-.6672	-.1410
	MEDIUM FIRMS	LARGE FIRMS	-.3962*	.11335	.003	-.6593	-.1332

4.4. Annual financial turnover growth of construction firms of small, medium and large construction firms in Niger Delta, Nigeria

Table 8 shows the annual financial turnover growth of construction firms based on the size of firms. The decision rule is that any financial turnover growth whose mean falls between 1.0 – 1.8 is of very low growth, 1.8 – 2.6 is of low growth, 2.6 – 3.4 is of moderate growth, 3.4 – 4.2 is having high growth and 4.2 – 5.0 is regarded as having very high growth. The result indicated that small and medium size construction firms in Niger Delta experienced moderate financial turnover growth from 2007 to 2015. However, there was a

decline in the financial turnover growth of the small and medium size construction firms from moderate level to low level in 2016. The average mean scores of 2.89 and 2.96 for small and medium construction firms respectively implied that their overall level of financial turnover growth of firms small and medium size construction firms in Niger Delta, was moderate.

Table 8 also shows that large construction firms experienced moderate financial turnover growth from 2007 to 2009. It was also noted that large firms experienced improvement in their financial turnover growth between 2010 and 2013. However, the high financial turnover growth dropped to moderate growth in 2014 and the situation continued till 2016. The average mean score of 3.34 showed that the overall level of financial turnover growth among large construction firms in Niger Delta was moderate within the period under this study.

Table 8: Annual Financial Turnover Growth of Small, Medium and Large Construction Firms in Niger Delta, Nigeria

Size of Firms /Year	**Small Firms (1-50) N=874**		**Medium Firms (50-250) N=71**		**Large Firms (Above 250) N=35**		**Combined N=980**	
	M.S	Remark	M.S	Remark	M.S	Remark	M.S	Remark
2007	2.62	M.G	2.82	M.G	3.31	M.G	2.66	M.G
2008	2.61	M.G	2.82	M.G	3.31	M.G	2.65	M.G
2009	2.70	M.G	2.86	M.G	3.34	M.G	2.74	M.G
2010	2.95	M.G	3.06	M.G	3.46	H.G	2.98	M.G
2011	3.08	M.G	3.20	M.G	3.51	H.G	3.11	M.G
2012	3.22	M.G	3.27	M.G	3.57	H.G	3.23	M.G
2013	3.29	M.G	3.35	M.G	3.63	H.G	3.31	M.G
2014	2.99	M.G	2.85	M.G	3.29	M.G	2.99	M.G
2015	2.94	M.G	2.93	M.G	3.14	M.G	2.95	M.G
2016	2.46	L.G	2.42	L.G	2.86	M.G	2.47	L.G
Level of Annual Financial Turnover in Niger Delta	2.89	M.G	2.96	M.G	3.34	M.G	2.91	M.G

L.G = Low Growth, M.G = Moderate Growth, H.G = High Growth

4.4.1. Kruskal Wallis test for comparing the annual financial turnover growth among small, medium and large construction firms in Niger Delta, Nigeria

Table 9 shows the result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant difference in the level of annual financial turnover growth among small medium and large construction firms in Niger- Delta, Nigeria. P-value of 0.001 is less than 0.05 significance level, hence the hypothesis was rejected. This implies that there is a statistically significant difference in the level of annual financial turnover growth among small, medium and large construction firms in Niger Delta, Nigeria. The mean ranks revealed that the large construction firms experienced higher annual financial turnover growth than small and medium firms. In other word, the size of construction firms affects the level of annual financial turnover growth of construction firms in Niger Delta.

Table 9: Kruskal Wallis test for comparing the annual financial turnover growth among small, medium and large construction firms in Niger Delta, Nigeria

Level of Annual Financial turn Over Growth of Firms based on Size of the Firms in Niger Delta	Mean Rank	Decision @ 0.05 Sig lev.
Small Firms	11.91	
Medium Firms	13.36	
Large Firms	25.73	
Chi-Square	13.57	
D,F	2	
P- Value	.001	Reject

4.4.2. Post Hoc test on level of annual financial turnover growth of small, medium and large construction firms in Niger Delta, Nigeria

Table 10 shows the results of Post Hoc Test on Level annual financial turnover growth of firms based on size of the firms in Niger Delta. The result of Bonferroni's multiple comparisons shows that large construction firms contributed to the significant difference in the level of annual financial turnover growth of firms in Niger Delta. This was validated by Dunnest test result which showed that small and medium construction firms have the p-values of 0.001 and 0.002 respectively. These P- values are less than the 0.05 significant level. This implies that that the level of annual financial turnover growth of firms among small and medium construction firms are significantly different from large construction firms in Niger Delta.

Table 10: Post Hoc test on level of annual financial turnover growth of small, medium and large construction firms in Niger Delta, Nigeria

						95% Confidence Interval	
	(I) SIZE OF CONST FIRMS	(J) SIZE OF CONST FIRMS	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Bonferroni	SMALL FIRMS	MEDIUM FIRMS	-.0700	.10512	1.000	-.3365	.1966
		LARGE FIRMS	-.4565*	.10512	.001	-.7230	-.1899
	MEDIUM FIRMS	SMALL FIRMS	.0700	.10512	1.000	-.1966	.3365
		LARGE FIRMS	-.3865*	.10512	.003	-.6531	-.1200
	LARGE FIRMS	SMALL FIRMS	.4565*	.10512	.001	.1899	.7230
		MEDIUM FIRMS	.3865*	.10512	.003	.1200	.6531
Dunnett t (2-sided)[a]	SMALL FIRMS	LARGE FIRMS	-.4565*	.10512	.001	-.7004	-.2125
	MEDIUM FIRMS	LARGE FIRMS	-.3865*	.10512	.002	-.6305	-.1426

4.5. Net income growth of small, medium and large construction firms in Niger Delta, Nigeria

Table 11 shows the net income growth of construction firms based on the size of firms. The decision rule is that any net income growth whose mean falls between 1.0 – 1.8 is of very low growth, 1.8 – 2.6 is of low growth, 2.6 – 3.4 is of moderate growth, 3.4 – 4.2 is having high growth and 4.2 – 5.0 is regarded as having very high growth. The result showed that small and medium size construction firms in Niger Delta, Nigeria experienced

moderate net income growth from 2007 to 2016. The mean scores of 3.14, 3.11, 3.11, 3.14 and 3.29 indicated that large size construction firms in Niger Delta, experienced moderate net income growth in 2007, 2008, 2009, 2010 and 2011 respectively. The mean scores of 3.40, 3.43 and 3.40 implied that large size construction firms experienced high net income growth in 2012, 2013 and 2014 respectively. However, in 2015 and 2016 the large firms experienced moderate net income growth. The average mean score of 2.94 revealed that the overall level of net income growth of construction firms in Niger Delta was moderate within the period of this study.

Table 11: Net income growth of small, medium and large construction firms in Niger Delta, Nigeria

Size of Firms /Year	**Small Firms (1-50) N=874**		**Medium Firms (50-250) N=71**		**Large Firms (Above 250) N=35**		**Combined N=980**	
	M.S	Remark	M.S	Remark	M.S	Remark	M.S	Remark
2007	2.66	M.G	2.70	M.G	3.14	M.G	2.68	M.G
2008	2.65	M.G	2.70	M.G	3.11	M.G	2.70	M.G
2009	2.66	M.G	2.70	M.G	3.11	M.G	2.68	M.G
2010	2.81	M.G	2.76	M.G	3.14	M.G	2.84	M.G
2011	2.99	M.G	3.01	M.G	3.29	M.G	3.01	M.G
2012	3.16	M.G	3.18	M.G	3.40	H.G	3.17	M.G
2013	3.30	M.G	3.32	M.G	3.43	H.G	3.31	M.G
2014	3.17	M.G	3.24	M.G	3.40	H.G	3.26	M.G
2015	2.96	M.G	2.94	M.G	3.23	M.G	2.97	M.G
2016	2.65	M.G	2.76	M.G	3.11	M.G	2.74	M.G
Level of Net income of Construction Firms in Niger Delta	2.90	M.G	2.94	M.G	3.24	M.G	2.94	M.G

L.G = Low Growth, M.G = Moderate Growth, H.G = High Growth

4.5.1. Kruskal Wallis test for comparing the level of net income growth among small, medium and large construction firms in Niger Delta, Nigeria

Table 12 shows the result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant difference in the level of net income growth among small medium and large construction firms in Niger- Delta, Nigeria. P-value of 0.005 is less than 0.05 significance level, hence the hypothesis was rejected. This implies that there is a statistically significant difference in the level of net income growth of firms based on size of the firms in Niger Delta.

Table 12: Kruskal Wallis test for comparing the level of net income growth among small, medium and large construction firms in Niger Delta, Nigeria

Level of Net Income Growth of Firms based on Size of the Firms in Niger Delta	**Mean Rank**	**Decision @ 0.05 Sig lev.**
Small Firms	12.18	
Medium Firms	14.18	
Large Firms	24.64	
Chi-Square	10.55	
D.F	2	
P- Value	.005	Reject

The mean ranks showed that large construction firms experienced higher net income growth than small and medium construction firms in Niger Delta, Nigeria. In other word, the size of construction firms affects the level of net income growth of construction firms in Niger Delta.

4.5.2. Post Hoc test on level of net income growth among small, medium and large construction firms in Niger Delta, Nigeria

Table 13 shows the results of Post Hoc Test on Level net income growth of firms based on size of the firms in Niger Delta. The result of Bonferroni's multiple comparisons shows that large construction firms contributed to the significant difference in the level of net income growth of firms in Niger Delta. This was validated by Dunnest test result which showed that small and medium construction firms have the p- values of 0.01 and 0.03 respectively. These P- values are less than the 0.05 significant level. This implies that that the level of net income growth of firms among small and medium construction firms are significantly different from large construction firms in Niger Delta.

Table 13: Post Hoc test on level of net income growth among small, medium and large construction firms in Niger Delta, Nigeria

	(I) SIZE OF CONSTRUCTION FIRMS	(J) SIZE OF CONSTRUCTION FIRMS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Bonferroni	SMAL FIRMS	MEDIUM FIRMS	-.0330	.08703	1.000	-.2536	.1877
		LARGE FIRMS	-.3358*	.08703	.002	-.5565	-.1151
	MEDIUM FIRMS	SMAL FIRMS	.0330	.08703	1.000	-.1877	.2536
		LARGE FIRMS	-.3029*	.08703	.005	-.5235	-.0822
	LARGE FIRMS	SMAL FIRMS	.3358*	.08703	.002	.1151	.5565
		MEDIUM FIRMS	.3029*	.08703	.005	.0822	.5235
Dunnett t (2-sided)[a]	SMAL FIRMS	LARGE FIRMS	-.3358*	.08703	.001	-.5378	-.1338
	MEDIUM FIRMS	LARGE FIRMS	-.3029*	.08703	.003	-.5048	-.1009

4.5. Discussion of findings

The economic performance of construction firms was evaluated using the employment growth, Annual financial turnover growth and net income growth. This study reveals that the overall level of employment growth among small and medium size construction firms in Niger Delta is moderate and the level of employment growth among large construction firms in Niger Delta is moderate. It also reveals that the overall level of employment growth based on the three firm sizes was moderate.

The result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant difference in the level of employment growth of firms based on size of the firms in Niger Delta, showed that there is a statistically significant difference in the level of employment growth of firms based on size of the firms in Niger Delta. In other word, the size of construction firms affects the level of employment growth of construction firms in Niger Delta.

The results of Post Hoc Test on level of employment growth of firms based on size of the firms in Niger Delta, shows that large construction firms contributed to the significant

difference in the level of employment growth of firms in Niger Delta. This implies that the level of employment growth among large construction firms is significantly different from small and medium construction firms in Niger Delta.

This study concurs with Dania *et al.* (2013), who concluded that multinational firms have higher capability, organization, and capacity than indigenous construction firms. This study is also in consonance with Messersmith and Guthrie (2010) which suggested three reasons why the level of employment growth in large construction firms is higher than that of small firms. Firstly, by their nature, small firms tend to require a greater degree of flexibility from their employees as individuals have greater variety of tasks. Secondly, human resource decisions can have a larger impact on small firms. A poor recruitment decision or the failure to retain a skilled member of staff is likely to be more significant in small firms than large firms. Thirdly, small firms are likely to have fewer formal procedures in place than larger firms.

The result shows that the overall level of financial turnover of construction firms operating in Niger Delta was moderate within the period of this study. The overall level of financial turnover growth of small and medium construction firms in Niger Delta, was moderate and the overall level of financial turnover growth among large construction firms in Niger Delta was moderate within the period under this study.

The result of Kruskal Wallis test on the hypothesis which states that there is no significant difference in the level of annual financial turnover growth among small, medium and large firms in Niger Delta shows that there is a statistically significant difference in the level of annual financial turnover growth of the firms. In other word, the size of construction firms affects the level of annual financial turnover growth of construction firms in Niger Delta.

The results of Post Hoc Test on level annual financial turnover growth of firms based on size of the firms in Niger Delta shows that large construction firms contributed to the significant difference in the level of annual financial turnover growth of firms in Niger Delta. This implies that that the level of annual financial turnover growth of large construction firms is significantly different from small and medium construction firms in Niger Delta. This implies that the volume of work done by large construction firms is more than the volume of work done by small and medium construction firms within the period of this study. This can be attributed to their capacity, innovativeness, and managerial qualities. The level of resources available to bid and execute project can also affect the volume of work done by the firms.

The result revealed the overall level of net income of construction firms operating in Niger Delta, Nigeria was moderate within the period of this study. The result of Kruskal Wallis test that was conducted to test the hypothesis which states that there is no significant difference in the level of net income growth of firms based on size of the firms in Niger Delta shows that there is a statistically significant difference in the level of net income growth of firms based on size of the firms in Niger Delta. In other word, the size of construction firms affects the level of net income growth of construction firms in Niger Delta. The results of Post Hoc test shows that large construction firms contributed to the significant difference in the level of net income growth of firms in Niger Delta. This implies that that the level of net income growth large construction firms is significantly different from small and medium construction firms in Niger Delta.

This study is in agreement with Fiegenbaum and Karnani (1991), and Hardwick (1997) and who opined that larger firms have some advantages over small firms such as a greater possibility of taking advantage of scale of economies which can enable more efficient production, a greater bargaining power over both suppliers and distributors or clients, exploiting experience curve effects and setting prices above the competitive level. It is also

argued that larger firms are more stable and mature and they can generate greater sales and greater volume of work because of the greater production capacity that will enhance capital cost savings with the economies of scale. This study is consistent with most studies which concluded that firm size greatly influenced its performance (Kipesha, 2013)

5. CONCLUSION

This study concluded that the overall level of employment growth among construction firms in Niger Delta is moderate. It concludes that the level of employment growth among large construction firms is higher than the level of employment growth among small, and medium construction firms in Niger Delta.

This study concluded that the overall level of financial turnover growth of construction firms in Niger Delta is moderate. The level of financial turnover growth of small, medium and large firms is also moderate. This study also concluded that the level of financial turnover growth of large construction firms in Niger Delta is higher than the level of financial turnover of small, and medium construction firms in Niger - Delta.

This study evaluated the net income growth of construction firms in Niger Delta, Nigeria and concluded that there is moderate level of net income growth among the construction firms in Niger Delta. It also concluded that the level of net income growth of large construction firms is higher than the net income growth of small, and medium construction firms in Niger Delta.

This study adopted subjective measure to evaluate some sets of economic performance indicators (annual employment growth, annual financial turn-over and net-income growth) of construction firms in Niger- Delta, Nigeria over a period of ten years (2007-2017) on a five-point scale (1-5).

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

EMPIRICAL ASSESSMENT OF TRADITIONAL HUMAN RESOURCE DEVELOPMENT PRACTICE OF CONSTRUCTION FIRMS IN NORTH WESTERN, NIGERIA

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ABSTRACT

Purpose: Construction firm is fundamental sector of economic; it transforms various resources into constructed physical infrastructure necessary for socio-economic development. It embraces process by which physical infrastructures are planned, designed, produced and repaired or maintained. In order to effectively carry out those responsibilities, construction firms are expected to formulate and put in place HRD strategies that vigorously develop their human resource effectively, being fundamental factor of production. Therefore, the study assesses traditional Human Resource Development (HRD) strategies in North-western, Nigeria construction firms.

Design/methodology/approach: The primary data for the study were collected through field work, involving the administration of a structured questionnaire to elicit information available and categories of HR in the construction firms in Northwestern Nigeria, traditional Human Resources Development strategies adopted by the firms. Data collected were analyzed using descriptive and inferential statistical tools.

Findings: The study revealed that, predominant HR in the sampled construction firms was bricklayers' and. concrete technologist, while professional staff among the HR categories was given more priority. With respect to traditional HRD strategies practice in the study area, training programme and mandatory training of new employees were the major HRD strategies in practice. However, production skill was rated higher among the HRD practice by construction firms.

Originality/value: The study concludes that HRD practice was found very fair, this is because construction firms are business oriented. The study recommends that government and professional body should pay more attention on construction firms operation, particularly on HRD.

Keywords: Construction firms; Human resource development practice; Nigeria; North Western.

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1. INTRODUCTION

Construction industry is a sector of the economic nerve centre that brings together different factors of production, using a technical process to produce construction products or services. The activities of the industry are significant to the achievement of national and socio-economic development goals. It provides infrastructure and contributes immensely to employment, gross fixed capital formation and gross domestic products (GDP) (Ibironke, 2003; Raza, 2008). Indeed, the industry is regarded as a barometer through which the good or ill-health of the nation's economy is measured and monitored (Agunbiade, Adeniyi, Olokesusi, Olufemi and Agboola, 1995). The traditional procurement practice includes sequential approach at different stages to designs and develop construction project (Garza, 1994). These organizational and sequential processes to project development characterized construction industry as being complicated and challenging in nature (Vinit, Johan, Hakan and Pontus, 2010).

With respect to complex nature of the construction industry it represents one of the most dynamic, risky, complex, and diverse industrial environments (Alvin, 2011). Being project-based in nature, the products are very vast and production responsibilities are divided among many participants such as Architects, Builders, Quantity Surveyors and Engineers. Each participant performs different functions belonging to different organizations with different objectives, policies and practices as well (Aina, Adesanya and Ojo, 2009; Pettus, 2003). Aina et al., (2009) added that participants are often freshly assembled for current project. It is volatile with peaks and falls in level of activities. Variation in number, size and types of projects undertaken by the industry over time (Turner and Keegan, 2001). These are responsible for significant variation in changing requirement of staff in terms of capability, knowledge, experience and skill profiles (Turner, 2002). In addition to these complex natures, the industry is still faced with other challenges.

There are numerous challenges facing the construction industry today such as: economic swings, new markets emerging in the global economy, increasing competition, impact of technology, growing demand of complex infrastructure by clients, technological advancement and innovation in all forms of businesses, increased in quantity demands from clients (Abu Hassan, Arman, Mohamadand Nurkhuraishah, 2011). Hence, solution to these kinds of problems requires specially trained personnel to be able to mitigate its various complicated dimensions. This makes adequate attention on HRD issues in the construction industry imperative. Therefore, the industry requires the possession of a broad range of management talents, skills and capacity for a continuous approach to problem solving within competitive environment (Aniekwu and Ozochi, 2010). According to Oladeji (2002) a dynamic organization at the competitive edge is one that is imaginative and innovative in its HRD programme providing training and education that would make its human resource productive and innovative.

HRD is part of management practices which is defined as the process of increasing the knowledge, skills and competences of all the people in a working environment like construction industry (Sriyan, 1997). In addition, Adams (1997) took a broader view of HRD as improving competence, culture and commitment which include opportunities for employees' training, re-training, career development and mentoring. The purpose of HRD is to enhance learning in work-related systems, to ensure effective and efficient use of resources (Yuan and John, 2008), and also improve organization performances (Kasimu, Rosilan and Fadhlin, 2013). According to Mathis and Jackson (2000) human

resources development is progressively considered as a survival tool in competitive and continuously changing environment (Kasimu *et al*., 2013).

The foregoing issues indicate the fact of HRD as a tool for the achievement of construction firms' core objectives. But many business organizations focus more on profit making neglecting to improve their HR. This may lead to financial milt down of many construction firms as a research problem. It is therefore, necessary for the construction firms to continuously be updating their Human Resource (HR). The construction industry presents a challenge to each member of the construction team, all members of the team bear heavy responsibilities and it is the duty of the various organizations to assist their individual members to discharge their respective responsibilities in an effective manner. Being fundamental sector of economy, activities of this sector is significant to the achievement of national and socioeconomic development goals. Indeed, the sector is regarded as a barometer through which the good or ill-health of the nation's economy is measured and monitored. To enhanced security condition prevailing in the study area, call for effective HRD in construction firm, due to its multiplier effects. This informed the need for this study. Hence, the study assesses the extent to which HRD are practiced by construction firms in North Western Nigeria.

2. REVIEW OF RELATED LITERATURE

In recent times the incident of organizational development and improved performances became paramount in many organizations (Ayoola, 2014). The workforce is the most valuable asset for an efficient outcome of any organization and this is especially true in the case of labour-intensive industries (Malkani & Kambekar, 2013) like construction industry. Unlike many organizations whose performances are enhanced by new emerging technologies, construction industry is still a labour-intensive, as a result human resource is the most important and very often the most expensive resources deployed within construction industry (Loosemore *et al*., 2003). Drucker (1993) submitted that the fundamental economic resource is no more capital, natural assets, nor work, but human resources. Human resource is an important factor in the development of the construction (Mohamed, Andrew, Dainty, & Stephen, 2011).

Professional HR in the construction industry include: architects; builders, engineers, (for example structural, geotechnical, building services, mechanical and electrical), estate surveyors and valour's, quantity surveyors, land surveyors and town Planners. The professionals in the industry are expected to have been scientifically, technologically and management oriented (Katz, Aldrich, Welbourne and William, 2000). They are responsible in applying the basic principles of management to oversee the execution of projects they are properly trained on the use of managerial skills. Generally, professionals are university graduates or qualified personals. Technical personnel specialize in analytical and problem solving. They should be able to estimate the type and quantity of material required to complete a job and how long a job will take to be completed. Technical staffs include line managers and site supervisor/resident builders. These categories of staff often have advanced technical certificate, national diploma or higher national diploma certificate from polytechnics. Also, technical personnel comprised foremen of different trade sections, specialist and general foremen, structural, electrical laboratory technicians, construction engineers and plant and equipment superintendents. Artisans and craftsmen are construction operatives who contributed skilfully with their hands in the practical realizations of a project. Artisans and craftsmen are equally as important as professionals,

in the construction industry. In spite of advancement in technology, plant and equipment and in particular robotics, the construction industry is one of the few that still relied heavily on individual skills of tradesmen. There is and always will be the need for tradesmen such as carpenters/joiners, block layers/bricklayers, still fixer, plumbers, electricians, floor and wall tillers.

The concept of HR refers to the managerial, scientific, engineering, technical, crafts and other skills which are employed in creating, designing, developing organizations management and operating production as well as services of enterprises (Oladeji, 2002). Human Resource (HR) is also defined as the knowledge, skill, experiences, energies and attitude employed by organizations, which are potentially useful for the production of goods and services. HR is recognized not just in terms of hours work but also skills, knowledge, attitudes, experience and similar attributes that affects particular human capabilities to do productive works and would be most suitable for the realizations of their purposes, aspirations or objectives (Stephen, 2011).

Human resources development can be defined as a set of systematic or planned activities designed by an organization to provide its members with the opportunities to learn necessary skills with a view to meeting current and future job demands. Also HRD seeks to develop people's knowledge, expertise, productivity and satisfaction, whether for personal or groups/team gains or for the benefit of an organization (Mclean and Mclean, 2001). Swanson (2007) has defined HRD as a process of developing and unleashing human expertise through training for the purpose of improving performance.

HRD as discussed can be a stand-alone function, or it can be one of the primary functions within the HR Management Department. An ASTD sponsored study (Mclagan, 1989) identified the HRD role and competencies needed for an effective HRD function. This ASTD study documented a shift from the more traditional training and development topics to a function that includes career development and organization development issue as well. Training and Development (T&D) focus on changing or improving the knowledge, skills and attitudes of individuals. Training typically involved providing employees the knowledge and skills needed to do a particular task or job, though attitude changes (Swanson, 2007).

Education is the key to creating, adapting and spreading knowledge. It increases people's capabilities to learns and to interprets information. But higher education increases the technical training needed to build a labour force that can keep up with a constant stream of technological advances, which compressed production cycles and speed the depreciation of human capital, such as the construction industry (Aidah, 2013). Education produced people, who can monitor technological trends, assess their relevance to an organization's prospects and help formulate an appropriate organizational strategy. It improved the construction and organizational performance in terms of project delivery, reduce construction rework, and improve problems solving solutions and decision making (Oladeji, 2002).

Fagbola (2012) and Mahapatro (2010) defined training as "an organized activity to for increased the knowledge and skills of the people for a definite purpose. It involves systematic procedures for transferring technical know-how to the employees so as to increase their knowledge and skills for doing specific job with proficiency (Mahapatro, 2010). Abiodun (1999) submitted that "training is a systematic development of the knowledge, skills and attitudes requires by employees to performed adequately on a given task or job, it can take place in a number of ways: on the job or off the job; in the organization or outside the organization (Mullins, 1999).

In order to effectively implement training and development programmes, several methodologies have been put forward in previous studies. Among the other training

methods is on the Job Training's: This relates to formal training on-the job. Workers become more experienced on the job over time due to modification of job behaviours at the point of the trainings or acquisition of skills. Atiomo (2000) identified on–the–job Training as the training in the normal work situation. In other words, the trainee learned as he does his job, with time perfected completely. Off–the–job training, on the other hand, is the training in the knowledge behaviours pattern requires for a task, job or occupation away from the normal work situation and day–to–day pressures (Smith, 2002). Tabassi and Barker (2009) made a comparison between on-the-job and off-the-job training. According to the authors, in terms of emphasis, off-the-job training is about learning basic facts and skills while on-the-job is about getting the job done. The ultimate goal of off the- job is "knowledge" while that of on-the-job is developing "best practices". Induction/Orientation: is carried out for new employees on the job to makes them familiar with the total corporate requirements like norms, ethics, values, rules and regulations. Another training method practice in the construction industry is apprenticeship a method of training where an unskilled person understudies of a skilled person. Apprenticeship programmes are more comprehensive trainings that combined on–the–job training with related classroom instruction and are available for electricians, iron workers, carpenters and other artisans (Tabassi and Barker, 2009).

Demonstration as a training method in the construction industry involved, teaching by example whereby the skilled worker performs the job and the unskilled worker closely observed so as to understand the job process. A conference is a training method that involves presentations by more than one person to a multifarious audience. It is more cost effective as a group of employees are trained on particular topic all at the same time large audiences. This method, however, is disadvantageous because it is not easy to ensure that all individual trainees understand the topic at hand as a whole (McCourt and Derek, 2003).

Coaching and Mentoring: This involved having more experienced employees (McCourt and Derek, 2003; Torringoton, Hall and Taylor, 2005). It is argued that mentoring offered a wide range of advantages for development of the responsibility and relationship building (Torringoton and Tan, 1998). The practice is often applied to newly recruited graduates in the organization by being attached to a mentor who might be their immediate manager or another senior manager. This however, does not imply that older employees are excluded.

Vestibule is also another training method. This is done through industrial attachment for the purpose of skills and technologies transfer. The effect is the acquisition of practical and specialized skills. Formal training method, this method involved practical and theoretical teaching process, which could be done within or outside the organization. When training is carried out inside an organization, it is called an in-house training, while off-house training is carried out in professionalized training areas or places outsides the organization such as universities, polytechnics and professional institutes or institutions; other training method include vocational training schools and vestibule schools which provide practical on –the – job knowledge and skills in diversed areas of human endeavour and is more formal than apprenticeship programme. Industrial training is a form of training that provides an on–the–job situation for trainees and is usually part of the curriculum for higher educational programmes in universities, polytechnics and lasted between 3 and 4 months. It is coordinated in Nigeria by the Industrial Training Fund (ITF, 2005). Conferences and Workshops are for professional peers and superiors to rub minds, interact and share ideas on development perspective within a profession or industry higher qualification programmes include diploma, graduate and postgraduate programmes offered in institutions of higher learning, companies and organizations alike uses it as a platform to sponsor their staff to acquire knowledge at the higher level to equip them with requisite skill to face more daunting tasks in the organizations.

3. RESEARCH METHODOLOGY

The primary data for this study were collated through field work, involving the administration of a structured questionnaire to elicit information available and categories of HR in the construction firms in Northwestern Nigeria, traditional Human Resources Development strategies adopted by the firms. Using Purposive sampling technique, the study selected three states namely: Sokoto, Kebbi and Zamfara states from North Western Nigeria. The target population for the study consisted of all registered construction firms in the selected states. The number of registered construction firms was obtained from the corporate affairs commission in each state. Twenty percent (20%) of the construction firms with offices in the three states were selected using random sampling, yielding 66 firms. In each firm, six-member staff was selected making a total of 396 respondents. Hence, a total of 396 questionnaires were administered out of which 238 were retrieved. Data collated were analyzed using percentage, mean scores, rank indexes and F- value statistics.

4. RESULTS AND DISCUSSION

Table 1 **i**dentifies the categories of Human Resources in the sampled firms namely: administration/management staff, professional staff, technicians, tradesmen and artisans. The result shows that technical staff have (33%), followed by professional staff with (28%), while tradesmen and artisans (26%), However, Administrative/Management staff with (13%) respectively. The results highlighted the importance attached to technical staff in the study area. This is more pertinent with construction firms because of their technical functions. The skills requirements for technical personnel are usually analytical and problem solving in nature (Learning and Skills Council, 2003). There will be the need for technical staff.

According to Yakubu (2005) technical staff, for instance, should have the abilities to identifies and estimate the correct types and quantities of materials required to complete a job and accurately estimate how long a job will take to be completed and at what cost (Dubem, Stephen, Oluwaseyi and Onuwa, 2012). In competitive and continuous changing environment like construction firm, technical staff will ensure effective and efficient use of resources and improved organization performances. Shortage of technical staff may affect firm performance indexes such as: timely completion and quality work man ship.

Table 1: Categorization of human resources in the sampled construction firms

Categorization of human resources	Percentage (%)	Rank
Technical staff	33	1
Professional staff	28	2
Tradesmen and Artisans staff	26	3
Management/ administrative staff	13	4
Total	**100**	

The traditional HRD practice adopted by construction firms in the study area were presented in Table 2. The result identified training programme with (44%) as the most frequently practice in construction firms in the study area; this followed by development programme with (31%) and education system score (25%). It appeared that training programme (44%) was ranked high among the HRD programme. This is more pertinent

with construction firms because training programme concerned with improving current job performances and imparting specific skills among operatives such as tradesmen and artisans (Fagbola, 2012; Mahapatro, 2010) being the operative as largest as they available. Odusami *et al.,* (2007) and Chan (2005) observed that training has become the only source of sustainable long term competitive advantage in the construction industry. Obiegbu (2003) added that employees acquire sufficient, relevant technical knowledge and skills for dealing with problems of the Construction Industry; acquiring practical field, providing technical abilities to visualize, solve practical construction problems, enhancing the safety of workmen and impact significantly on project delivery Tabassi *et al*., (2011) argue that training played a critical role in increasing workers' adaptability and flexibility with employers.

Table 2: Identified traditional HRD practice adopted by construction firms

HRD Programme	**Percentage (%)**
Training	44
Development	31
Education	25
HRD Policies	
Mandatory training of employees upon joining the firms	37
Employee request	26
No specific policy	18
Supervisors recommendation	10
Performance appraisal	9

Table 2. Revealed information on HRD policies, the results show how respondents were selected for training and development in their respective construction firms. Mandatory training of employees upon joining the firms score (37%) and (26%) of employees were selected for training and development based on request, while 10% and 9% were sent for training and development based on Supervisors recommendation and Performance appraisal respectively. It appeared that mandatory training upon joining the firms was highly selected. Training policy of an organization is a laid down statement of trust of what the organization is prepared to do or offers in terms of developing its employees (Odusami et al., 2007). This study is consistent with Coles (1986) who indicated that other companies may preferred to recruit personnel that are already trained and professionally qualified as a policy to reduce cost of staff development.

Further examination on HRD strategies adopted, revealed various methods of training, educational and developmental systems practice by the sampled construction firms (Table 3). Using mean score to rank the variables and ANOVA F to test the significance of each variable with respect of HRD strategies adopted. Table 3 showed several training methods adopted by sampled firms as part of their HRD practice, namely: induction/orientation (mean score=2.18), apprenticeship (mean score=2.02), coaching and mentoring (mean score=2.24), presentation (mean score=2. 20), on-site training (mean score=2.58) and off-site training methods (mean score=1.78). However, only three of these methods were found significant. These are on-the-site at ($F=6.259$, $P<0.05$), followed by coaching and mentoring, significant at ($F=5.890$, $P<0.05$) and induction/orientation, significant at ($F=3.598$, $P<0.05$). Those training methods were found to be the most significant training strategies adopted by sampled construction firms. It appeared that among the training methods, on-the-site training method (2.58 mean rating) was ranked highest and must significant at ($F= 6.259$, $P<0.05$). This is largely expected as most duties in the construction

industries were carried out on-the-site, giving opportunities to largest groups of employees to be trained while on the job. It is given preference because training take place in the environment in which the trainee will work at the end of his training (ITF, 2005). Also trainee work with equipment and materials which they will use at the completion of training and the job procedures are the same as obtained after training. On-the-job training is about getting the job done and it is dynamic, situated and practice-oriented (Tabassi and Bakar, 2009).

Table 3: HRD strategies adopted by construction firms

HRD Strategies	Mean Score	Ranks	ANOVA F
Training methods			
On-the-site	2.58	1	6.259**
Coaching/mentoring	2.24	2	5.890**
Induction/Orientation	2.18	3	3.598**
Presentation	2.20	4	3.309**
Apprenticeship	2.02	5	3.132**
Demonstration	2.00	6	1. 485
Off-the-site	1.76	7	2. 260
Conference	1.91	8	1.990
Vestibule	1.06	9	1.014
Educational system			
Informal education	1.50	1	2.781**
Formal education	1.15	2	2.061
Development methods			
Promotion	1.42	1	4.157**
Under-study	1.33	2	2.863**
Job-rotation and transfer	1.08	3	2.188
Self-development	1.23	4	2.145

**: significant at 5% level

There were two components of education system (Table 3) practice by sampled construction firms. These are informal and formal education systems. The mean rating of informal education system (mean score=2.781) ranked higher and significant at ($F=2.781$, $P<0.05$) than formal system (mean score 2.061). This indicates that HRD strategies practice by sampled firms in relation to education system were mainly informal (mean score 2.781) ranked highest and significant at ($F=2.781$). Development of HRD strategies (Table 3) adopted by sampled construction firms include, promotion (mean score=1.42), under-study (mean score=1.33), job rotation and transfer (mean score=1.23) and self-development (mean score=1.08). However, promotions with higher (mean score 1.42) were found to be the most significant component ($F=4.157$, $P<0.05$) followed by under-study (mean score 1.3) and significant ($F=2.863$).

The findings on HRD programme and methods adopted indicated that the HRD strategies practiced in the study area had little attention on education system. This is more pertinent because of the unstable nature of the construction industry typified by casualization of workers, workers being employed from the inception of projects, and laid off at its end and many laboured-only subcontractor arrangements (Loosemore, Dainty and Lingard, 2003). Aina *et al.,* (2009) added that participants are often freshly assembled for

current project. This could have number of implication to performance of construction firms. However, Jayawardane and Gunawardena (1998) argued that absence of education among construction firms in developing countries results in poor quality work, high wastages and long terms productivity declined in the industry.

The extent to which employees in the sampled construction firms have been developed in the areas of HRD practices are presented in (Table 4). The result shows that most of the employees were highly developed in the area of technical knowledge (means=4.20), production skills (means=4.05) and legal/regulatory policy (means=4.01). The extent to development in communication skills is above average (means=3.51) while development in the area of computer/IT was below average (means ranked=3.44). It appeared that, technical knowledge (means ranked=4.20) and Production skills (means ranked=4.05) respectively were highly ranked by the respondents, while Computer/IT was least ranked with (mean ranked=3.44).

Table 4: HRD practice areas and employees' development

	Excellent	**Good**	**Fair**	**Poor**	**Very poor**	**Mean Score**	**Rank**
Technical knowledge	51.3	23.1	15.4	7.7	2.6	4.20	1
Production skills	47.1	23.5	19.6	7.8	2.0	4.05	2
Legal/regulatory policy	38.3	38.3	13.3	6.7	3.3	4.01	3
Management of People	34.7	44.9	8.2	10.2	2.0	4.00	4
Health and Safety	29.8	42.6	21.3	4.3	2.1	3.94	5
Customer care and marketing	38.5	23.1	21.2	11.5	5.8	3.77	6
Leadership	28.3	24.5	35.8	9.4	1.9	3.68	7
Business and Finance	27.7	36.2	12.8	19.1	4.3	3.64	8
Communication skills	23.1	25.6	30.8	10.3	10.3	3.51	9
Computer/IT	22.0	32.0	20.0	20.0	6.0	3.44	10

5. CONCLUSION AND RECOMMENDATIONS

The study concluded that HRD practices in the construction firms was found very fair, this is because they pay more attention on few staff (brick layer and concrete technologist) and mostly concerned on practical oriented training (production and technical skills) methods. The firms have low concern on management skills, performances appraisal, job rotation and formal education of their HR. Hence, the HRD practices highly favoured on-the-site training method. The prevailing features may lead some negative factors such as: construction delay, time and cost over- run, poor workmanship as well as profit margins. In addition, the situation at hand will also discourage young generation (youth) taking employment with study organizations (construction firms) due to poor H R Development practice which is against their career development. This will contribute to unemployment rate, by and large lead to in security situation in the study area.

Based on the findings of the study and conclusions drawn, the following recommendations were made: It is recommended that professional institution and relevant government agencies, should embark on enlightenment campaigns to educate contractors and review policies of the construction firms respectively, through annual accreditation and renewal of license. However, clients should give preference to quality of employee, by

critical assessment of firms' profile before contract award. These could encourage construction firms to invest more on human resource development of their employees.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

INFLUENCE OF TRANSACTIONAL CONTRACTS ON COMMUNITY STAKEHOLDERS' ENGAGEMENT DURING CONSTRUCTION PROJECT IMPLEMENTATION

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ABSTRACT

Purpose: Transactional contract is procedural, rigid and inhibits cooperative dealings based on definitive risk allocation. Parties are concerned about self-interest only, thereby exposing non-contractual parties such as the community stakeholders to combative engagement. This study assessed the scope of incentives within transactional-traditional procurement framework with a view to determine their appropriateness to address community stakeholders' needs towards curbing projects opposition during implementation. The objective was to determine whether transactional contractual characteristics in traditional procurement framework affect the outcome of firm's engagement with the community.

Design/methodology/approach: The study involved a questionnaire survey of 200 construction professionals and community leaders in Akwa Ibom and Imo State, Nigeria. The study data were analysed using the mean item score, and the test of hypothesis involved chi square.

Findings: The study revealed that fragmented practice, opportunism, moral hazards and adverse selection attributes inherent in traditional procurement framework inhibit progressive dialogue, inclusive progressive interaction, and open and transparent dealings with community stakeholders. Transactional contractual practice therefore hinders effective engagement with the community during project implementation.

Research Limitations/Implications: The finding of the study infers the need to modify transactional attributes to enhance flexibility, solidarity, mutuality and restrain of opportunism in traditional procurement framework. These adaptations will ensure synergistic engagement of external stakeholders towards improved efficiency.

Originality/value: The study espoused the relevance of effective contract design as a yardstick to mitigate project organisation/external stakeholders' interface management problems during construction project implementation.

Keywords: Adverse selection; engagement; external stakeholders; moral hazards; opportunism.

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1. INTRODUCTION

Macneil (1985) explained contractual relationship using two focal terms namely: transactional, and relational. Transactional contract empowers the client to specify all the requirements of the project. This feature essentially characterises project procurement using the traditional procurement route. Strahorn, Gajendran and Brewer (2015) maintained that, traditional procurement with it inherent transactional-based failings is ever present in the construction industry. The continuous application of this approach prevails, despite the emergence of new approaches and growing dissatisfaction by clients (Dada, 2012, Idoro, 2012; & Salako & Ajayi, 2011). In Nigeria, the traditional procurement framework is also largely used in organising and managing the delivery of construction projects (Idoro, Iyagba & Odusami, 2007; Ojo, 2011; Ogunsanmi, 2012; & Oladinrin, Olatunji & Hamza, 2012). The continuous widespread applications of the traditional approach have been variously attributed. However, widely advanced justification has to do with the idiosyncratic attitudes of professionals to stick to one procurement method based on familiarity (Masterman, 2002). Clients are also willing to develop other forms of relationship with stakeholders using other novel procurement approaches but often recourse to adopting traditional practice (Eriksson, 2008). Public sector clients may be constrained to adopt traditional procurement route by public procurement laws, but the private sector clients who are tied to regulatory regime are also stuck similar practices (Idoro, Iyagba & Odusami, 2007). The traditional practice bundles arrays of stakeholders together but focuses mainly on the needs of stakeholders with contractual capacity to the project. This practice is linked with poor project performance particularly in complex, high risk project situations (Ibrahim, Costello, & Wilkinson, 2011).

The word stakeholder is a comprehensive term. It is used to describe a person or group of people with vested interests in the outcome of a project (Olander, 2007). Research studies identify two broad categories of construction project stakeholders namely: internal and external (Winch, 2002). The internal stakeholders have contractual capacity in the project while the external have vested interest with no contractual capacity. The community is a member of the external stakeholder group (Aaltonen & Kujala, 2010). Despite the vastly documented problems linked with ineffective community engagement during construction project implementation, project management literatures have limitedly tackled project organisation-community interface concerns. The relationship between stakeholders at the project environment is faced with diverse problems. Cases of opposition, resource flow distortion, increased costs of resource, protest, disturbances, blockage, and stoppage of work are still prevalent in many project scenarios across the globe (Teo & Loosemore, 2012; Ekung & Lashinde, 2016). In response, to why these problems persist, construction organisations often argue that, their primary responsibility is to the client/project team. This implies that, community interests are not designed into the contractual framework signed between the clients and contractors (Ihugba & Osuji, 2011). Stakeholder's management is therefore practiced as a corrective, problem-solving ritual than a proactive engagement aimed to tackle genuine concerns. Efforts of project organisation are therefore targeted at managing eschewing interface problems, instead of seeking proactive engagement to prevent opposition. The term stakeholder engagement describes a structured process encompassing agreement to negotiate, setting criteria for negotiation, and monitoring the outcome (Ihugba & Osuji, 2011). It is concerned with how the firm relates with the stakeholders in stimulating benefits and developments (Greenwood, 2007). The

framework to negotiate and monitor outcome of firms' engagement with community is one area where project management literatures have not tackled comprehensively. Growing volumes of literatures is interested mainly in upstream stakeholder that is, client and project team interface management. Limited empirical literatures exist that documents the influence of between contractual characteristics on community stakeholders' engagement outcomes.

Although several studies have explored the loopholes in transactional contracts (Ojo, Adeyemi and Fagbenle, 2006 and Dada, 2012); convergent view across literatures suggests communication, rigid framework, late inclusion of construction organisations and externalities in projects in projects must be improved. The breach in communication in this approach between the different phases of project increases uncertainty in the delivery environment (Ojo, 2009). Whilst this contractual practice is prevalent within the Nigerian construction domain, the implications on external stakeholder's engagement are not documented. This study examined the extent to which mechanics of transactional contract supports or inhibits external stakeholder engagement. The goal is to highlight grey areas in traditional procurement practice that hinder engagement processes and their effectual implications on relationship management at the project implementation level. Achieving the goal of the study is relevant in a number of ways. First, it provides a vital mechanism for enhancing project outcome through improved relationship management within traditional procurement framework. Second, it redefines the need for a move away from adversarial practice to relational contracting by pinpointing areas for improvement.

2. LITERATURE AND THEORETICAL FRAMEWORKS

2.1. Theoretical framework

Transactional contracts describe a contractual relationship characterised by conflicting goals; the total efforts of parties are geared toward curtailing possible opportunistic tendencies from one another (Sancini & Sicilia, 2010). The opportunism in transactional contracts is embedded in agency theory. The agency theory posits that, an agent of a principal possesses antagonistic interest to that of the principal (Jason & Meckling, 1996). This tendency creates asymmetric information which is dependent on contingent factors such as uncertainty and measurability (Sancini & Sicilia, 2010). Transactional contracts also ignore the interest and the needs of the downstream stakeholders, and rather focused on temporary financial responsibilities (King Bethania & Benassi, 2013). Other characteristics of the system include approximately described work, lack of incentives, stiff hierarchical structure, and top down policy framework (Baron & Kreps, 1999). Contracting parties are not able to work the full details of contingencies and the relationship governing a contract from the outset (Katz, 2005). The participation of a third party (sub-contractors) in transactional relationship is tagged to deadlines, risks taking, and penalties. The tendency to review or even shift responsibility where it is beyond anticipated risk benchmarks, pegged by the firm is very minimal.

Transactional contracts elements in traditional procurement framework ensures that timeline of work are pegged on predictable fixed price, detailed scoping precedes construction, clear assignment of risk, wide industry familiarity and usage, and suitability for use with competitive bidding as mandated by the public procurement act (Ashworth, Hogg & Higg, 2013). On the end of the scale are the adversarial relationships, excessive

claims, and poor communication. The reasons for the adoption of transactional contract are numerous. Contractors often time, leave terms of contract unresolved trusting future negotiation such as claims to fill the void (Katz, 2005). There is also a factor associated with the lack of awareness due to limited resources to negotiate the full details of the contract by the firm. Adopting the theory of transaction economics, Reeves (2008) explained that traditional procurement is based on the premise that, exchange is only possible, where parties possess imperfect information about the other parties, and their side of the contractual bargain. Different parties are engaged at different stage in the project life cycle, thereby generating opposing views and objectives. The practice has been christened 'bullet proof plates' designed to allocate economic burden to the construction organisations (Reeves, 2008). Traditional procurement framework also lacks incentive to help other achieve their objectives, since all parties have separate responsibilities. Traditional procurement contract therefore fulfils the characteristics of transactional contract practice in all fronts.

Only recently, concerns are beginning to emerge about the adequacy of traditional project systems to address external organisations interests (Cheung and Rawlinson, 2008). Gunathilake & Jayyasena (n.d) assert that, traditional procurement practice has failed the demands of contemporary business environment due to its lack of competitiveness in the international domain. Mathews and Howell (2005) summarised problems of traditional contractual approach with respect to relationship management into four categories. These include: good ideas are withheld; limits co-operation and innovation; pressure on locals'; and inability to optimise project interfaces. Interface problem in the coordination and management of different contractors' input is also prominent. Due to these limitations, traditional contracts is considered inappropriate for emerging markets, new technology adaptation and meeting ever changing needs of the project environment.

2.1.1. External stakeholders in construction environment

A stake in a construction project is either affected by the project or impacts the realisation of a project. Olander (2007) added another dimension by asserting that, 'vested interest' must be established in defining stakeholders. CIOB (2008) categorised stakeholders as: business partner; regulatory agencies; and external influencers. Chinyio and Olomolaiye (2010) maintained that, the external influencers most times, lack contractual capacity and are strongly connected with outcome of the project and the impact on the environment. These attributes characterised the community stakeholder group. Walker, Bourne and Shelley (2008) maintained that stakeholders are in four categories namely: upstream supply chain partners; downstream supply chain partners; external stakeholders; and, project stakeholder group. Newcombe (2003) classified stakeholders as primary or secondary. The difference between primary and secondary stakeholders is explained by Winch's scope of contractual capacity in the project (Winch, 2002).

From the foregoing review, it is evident that existing literatures broadly identify community stakeholders as external, thereby depicting homogeneity. Ekung, Effiong and Ibanga (2016) established that community stakeholders are not homogenous as portrayed in the literatures. Jahawar and McLaughlin (2001) insisted that, community-based stakeholder cannot be assumed to be homogenous when the concept of stakeholder is itself heterogeneous. Ekung, Ogboji and Okonkwo (2013) demonstrated that differential exist among community-based stakeholders. Although each group have varying level of influence, all independent group is however powerful and can oppose a project. Rosario & Goh (2007) found that community stakeholders are perceived to have less impact on project implementation and success. The resource dependence theory (Jawahar & McLaughlin,

2001) proved otherwise, and demonstrated that, community stakeholders could prevent the flow of resources into the project organisation. Olander (2009) observed that lack of cooperation between the firm and external stakeholders could result in many adverse implications during project delivery. Teo and Loosemore (2012) reported related impacts to include increased tension around the projects; costly disputes, and delays, if not well managed (Loosemore, 2000). Post, Preston and Sachs (2002) therefore concluded that every project must obtain social licence from the community-based stakeholders to operate successfully.

2.1.2. Stakeholder engagement

The need to engage stakeholders in project environment remained a significantly researched project success criterion in construction management literatures (Yang, Shen & Ho, 2009; Winch, Mucha, Roberts, & Shinn, 2007; Rahman & Kumaraswamy, 2002). It is also increasingly adopted to assess procurement system's ability to deliver on objectives (Yuan, Skibniewski, Li, & Zeng, 2010). Engagement is a structured process encompassing agreement to negotiate, setting criteria for negotiation and monitoring the outcome. Stakeholders' engagement begins with consultation, negotiation, and dialoguing with the stakeholders in order to understand how best their expectation can be met (Ihugba & Osuji, 2011). Bal, Bryde, Fearon, and Ochieng (2013) conceived engagement as a process involving identification; relating, prioritisations, managing, measuring performance, and implementing outcomes. Arnstein (1969) identified eight processes in stakeholder's engagement: manipulation; therapy; informing; consultation; placation; partnership; delegated power and citizen control. The fundamental premise in Arnstein's model is that, an increase in the level of participation is directly proportional to engagement outcome. However, Ihugba and Osuji (2011) concluded that engagement process/levels do not need to follow any sequence, but its usefulness should be measured against an effective involvement of the stakeholders.

2.1.3. Relationship between stakeholder engagement and contractual practice

The nature of contractual provisions enhances or hinders the management of external stakeholders' perception. It has the tendency to influence project decisions and the overall success. In a study of contractors and client perception of problems in traditional procurement method, Dada (2013) concluded that, the relationship among participants ranked least among twenty factors examined by the study. This suggests a low level of significance given to the contractual relationships by stakeholders in traditional procurement environment. Yang, Shen and Ho (2009) acknowledged that, limited numbers of studies are conducted on stakeholders' relationship. Relationship among the various parties in project delivery is therefore established in contractual terms. The understanding of contract type and its inherent lacunas is critical to effective decision making. According to Davidson & Sebastian (2006), contracts are living document in which allowances must be made for unforeseen conditions at implementation level. They also identified construction contracts as most vulnerable to administrative problems. The key factor in the traditional contractual practice that hinders external relationship management is the lack of co-operation between the client and contractor's organisation; lack of trust, and ineffective communication (Cheung and Rawlinson, 2008). This is largely responsible for the overall adversarial relationship that the practice is known for. Win-lose attitude, delay, cost overruns; costly litigations are also common results generated from traditional contracts interface (Ashworth, Hogg & Higgs, 2013).

However, since contracts are living document in which allowances must be made for unforeseen conditions at the delivery environment (Davidson & Sebastin, 2006), it follows that, flexible contractual terms are needed to tackle community stakeholder's concerns. However, achieving this objective is hindered by the vulnerability of construction contracts to administrative problems (Dada, 2013; Davidson & Sebastin, 2006). This study argues that, transactional contract such as the traditional forms are defined by rigid clauses hence, parties' actions are streamlined to contract provisions. Another critical factor militating against effective external relationship management in the traditional form is late involvement of the contractor in the supply chain. In contrast, early involvement of the contractor in the delivery process could trigger the willingness to explore co-operative relationship (Erikksson & Pesamaa, 2007). Early involvement of the contractor will also pave way for the exploration construction environment- related factors that could impact the delivery process.

Inappropriate selection and use of contractual type and procurement strategy and subsequent contract management procedures could also pose severe challenges to achieving project objectives (Oluka, Benon & Basheka, 2012). According to contractual theory, a contract is a platform in which each party's interest, duties, goals, strategies and responsibilities are spelt-out to give credibility enforcement in cases of breaches (Oluka, Benon & Basheka, 2012. This is facilitated by the relational norm the contract creates between the contractor and the client. Although, the community stakeholder is not expressly privy to construction contract, they are however, influenced by the nature of such contractual relationship. The choice and use of procurement system therefore do not only affect parties' relationship but also impacts project organisation interface implementation (Ogunsanmi, 2013; Eriksson & Westerberg, 2012). This study therefore tackled dearth of literatures on the effect of transactional contract on community stakeholders' engagement, with a view to pinpoint refinements needed to improve efficiency. To achieve this goal, the study evaluates the perception of relevant construction experts on the influence of transactional contract characteristics on the enablers of efficient external stakeholders' engagement. Perception represents the pattern in which information around us is prioritised by an individual (Rawlinson & Cheung, 2008). It is also the mental functions of expressing feelings about a concept (Mullins, 1996). Respondents' perceptions in this study are used to determine the hypothesis which measured the degree of interdependence between transactional contractual characteristics and external stakeholders' engagement outcome. The hypothesis states that, there is no significant statistical interdependency between external stakeholder engagement and transactional contract norms.

2.2. Conceptual framework and variables of the study

Figure 1 presents the conceptual framework of the study. Four characteristics of transactional contracts generated from the literature in the foregoing sections are measured in the study. These include: fragmented practice; opportunism; moral hazard, and adverse selection. Moral hazard defines efficiency constraints in traditional contract due to lack of incentives for promoting relationships (Miller & Whitford, 2006). The term fragmented practice is conceived to mean the separation of design from construction. Opportunism is the adversarial practice in which party tend to seek individual gains (Joshi and Stump, 1999). Moral hazard is the lack of incentives for meeting stakeholders' needs in the contract (Miller & Whitford, 2006). Opportunism is the pursuit of self-interest in an exchange relationship (Joshi & Stump, 1999). It is 'the incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate or

otherwise confuse' (Willamson 1985 cited in Reeves, 2008 p 3). Adverse selection is concerned with regulated procurement practices that is, over reliance on public procurement laws that prioritised only the selection process. This means that other important issues associated with contract management during project execution including relationship management are not prioritised.

The study also generates four enablers of effective stakeholder engagement namely: promotion of on-going dialogue; inclusive and on-going interaction; open and transparent dealings; and building enduring relationship (Ihugba & Osuji, 2011). The proposition is that transactional contract enhances or inhibits promotion of on-going dialogue; inclusive and on-going interaction, open and transparent dealings and building enduring relationship.

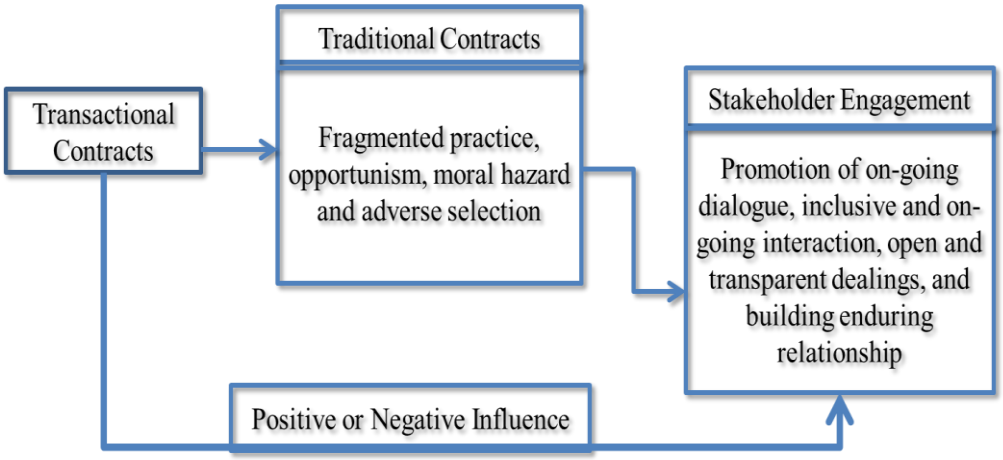

Figure 1: Conceptual Framework of Transactional Contracts and their Impact on Community Stakeholders' Engagement during Project Implementation

3. METHODOLOGY

To achieve the objective of the study, a questionnaire survey was conducted. The sample frame comprised construction professionals in two states (Akwa Ibom and Imo). Since the use of traditional contract is widespread, the entire population was treated to be homogenous. These states were selected based on their revenue profiles that translate into the ability to commission construction works. A preliminary inquiry was conducted using contact persons in the state's Chapter offices of the respective professionals in the built environment. An estimated population size of 477 was obtained. Out of this figure, 177 were in Akwa Ibom State, while over 300 are based in Imo State. To provide basis for comparison of study data, equal sample size of 100 each from each state were used. The samples are those that could be reached personally and through emails. The study targeted professionals (architects, quantity surveyors, construction managers and project managers in both contracting and consultancy practices. A purposive sample of 200 respondents was sampled at random but to a stratified construction experts.

The questionnaire comprised fives questions, first, second and third questions elicited respondents' professions, years of experience, and the number of projects procured using traditional procurement framework. The fourth and fifth questions relates to specific objective of the study. Respondents were asked to rank characteristics of transactional

contracts to reflect how they hinder the attainment of the enablers of stakeholders' engagement using a Likert scale 1 to 5 with 1 being least impact and 5 highest impacts.

The data was coded in Statistical Package for Social Science (SPSS) and analysed using the mean and Chi Square test. Due to the lack of previous empirical study that validated these factors as measurement variables for transactional contractual and enablers stakeholder engagement, it became imperative to test the reliability of the scale and of the data collection instrument. Since a 5-point Likert was used, and with Cronbach Alpha being valid at 0.7 and above (DeVellis, 2003; Pallant, 2010), mean inter-item correlation was applied to achieve higher reliability values. The applied correction yielded a high Cronbach's value of .88. Acceptance of the hypothesis was determined using the critical p-value (where $p < 0.05$ is rejected; and $p > 0.055$ is accepted). Acceptance of the hypothesis means that there is no significant statistical interdependency between transactional contract and external stakeholders' engagement. Rejection on the other hand implied that transactional contract norms hinder external stakeholders' engagement.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1. Respondents characteristics

The first analysis conducted was to determine the proportion of respondents' profession, years of experience, and numbers of project executed using the traditional procurement framework. The result is shown in Table 1. Sixty-Six (66) samples of the questionnaires were retrieved, and this is equivalent to 33% response rate. This is significant and adequate to accept the result of the study as it is above 25-30% benchmark of most research work in construction management (Hoxley, 2008). Quantity surveyors are the largest professional group of the sample. Architects also form the second largest sample. While the result of the quantity surveyors group was expected as leading expert in contractual matters in the construction industry, the outcome with architects is not a surprise and is apparent, as the head of traditional project management organisations. Over 77% of the sample have years of professional experience above 5 years, and another 77% of the sample have also executed over 10 projects using the traditional procurement framework. The overall result in Table 1 is adjudged adequate to accept the study's findings based on their years of experience.

Table 1: Respondents' background information

Profession			Years of Experience			Number of Projects		
Groups	**N**	**%**	**Years**	**N**	**%**	**Quantity of Projects**	**N**	**%**
Architects	18	27	< 5 years	15	23	<10 projects	15	23
Q/Surveyors	22	33	5 to 10	18	27	10 to 20	18	27
Project Managers	15	23	10 - 20	17	26	20 to 25	17	26
C/Managers	11	17	20 & above	16	24	Above 25	16	24
Total	**66**	**100**	**Total**	**66**	**100**	**Total**	**66**	**100**

4.2. Impact of transactional contracts on external stakeholders' engagement

Data presented in this section analysed respondents' severity of the influence of transactional contractual practice on effective stakeholders' engagement. The degree of impact (mean item score) is presented using radar in Figure 1). Radar provides a pictorial view of hierarchy, and has gained increasing application in construction management research (Wood & Eliis, 2005; Sultan & Kajewski, 2004). In the referenced studies, radar was used to describe ranking opinion of respondents about various issues including degree of impact.

The views of respondents as seen in Figure 2 tend to dilate towards high ranking for variables: FPBR; FPII; OPD; OII; FPPD; ASII; OBR; and FPRT. Respondents however maintained indifference in their ranking of MHBR. The result of MHBR implies lack of renowned opinion about the impact of moral hazard on relationship building in construction contracts. The figure also contracted towards low ranking for variables: ASPD, ORT, MHRT, MHPD, and MHII; and wanes towards very low ranking for variables ASBR, and ASRT. Fragmented practice and opportunism attributes of transactional contracts are the leading factors contributing to ineffective stakeholders' engagement. These factors constitute 80% of the significant impact factors with scores between 3.75 and 4.02. Fragmented practice impedes relationship building ranked first; fragmented practice hinders inclusive and on-going interaction (2nd), opportunism hampers promotion of dialogue ranked (3rd), and opportunism hinders inclusive and on-going interaction 4th. Other significant impact factors are: adverse selection impedes inclusive and on-going interaction (5th), and fragmented practice hinders resolved to be transparent and open in dealing with the stakeholders.

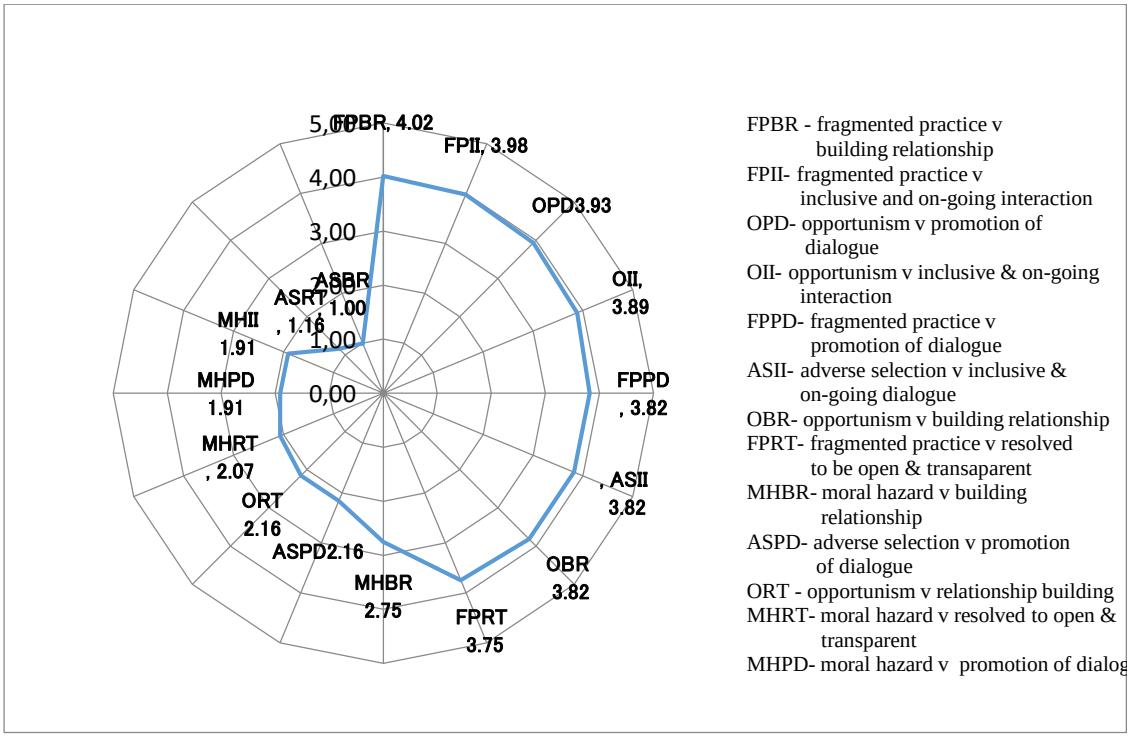

Figure 2: Ranking perception of transactional contract attributes on stakeholders' engagement

Also, transactional contracts attribute adverse selection and moral hazards inhibit relationship building, resolved to be open and transparent, inclusive and on-going interaction, and promotion of dialogue only. Ninety-Five percent (95%) of the lowly rated factors are connected with adverse selection and moral hazard. Wide dissimilarity also exists between significantly high impact factors (fragmented practice and opportunism), and low rated impact factors (moral hazards and adverse selection). Fragmented practice and opportunism are most significant transactional contractual attributes inhibiting effective community stakeholder engagement. This is not say, adverse selection and moral hazards are irrelevant. On the contrary, it portrays that; fragmented practice and opportunism are the key indicators of transactional norms in construction contract that the stakeholders prioritise. On the other, adverse selection and moral hazards are never considered relevant areas for improving community stakeholders' engagement practices.

The study further explored variation in respondents rating opinion in order to determine whether respondents' perceptions are homogenous, or whether they deviate significantly. Figure 3 is a plot of variance and standard deviation of respondents' views of the impact of transactional contract attributes on the enablers of external stakeholder engagement. The horizontal plane represents the six factors cross-tabulated for degree of impact, while the vertical plane represents means and standard deviations. The results show no significant difference in the perceptions of respondents, since plots are parallel. Means plot and the plot of standard deviation tends increase and decrease simultaneously.

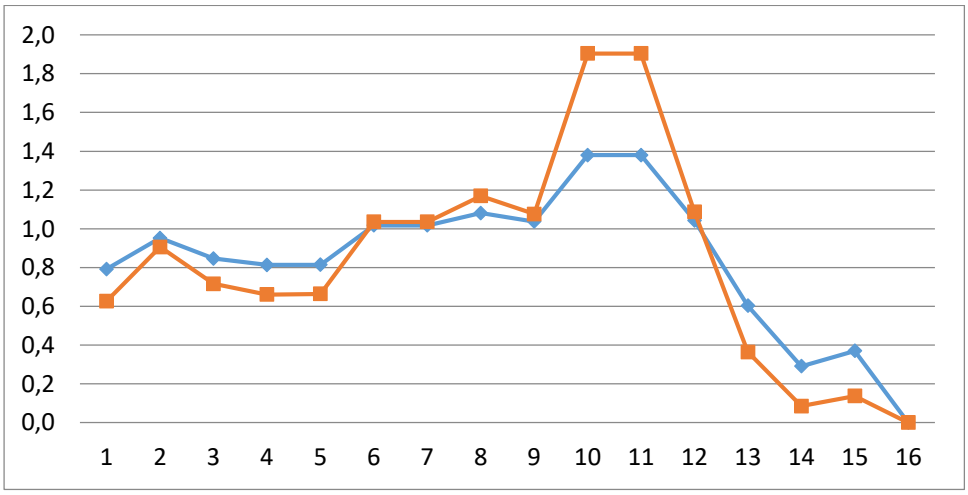

Figure 3: Perceived variation in respondents' perception of the impact of transactional contracts on external stakeholder engagement

4.3. Tests of hypothesis

The test of hypothesis involved an analysis of interdependence using chi-square. The test involved Cross-Tabulation of enablers of effective stakeholder engagement and transactional contract attributes. The test was conducted to make inferences about the perceptual degree of impact between both components of the study that is, the nexus between transactional contract and effective external stakeholders' engagement. The results indicate a strong interdependence between transactional contract and community stakeholders' engagement. The p-values for all variables evaluated lean towards Asymp. Sig .000 (Table 2), and are less than critical p-value ($p<0.005$). The hypothesis is consequently rejected and alternate hypothesis accepted. This means that, statistical

interdependency between external stakeholder engagement and transactional contract attributes is very high. Contractual attributes limiting fragmentation, opportunism, moral hazard and adverse selection are significant incentives for improving community stakeholder's engagement outcome.

Table 2: Chi-square test of interdependency between transactional contract and community stakeholders' engagement

Factors	χ^2	df	P-value	Decision
1.Fragmented practice v relationship building	14.727[a]	3	.002	Reject
2.Fragmented practice v inclusive and on-going interaction	11.455[a]	3	.010	Reject
3. opportunism v promotion of dialogue	14.182[b]	4	.007	Reject
4. Fragmented practice v promotion of dialogue	25.636[a]	3	.000	
5. Opportunism v building relationship	21.909[b]	4	.000	Reject
6. Moral hazard v relationship building	39.455[c]	2	.000	
7. Adverse selection v promotion of dialogue	29.455[d]	1	.000	Reject
8. Opportunism v relationship building	33.500[b]	4	.000	Reject
9. moral hazard v resolved to open & transparent	5.636[a]	3	.000	Reject
10. Moral hazard v promotion of dialogue	21.909[b]	4	.000	Reject
11. Adverse selection and relationship building	20.455[d]	1	.000	Reject

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 11.0.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.8.
c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.7.
d. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 22.0.

4.4. Discussion

The result in Table 1 indicates that, requisite professionals with adequate knowledge of contractual issues were involved in the study. The result in Figure 1 also presents a range of implications. First, the method of selecting contractors for engagement and incentives to engage in traditional procurement framework are unrelated to external stakeholders' engagement outcome. It follows therefore that, incentive to engage in a contract is not a stand-alone parameter for improving engagement performance. It means that, provision of incentive is rather a low stimulant for improving engagement performance based on individual party advantage. To improve stakeholders' engagement in traditional procurement framework, first, joint or collaborative responsibilities is important. Collaboration is however alien to traditional procurement framework; therefore, a complete move away from extant practice is therefore reiterated. Second, there is need to commence engagement early as soon as project objectives are formulated. The responsibilities should not be delegated to the contractor only, but joint consultation represents the best option to achieve efficiency. To achieve this, early contractor's involvement in the supply chain is necessary. Third, the significant tie between on-going and inclusive interaction and effective engagement is not unexpected. It is widely established in the literature that stakeholders' interest is dynamic and varies within the lifecycle of the project (Nash, Chinyio, Gameson & Suresh, 2010). It is also held that, stakeholder identification and management should be iterative through the life cycle of the project (Olander, 2009). The respondents' view in this context is therefore widely consistent with existing body of knowledge.

Increasingly also, numerous studies have criticised transactional contracts and recommends relationship based approaches for effective management of social risk (Argren, Widen & Olander, 2012*;* Oluka, Benon, & Basheka, 2012; & Kashiwagi,

Kashiwagi, Smithwick, & Kashiwagi, 2012). Schwarka and Anigbogu (2012) also found that rules regularisation in traditional procurement practices significantly influence project delivery. Areas of concerns include information asymmetry. Lack of information disclosure is one of the leading sources of conflicts in global infrastructure construction (Andersson & Johansson, 2012; Teo & Loosemore, 2012). In contrast, other studies have shown that relationship-based collaborative form is adequate in accomplishing external stakeholders' engagement (Ross, 2009). The management of social risks in projects requires joint risk management between the project organisations and construction organisations (Osipova & Eriksson, 2009; Tsai & Yang, 2010; & Osipova & Eriksson, 2011).

Based on the established impact of transaction contractual practice on external stakeholders' engagement, transactional contract is therefore a one-way traffic that seeks only the interest of the contracting parties. Its rigid clauses are seldom amended to address the needs of community stakeholders. Transactional contracts are also fragmented, opportunistic, and morally hazardous and employs adverse selection criteria and guidelines. These mechanics are counterproductive to external stakeholders' engagement. While it is not the intention of the study to undertake extensive discussion of traditional procurement practice, it is pertinent to assert that, the test of the study's hypothesis strongly agrees with extant criticisms in the literature. The implication therefore is that, mechanics of transactional contracts are inadequate to address the needs of external stakeholder in the project environment. Whilst the construction industry in Nigeria may seek a move-away from inherent practices, improvement can structure into future contracts by allowing for flexibility, solidarity, mutuality and restrain of opportunism. Flexibility would enhance real-time modification of contracts to reflect project environment as condition get varied. Solidarity describes beliefs in collaborative working while mutuality prioritises and maximises each party's objectives.

5. CONCLUSION

Based on the widespread use of traditional procurement framework (a practice driven by transactional contractual attributes) in Nigeria, and the increasing controversy surrounding community engagement outcomes, this study evaluates the role of contractual attributes in external stakeholders' engagement outcome. The study established that transactional contracts hinder effective community (external) stakeholders' engagement. This implies that, fragmented practice, opportunism, moral hazards and adverse selection attributes inherent in traditional procurement framework inhibit progressive dialogue, inclusive progressive interaction, and open and transparent dealings needed for efficient engagement with community stakeholders. The conclusion of the study suggests the need for modification of traditional contractual practice to improve external stakeholder engagement and overall project environment interface harmony. To ensure effective stakeholders' engagement outcome and project interface harmony in traditionally procured contracts, joint responsibility of client and contractor organisations is required. It is also necessary to commence engagement early in the project as soon as project objectives are formulated. Moreover, to address directly, community stakeholders' needs, using contractual practices, future contracts must allow for flexibility, solidarity, mutuality and restrain of opportunism. Flexibility enhances modification of contracts to reflect project-site related factors; solidarity describes beliefs in collaborative working, while mutuality prioritises and maximises each party's objectives.

The study understands that the research topic has strong relationship with social and psychology applications. Future studies may explore the research problem using relevant research strategy with strong social network and mixed approach to appropriately espouse the missing link.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

FACTORS INFLUENCING OUTSOURCING OF FUNCTIONS AS EFFECTIVE MANAGEMENT STRATEGY BY TELECOMMUNICATIONS FIRMS IN NIGERIA

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ABSTRACT

Purpose: With the fierce competition in the global market, outsourcing is seen as one of the management strategies and major avenues for many firms to improve their competitiveness. Telecommunications firms have therefore used this model to achieve some critical telecommunications infrastructures. As such, this study identified, assessed and categorised into a smaller number of groups the factors influencing outsourcing of functions as effective management strategy by telecommunications firms in Nigeria.

Design/methodology/approach: The study used the survey research design. A two-stage sampling procedure was used for the study. Firstly, the telecommunications firms that took part in the study was selected using a stratified random sampling and secondly, the employees of these selected firms who are directly involved with outsourcing of functions were selected using the random sampling approach. In all, a total of one hundred and eighty (180) copies of questionnaire were administered and of this number, fifty-three (53) respondents returned complete copies of questionnaire. This study identified 18 factors influencing outsourcing of functions.

Findings: The results show that all the factors identified have means greater than 3 which shows that majority of the respondents agree that those factors are the ones actually influencing outsourcing of functions by telecommunications firms in Nigeria. 'Lower costs', and 'allow resources to focus on core business function' are rated very high as the factors influencing outsourcing of functions. Through the use of factor analysis technique, these factors were reduced and grouped into a smaller number with the dictates of what is obtainable in telecommunications firms in Nigeria. These groups are 'cost and flexibility related factors', 'quality and time related factors', 'allow resources to focus on core competency factors', and 'innovation related factors'.

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Originality/value: The study concluded that the research is illuminating in the sense that it reveals more regarding the identification, categorisation/grouping of the factors influencing outsourcing of functions by telecommunications firms in Nigeria.

Keywords: Factor analysis; facilities management; infrastructure; Nigeria; outsourcing; telecommunications firms.

1. INTRODUCTION

Outsourcing is contracting with another company or person to carry out a particular function (Rodriguez & Diaz, 2008). That is, the act of delegating responsibility for performing a task to some other entity (Krell, 2006). Outsourcing has no doubt taken the world by storm, becoming one of the major avenues for many firms to improve their competitiveness. It has been a pervasive trend over the past 20 years in the world. For example, outsourcing has been successfully implemented within the manufacturing industry (Gilley & Rasheed, 2009). It has also emerged as a major trend in many service industries, such as, telecom operator Zain (now Airtel in Nigeria) signed a deal with Ericsson to outsource the management of its network and field operations in Nigeria for a five-year term, in a bid to improve its operations in the country (Field, 2009). Outsourcing arose as a management tool of a compelling need for organisations to be more productive, more competitive and profitable (Olowa, 2009). To buttress this, Udoudoh (2015) is of the view that poor management may inhibit infrastructures from performing even to optimum level with telecommunications infrastructures not an exception.

Telecommunications market in Nigeria is a vital engine of the economy and an essential infrastructure that promotes the development of other sectors such as agriculture, education, industry, health, defense, banking, transportation and tourism (Arzika, 2000). Nigerian Telecommunications industry has witnessed significant growth over the last fourteen years, following the successful take-off of digital mobile telephone services in the country, using the Global System for Mobile communications (GSM) technology (Hassan, Oluwaranti, and Isola, 2009). From less than 500,000 fixed telephone lines as at mid-2001, the total number of fixed and mobile telephone lines increased to about 67.8 million lines as at June, 2009 (NCC, 2012). Up till the year 2001, Nigeria was classified as one of the Africa's most under-served telecommunications market, but today, Nigeria is one of the world's fastest growing telecommunications market (Ndukwe, 2006). Most of the activities, especially infrastructural development aspect, of this industry are being outsourced.

Outsourcing, on the other hand, has received increasingly attention in scientific research circle, but so far it has mainly been theoretical in nature and relied mostly on anecdotal evidence to support assertions (Shy & Stenbacker, 2003; Benjaafar, Elahi & Donohue, 2007). Moreover, most of them focus on very specific industries, for example, call centre (Ren & Zhou, 2008), information technology (Jae-Nam, Miranda & Yong-Mi; 2004), manufacturing (Dekkers, 2000), logistics (Alp, Erkip and Güllü, 2003; Ellram & Billington, 2001), facilities management (Ikediashi *et al*., 2012; Ikediashi, Ogunlana, & Odesola, 2015). However, few empirical investigations of outsourcing (Gilley, 2009), especially in specific regions or countries have been conducted (Bush, Tiwana, and Tsuji 2008; Baily, Masson, and Raeside, 2002). For example, Bush et al. (2008) has attempted to empirically study the drivers of software outsourcing decisions

and Baily et al. (2002) makes a survey into the outsourcing activities. They focused on the outsourcing in Japan and in Edinburgh and Lothians, United Kingdom.

However, documented scientific research evidence in the area of outsourcing of functions by telecommunications firms in Nigeria suggests that it has received little or no attention within this research enclave. And as such, it is imperative to know the factors influencing outsourcing of functions by these firms. This is with a view to drawing lessons that will aid in developing a body of outsourcing of functions knowledge in the Telecommunications industry in Nigeria in order to unravel and uncover local realities. Specifically, the objectives of this study are to:

i. develop a list of factors influencing outsourcing of functions by telecommunications firms in Nigeria.
ii. assess those factors and categorise them into a smaller number of groups using factor analysis approach.

The paper is therefore structured with introduction as the first section. This is followed by the theoretical concepts underpinning the study. The third section reviews the related literature. The fourth section gives the research methods used for the study. Following on, the fifth section analyses and discusses the result of the findings. Finally, the sixth section concludes the paper and offers some recommendations for further study.

2. THEORETICAL UNDERPINNING OF THE STUDY

Outsourcing may briefly be defined as 'the strategic and ongoing operational use of outside resources to perform activities traditionally handled by internal staff and resources' (Syska Hennessy Group, 2005). Outsourcing decisions require a firm to determine which activities they should vertically integrate and perform using internal resources ("in-source") and which activities they should procure from a third party supplier ("outsource") (Syska Hennessy Group, 2005). Outsourcing has become more important in today's increasingly competitive telecommunications environment (Chase, Jacobs, & Aquilano, 2004; Kakabadse & Kakabadse, 2003; Lankford & Parsa, 1999; Talluri & Narasimhan, 2004). Existing theory identifies the role that outsourcing can play in developing a competitive advantage for a firm. Three views of competitive advantage explain the role that outsourcing can play in increasing firm competitiveness; they are transaction cost economics (TCE), the resource-based view, and the knowledge-based view (Williamson, 1975, 1985). TCE posits that firms adopt governance structures which minimize the transaction costs (Williamson, 1975, 1985). In an outsourcing context, TCE predicts that firms will make an outsourcing decision when outsourcing results in a reduction in firm size that leads to an overall reduction in the required transaction costs (Aubert, Rivard, & Patry, 2004; Holcomb & Hitt, 2007; Kern & Willcocks, 2002; Murray & Kotabe, 1999; Schniederjans, Schniederjans, & Schniederjans, 2005). The *resource-based* view states that unique firm resources such as capital assets, capabilities, and processes enable a firm to execute strategies which can lead to efficiency and effectiveness improvements (Barney, 1991). The *knowledge-based* view opines that a core capability is a knowledge set that distinguishes one group from another and provides a competitive advantage (Leonard-Barton, 1992a). The knowledge set may take the form of employee knowledge or skills, technical systems, managerial systems, or norms and values.

3. REVIEW OF RELATED LITERATURE

Consistent with the existing literature, the motivation, objectives, and goals of a firm's outsourcing effort related to its activities as the factors influencing firm's supply chain (Fisher, Ramdas, and Ulrich, 1999; Heikkila and Cordon, 2002; Kakabadse and Kakabadse, 2000). Factors influencing outsourcing are the direct outcome of the operationalisation of a firm's competitive priorities into action plans. A thorough literature review of existing research was conducted to identify the most important factors influencing outsourcing functions by firms (Benjaafar, Elahi, & Donohue, 2007; Choi & Hartley, 1996; Frohlich & Dixon, 2001; Gottfredson et al., 2005; Insinga & Werle, 2000; Kakabadse & Kakabadse, 2000; Koh & Venkatraman, 1991; Lee, 2004; Leonard-Barton, 1992b; Loh & Venkatraman, 1992; McFarlan & Nolan, 1995; Min & Galle, 1991; Narasimhan and Das, 1999; Smith, Mitra, & Narasimhan, 1998; Weber, Current, & Benton, 1991).

For example, industry experts identified cost savings as the leading factor influencing outsourcing decisions (Gottfredson *et al*., 2005; Schniederjans *et al*., 2005). Outsourcing often improves cost competitiveness because a firm can eliminate unproductive assets, reduce capital spending, and partner with a firm that can perform an activity at a lower cost. Cost related outsourcing factors include the selection of a partner that offers lower total, logistics, regulatory, and/or legal costs to perform an activity. Firms may also be driven to select a partner that allows access to a new market, thus increasing sales volume which leads to economies of scale. Firms that focus on flexibility when making outsourcing decisions are influenced to effectively respond to changing customer requirements (Frohlich & Dixon, 2001). Changing requirements may take the form of demand fluctuations or changes in the required product characteristics (Schniederjans *et al*., 2005). Outsourcing factors that support flexibility include a desire to increase process responsiveness and the ability to change production volumes and supply chain activities in response to changing market demands (Choi & Hartley, 1996; Lee, 2004; Loh & Venkatraman, 1992; Narasimhan and Das, 1999; Weber *et al*., 1991). Outsourcing an activity to multiple vendors can improve a firm's preparedness to react flexibly to the uncertainty of the service provider environment.

Hoecht and Trott (2006) opine that firms that emphasise innovativeness when making outsourcing decisions focus on rapidly delivering products featuring new technologies and novel features. Outsourcing can improve innovativeness by allowing a firm to access skills and expertise not available in-house (Hoecht & Trott, 2006; Schniederjans *et al*., 2005). Similarly, firms may consider in-sourcing activities if it allows them to leverage unique skills and expertise not available to competitors. To accomplish this goal, factors influencing outsourcing related to innovativeness focus on the selection of sources that provide access to new technologies and expertise related to new technologies (Gottfredson et al., 2005; Leonard-Barton, 1992a; Loh & Venkatraman, 1992; McFarlan & Nolan, 1995; Weber *et al*., 1991).

Focusing on quality when making outsourcing decisions requires a firm to consider both the conformance and performance quality of products (Bozarth et al., 1998; Frohlich & Dixon, 2001; Gottfredson *et al*., 2005; Leonard-Barton, 1992a; Loh & Venkatraman, 1992; McFarlan and Nolan, 1995). The outsourcing of activities may be influenced by the availability of a vendor with superior expertise that can improve the conformance and/or performance of an activity for a firm (Schniederjans *et al*., 2005). A firm with superior in-house skill sets may be driven to in-source an activity if its ability to perform an activity in a higher quality manner leads to an advantage over competitors. A focus on time when making outsourcing decisions implies that a firm is competing on the ability to perform

activities more quickly or speedily with better on-time performance (Frohlich & Dixon, 2001). To improve product delivery speed and the ability to develop and deliver products on-time, a firm is influenced to choose sources that can conduct activities with less lead time compared to other potential sources (Narasimhan and Das, 1999; Weber et al., 1991). A firm may choose a source that offers comparatively faster process capability and reduced cycle times (Weber *et al*., 1991).

Based on the review above, this study identified 18 distinct, common factors influencing outsourcing. These 18 factors represent the most commonly cited factors influencing outsourcing decisions; however, they do not represent a comprehensive inventory of every possible outsourcing factor. The list of these factors is shown in Table 1.

Table 1: Factors influencing outsourcing of functions

Factors influencing outsourcing of functions	Authors
1. Allow resources to focus on core competency – low cost	Gottfredson *et al.* (2005)
2. Increase volume through new market penetration	Gottfredson *et al.* (2005)
3. Lower total costs	Schniederjans *et al.* (2005)
4. Reduce logistics costs	Gottfredson *et al.* (2005)
5. Reduce regulatory and legal	Schniederjans *et al.* (2005)
6. Improve process responsiveness	Choi and Hartley (1996)
7. Increase supply chain flexibility	Lee (2004)
8. Increase volume capability	Loh and Venkatraman (1992)
9. Multiple sourcing for uncertainty preparedness	Frohlich and Dixon (2001)
10. Allow resources to focus on core competency – flexibility	Schniederjans *et al.* (2005)
11. Access to specific labour and/or technology expertise	Safizadeh *et al*. (1996)
12. Gain access to new technology	Gottfredson *et al*. (2005)
13. Allow resources to focus on core competency – quality	
14. Improve conformance quality	Frohlich and Dixon (2001)
15. Improve product performance design quality	Frohlich and Dixon (2001)
16. Allow resources to focus on core competency – time	Frohlich and Dixon (2001)
17. Improve process capability and cycle times	Weber *et al.* (1991)
18. Improve process lead times	Weber *et al.* (1991)

4. RESEARCH METHODS

After due consideration of the research problem, the scientific method of inquiry which seems most appropriate to the research has been decided in accordance with the opinion expressed by Dixon (1994). The study made use of the survey research design and this is adjudged to be appropriate because the research is exploratory and descriptive in nature. It is descriptive because it involves collection of data and analysis to test hypothesis. The target population for the study includes all the telecommunications firms in Nigeria. These consist of GSM/Fixed wireless/CDMA operators and major telecommunications vendors with their head offices in Lagos. The names and addresses of these firms were extracted from the list of accredited telecommunications firms being maintained by the NCC. A two-stage sampling procedure was used for the study. Firstly, the telecommunications firms that took part in the study was selected using a stratified random sampling and secondly, the

employees of these selected firms who are directly involved with outsourcing of functions were selected using the random sampling approach. In choosing the sample size for the study, the recommendation of Boll and Gall as given in Adetoro (1997) was used that sample size should be determined by percentage based on the population size. They suggested that 20% should be used for up to 1,000 population, 10% for up to 5,000 population, and 5%for up to 10,000 population. For the purpose of this research the sample size for the study was determined using Boll and Gall method mainly because it is very easy to use. This method was applied to fixed wireless/CDMA operator firms. All the GSM operator firms and major vendors were sampled since they are not many (Table 2).

Table 2: Sample size for telecommunications firms in Nigeria

	Population	**Sample size**
GSM operator	5	5
Fixed wireless/CDMA	33	7
Major vendors	6	6
Total	**44**	**18**

The sample size that was used for the study is 18 (Table 2). The number of questionnaire that were administered to each of these 18 firms were determined by the number of employees in the firms that are directly associated with outsourcing of functions. A well-structured questionnaire was designed and administered on the employees of each of the firms sampled randomly. The number of employees in each of the firms who answered the questionnaire was determined by Boll and Gall method using percentage of total number of staff in the firms that are directly involved with outsourcing of functions. This arrangement implies that questionnaire was administered in two stages. The first stage was to find out number of employees that are directly involved with outsourcing of functions for the determination of representative sample that answered the questions. Tables 3 and 4 show the questionnaire distributed and summary of response rate respectively. The response rate for this study is 29.4%. Though, it small, one cannot totally say that it is too small for this kind of study.

Table 3: Questionnaire distribution

Telecommunications firms	Questionnaire distributed	Questionnaire returned
GSM operator 1	10	4
GSM operator 2	10	3
GSM operator 3	10	5
GSM operator 4	10	8
GSM operator 5	10	5
Fixed wireless/CDMA operator 1	10	3
Fixed wireless/CDMA operator 2	10	5
Fixed wireless/CDMA operator 3	10	2
Fixed wireless/CDMA operator 4	10	1
Fixed wireless/CDMA operator 5	10	2
Fixed wireless/CDMA operator 6	10	1
Fixed wireless/CDMA operator 7	10	3
Vendor 1	10	3
Vendor 2	10	1
Vendor 3	10	1
Vendor 4	10	4
Vendor 5	10	1
Vendor 6	10	1
Total	***180***	***53***

Table 4: Summary of response rate

Telecommunications firms	Questionnaire distributed	Number of responses	Percentage response
GSM operators	50	25	50.0
Fixed wireless/CDMA operators	70	17	24.3
Vendors	60	11	18.3
Total	***180***	***53***	***29.4***

5. RESULTS AND DISCUSSION OF FINDINGS

5.1. Respondents characteristics

Table 5 illustrates the results obtained. Question was asked if the respondents have been involved with some outsourcing projects before and the result shows that all the respondents (100%) have been involved with one or more outsourcing projects before. This shows that all the respondents are qualified to participate in the survey. Respondents were also asked to indicate whether or not they have managed some outsourcing projects before, the results (Table 5) show that 42 respondents out of 53 representing 79% indicated that they have managed outsourcing projects before. The implication of this is that majority of the respondents that took part in the survey are well knowledgeable about the subject matter. Respondents were also asked whether or not they have been involved in decision making in some outsourcing projects.

The result as shown in Table 5 indicates that about 60% of the respondents are decision makers regarding outsourcing projects. The remaining 40% are not involved with any decision making regarding outsourcing projects. The implication of this is that above average of the respondents are decision makers when it comes to outsourcing projects in Nigeria.

Table 5 further shows the highest academic qualifications of the respondents. 51% of the respondents indicated that master's degree is the highest level of education they possess. 34% of the respondents indicated that they hold bachelor's degree as their highest qualification, 9% indicated that Postgraduate Diploma (PGD) is their highest academic qualification, while the remaining 6% holds Higher National Diploma (HND). This shows that over 90% of the respondents hold bachelor's degree and above. The implication of this is that majority of the respondents have required academic qualification to be knowledgeable about the subject of the survey. Also, Table 5 shows the position of the respondents in their different organisations. The results indicate that 53% of the respondents are middle level managers, 28% are lower level managers, and 15% holds technical position, while the remaining 4% are top level managers. The implication of this result is that all the respondents participated in the study are holding managerial and/or technical positions. Additionally, Table 5 reveals the classification of the respondents' organisations. The results show that 47% of the respondents are working for GSM operators, 32% are working for fixed wireless/CDMA operators, while the remaining 21% are working in vendor organisation.

Table 5: Respondents' background information/general questions

	No of Responses	Percentage
Involved with some outsourcing projects		
Yes	53.0	100.0
No	0.0	0.0
Total	53.0	100.0
Involved with managing some outsourcing projects		
Yes	42.0	79.2
No	11.0	20.8
Total	53.0	100.0
Involved with decision making in some outsourcing projects		
Yes	32.0	60.4
No	21.0	39.6
Total	53.0	100.0
Highest qualifications		
HND	3.0	5.7
BSc	18.0	34.0
PGD	5.0	9.4
MSc	27.0	50.9
PhD	0.0	0.0
Total	53.0	100.0
My organisation can be classified as		
GSM operator	25.0	47.2
Fixed wireless/CDMA operator	17.0	32.1
Vendor	11.0	20.8
Total	53.0	100.0
My position in the organisation		
Top level manager	2.0	3.8
Middle level manager	28.0	52.8
Lower level manager	15.0	28.3
Technical position	8.0	15.1
Total	53.0	100.0

5.2. Analysis of factors influencing outsourcing of functions by telecommunications firms in Nigeria

A preliminary examination of the distribution indicating the mean and standard deviation is shown in Table 6. The results obtained indicate that all the identified factors have means greater than 3 which shows that majority of the respondents agree that those factors are the ones actually influencing outsourcing of functions by telecommunications firms in Nigeria. It is worthy of note to say that 'lower costs', and 'allow resources to focus on core business function' are rated very high as the factors influencing outsourcing of functions.

In a bid to fulfil objective two of this study, factor analysis approach was used in order to have a closer look at those factors influencing outsourcing of functions by telecommunications firms in Nigeria. Factor analysis enables a researcher to replace a larger data matrix which may have very little theoretical meaning with much smaller and

manageable one which tends to make sound theoretical sense. Thus, factor analysis also helps to achieve parsimony in data description.

5.2.1 Factor extraction

Table 7 shows the total variance analysis for each of the 18 identified factors influencing outsourcing of functions by telecommunications firms in Nigeria. In order to determine the number of factors that will be needed to represent the data, the percentage of total variance explained by each of the factors is examined. The total variance is given by the sum of the variance of each factor which totalled 18. Two approaches have been successfully used. Chan and Tam (2000), and Rustom and Amer (2006) made use of Eigenvalue and Screeplot approaches. Eigenvalue approach is used in this study.

Table 6: Preliminary examination of factors influencing outsourcing of functions

Factors influencing outsourcing of functions	N	Mean	Standard deviation
1.Allow resources to focus on core competency – low cost	53	4.60	0.566
2. Increase volume through new market penetration	53	3.68	0.850
3. Lower total costs	53	4.47	0.668
4. Reduce logistics costs	53	4.47	0.696
5. Reduce regulatory and legal costs	53	4.30	0.696
6. Improve process responsiveness	53	4.09	0.658
7. Increase supply chain flexibility	53	4.02	0.720
8. Increase volume capability	53	4.06	0.691
9. Multiple sourcing for uncertainty preparedness	53	3.91	0.766
10 Allow resources to focus on core competency - flexibility	53	4.49	0.639
11. Access to specific labour and/or technology expertise	53	4.15	0.632
12. Gain access to new technology	53	3.45	0.607
13. Allow resources to focus on core competency - quality	53	4.58	0.570
14. Improve conformance to quality	53	3.45	0.607
15. Improve product performance design quality	53	3.38	0.686
16. Allow resources to focus on core competency - time	53	4.58	0.497
17. Improve process capability and cycle times	53	3.38	0.686
18. Improve process lead times	53	3.42	0.663

In Eigenvalue approach (Table 7), only the factors that account for a variance greater than 1 (Eigenvalue greater than 1) are extracted out. Seventy-three percent (73%) of the total variance is attributed to the first 4 factors where these factors have an Eigenvalue greater than 1. Other 14 factors account for only about 26.7% of the total variance. In the literature reviewed, these 18 factors are mapped into five groups namely: Cost related

factors, flexibility related factors, innovativeness related factors, quality related factors, and time related factors. This research has identified that these five groups cannot work for telecommunications firms in Nigeria and that the 18 factors can be grouped into four.

5.2.2 Factor Rotation

The question of how the set of individual factors identified relate with each other has to be answered. It should be emphasised that one cannot interpret the un-orthogonal factors extracted at this stage as doing so may not yield accurate results. And so, having estimated the communalities (Table 8), inserted them in the main diagonal of the correlation matrix and extracted the un-orthogonal factors, one will have to proceed to rotate these factors so as to obtain factors which are more easily interpretable. This means that in factor analysis, the rotation of the factor matrix is highly essential.

Table 7: Total variance analysis

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.505	30.585	30.585	5.505	30.585	30.585	4.757	26.426	26.426
2	3.615	20.083	50.668	3.615	20.083	50.668	3.719	20.661	47.088
3	2.795	15.526	66.194	2.795	15.526	66.194	3.088	17.155	64.243
4	1.280	7.110	73.304	1.280	7.110	73.304	1.631	9.062	73.304
5	.976	5.420	78.725						
6	.777	4.316	83.040						
7	.684	3.802	86.842						
8	.505	2.804	89.646						
9	.444	2.466	92.112						
10	.332	1.842	93.954						
11	.288	1.598	95.552						
12	.200	1.113	96.666						
13	.159	.882	97.548						
14	.123	.683	98.231						
15	.114	.636	98.867						
16	.097	.538	99.405						
17	.068	.379	99.784						
18	.039	.216	100.000						

Rotation helps to eliminate medium loadings by maximizing the number of high and low loadings. These make interpretation more accurate. Several rotation techniques are available e.g. Oblimin and Varimax rotation methods. This study made use of Varimax technique because it is an orthogonal rotation, resulting in uncorrelated factors which are usually preferred most researchers because it assures that the factor loadings obtained are uncorrelated and independent of each other.

From Table 9, one can see that the factor analysis procedure with Varimax rotation applied to the data yielded a four-dimensional solution. The communalities (Table 8), which can be regarded as indications of the importance of the variables in the analysis are generally high (all above 48.2%). This shows that the variables selected for this study are appropriate and relevant.

Table 8: Communalities

Variable	Initial	Extraction	Variable	Initial	Extraction
1. Allow resources to focus on core competency – low cost	1.000	.904	10. Allow resources to focus on core competency - flexibility	1.000	.605
2. Increase volume through new market penetration	1.000	.870	11. Access to specific labour and/or technology expertise	1.000	.491
3. Lower total costs	1.000	.701	12. Gain access to new technology	1.000	.814
4. Reduce logistics costs	1.000	.674	13. Allow resources to focus on core competency - quality	1.000	.839
5. Reduce regulatory and legal costs	1.000	.882	14. Improve conformance to quality	1.000	.725
6. Improve process responsiveness	1.000	.665	15. Improve product performance design quality	1.000	.844
7. Increase supply chain flexibility	1.000	.482	16. Allow resources to focus on core competency - time	1.000	.570
8. Increase volume capability	1.000	.703	17. Improve process capability and cycle times	1.000	.851
9. Multiple sourcing for uncertainty preparedness	1.000	.734	18. Improve process lead times	1.000	.839

Table 9: Rotated component matrix

Variable	Component				Variable	Component			
	1	2	3	4		1	2	3	4
1.Allow resources to focus on core competency – low cost	.026	.041	**.949**	-.021	10.Allow resources to focus on core competency - flexibility	-.174	-.036	**.734**	.185
2.Increase volume through new market penetration	.198	.114	-.016	**.904**	11.Access to specific labour and/or technology expertise	**.492**	-.403	-.051	.290
3.Lower total costs	**.768**	-.044	-.324	.070	12.Gain access to new technology	.008	.512	.088	**.737**
4.Reduce logistics costs	**.788**	.170	-.150	.038	13.Allow resources to focus on core competency - quality	-.012	-.070	**.913**	-.010
5.Reduce regulatory and legal costs	**.875**	.022	-.335	.071	14.Improve conformance to quality	.035	**.850**	-.028	-.035
6.Improve process responsiveness	**.810**	.056	.049	.065	15.Improve product performance design quality	.062	**.897**	-.057	.178
7.Increase supply chain flexibility	**.684**	-.115	.027	.012	16.Allow resources to focus on core competency - time	-.135	-.079	**.731**	-.100
8.Increase volume capability	**.787**	.220	-.039	.184	17.Improve process capability and cycle times	.084	**.909**	-.049	.125
9.Multiple sourcing for uncertainty preparedness	**.822**	.202	.115	-.068	18.Improve process lead times	.142	**.881**	-.066	.194

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization

5.2.3 Grouping of the Factors

The four factors which altogether accounted for 73.3% of total variance in the 18 original factors may be regarded as composite factors influencing outsourcing of functions by telecommunications firms in Nigeria.

Factor 1 accounted for 30.585% of the total variance (Tables 7 and 9) and it is without doubt the most important factor. Of the 18 factors included in the analysis, eight of them loaded positively and significantly on this factor (Table 9). They included lower total costs (factor 3), reduce logistics costs (factor 4), reduce regulatory and legal costs (factor 5), improve process responsiveness (factor 6), increase supply chain flexibility (factor 7), increase volume capability (factor 8), multiple sourcing for uncertainty preparedness (factor 9), and access to specific labour and/or technology expertise (factor 11). The above-mentioned factors are the ones that are loaded strongly, positively and significantly, except factor 11 (access to specific labour and/or technology expertise) that didn't load strongly (0.492), though it loaded positively and significantly. This factor is therefore named 'cost and flexibility related factor'.

Factor 2 accounted for 20.083 percent of the total variance (Table 7). Associated with it are four factors which loaded strongly, positively and significantly. These are factors 14, 15, 17, and 18 (Table 9). Two of the factors are quality related and the other two are time related and it can be seen that all of them are strongly loaded (the minimum being 0.850), this factor will, however, be named 'quality and time related factors'.

Factor 3 accounted for 15.526 percent of the total variance (Table 4.3). These factors loaded highly on four factors. They are 'allow resources to focus on core competency-low cost', 'allow resources to focus on core competency-flexibility', 'allow resources to focus on core competency-quality', and 'allow resources to focus on core competency-time'. This factor is therefore named 'allow resources to focus on core competency related factors'.

Factor 4 is found to account for 7.11 percent of the total variance in the original data matrix. These are factors 2 and 12. That is, 'increase volume through new market penetration' and 'gain access to new technology'. These two factors loaded highly and the factor is named 'innovation related factors'. This is because new market penetration and new technology are issues related to the innovativeness of the firms.

While carrying out the review of literature, the researcher identified 18 factors which was mapped into five groups namely by the researcher as 'cost related factors', 'flexibility related factors', 'innovativeness related factors', 'quality related factors', and 'time related factors'. This research has, however, identified that these five groups cannot work for telecommunications firms in Nigeria and that the 18 factors can be re-grouped into four based on the outcome of this research. These are 'cost and flexibility related factors', 'quality and time related factors', 'allow resources to focus on core competency factors', and 'new market penetration/technology related factors'.

6. CONCLUSION

This study identified, assessed and categorised into a smaller number of groups the factors influencing outsourcing of functions by telecommunications firms in Nigeria. In the survey conducted, 18 telecommunications firms (involving five GSM operators, seven fixed wireless/CDMA firms, and six major vendors) participated. Findings from the study indicate that all the factors identified have means greater than 3 which shows that majority of the respondents agree that those factors are the ones actually influencing outsourcing of functions by telecommunications firms in Nigeria. Particularly, 'allow resources to focus

on core competency – low cost', 'allow resources to focus on core competency – quality', 'allow resources to focus on core competency – time', 'allow resources to focus on core competency – flexibility' and 'lower costs' are the first five most rated factors influencing outsourcing of functions.

The findings of this study is illuminating in the sense that the study reveals more regarding the categorisation/grouping of the factors influencing outsourcing of functions by telecommunications firms in Nigeria. Through the use of factor analysis technique, these factors were reduced and grouped into a smaller number with the dictates of what is obtainable in telecommunications firms in Nigeria. These groups are 'cost and flexibility related factors' consisting of the following factors: lower total costs, reduce logistics costs, reduce regulatory and legal costs, improve process responsiveness, increase supply chain flexibility, increase volume capability, multiple sourcing for uncertainty preparedness, and access to specific labour and/or technology expertise. The 'quality and time related factors' group have the following as the sub-factors: improve conformance to quality, improve product performance design quality, improve process capability and cycle times, and improve process lead times. The 'allow resources to focus on core competency factors' group has 'allow resources to focus on core competency-low cost', 'allow resources to focus on core competency-flexibility', 'allow resources to focus on core competency-quality', and 'allow resources to focus on core competency-time' as sub-factors, while the 'innovation related factors' group has 'increase volume through new market penetration' and 'gain access to new technology' as sub-factors.

The outcomes of this study have wider implications for practice and research. Firstly, this research has provided illumination and insight into the factors influencing outsourcing of functions by the telecommunications firms in Nigeria and other developing nations can draw lessons from this in order for them to unravel and uncover their own local realities. Secondly, the findings have the capability of advancing theory in the subject by adding to the pool of existing literature in the subject. This will at the same time spur research activities within this research enclave that have received limited attention among researchers in the study area.

While this research sheds new light on the outsourcing of functions in the telecommunications firms in Nigeria and one of the areas that researchers need to give proper attention is congruence between competitive priorities and outsourcing decisions. This can still be for telecommunications firms, but it is recommended that this kind of study can be expanded beyond telecommunications firms. Further, a wider study with focus to similarities and differences in the impact of outsourcing and business performance across a variety of industries with regards to infrastructure outsourcing is recommended.

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Journal of Contemporary Research in the Built Environment ISSN: 2636-4468
Volume 2, Numbers 1&2, 2018

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