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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.

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Journal of Contemporary Research in the Built Environment (JOCREBE)
Department of Building
Faculty of Environmental Studies
University of Uyo, Uyo, Nigeria
Email: jocrebe@uniuyo.edu.ng

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EDITORIAL

Akaninyene A. Umoh[1]
Editor-in-Chief

The "Journal of Contemporary Research in the Built Environment" Volume 1, Number 2 edition is out with its ISSN number. Articles that have scaled through our peer review mechanism are hereby published and cover areas of sustainable construction in all its ramifications. Highlight of the twelve papers in this edition are here presented only to arouse your appetite while you are encouraged to go through the main write-up.

On behalf of the editorial board, I wish to express our appreciation to all the contributors for their well-articulated articles that keep the flag flying towards our effort in attaining to a sustainable built environment for a better living. We are inviting you to send your articles for consideration in the next issue (Volume 2, Number 1) that is coming out very soon; we wish you a happy reading.

The first paper by Ujene and Akpanamasi provided an insight into the required supervisory competencies of selected professionals and factors influencing quality of supervision in construction projects delivery in Uyo, Nigeria. Exploratory and deductive cross-sectional survey research design was adopted for the study. Structured mail questionnaire were administered on 74 project managers, and data obtained analysed using descriptive, relative importance index, and Kruskal-Wallis tests. The results revealed that supervisory functions and factors influencing their quality vary significantly among selected professionals. The study concluded that the competencies of project managers and the factors influencing their quality of supervision depend on the primary professional affiliation of a project manager; that if the primary professional affiliation is not considered before assigning supervisory function, projects may suffer up to 40% pitfall in terms of performance.

The second paper by Wilson and Odesola aimed at determining the influence of site management-related causes of rework on the performance of oil and gas construction projects. A survey research design approach was adopted using stratified random sampling. Data were collected through structured questionnaire administered on 555 contractors and 395 consultants involved in the execution of oil and gas construction projects in South-South Geo-Political Zone of Nigeria and the analysed using Mean Item Score, Spearman Rank Correlation test, Kruskal Wallis test and One Sample T-test. Results showed agreement between contractors and consultants on the frequency of occurrence of site management-related causes of rework. Ineffective site leadership, poor communication, poor planning and allocation of resources, ineffective use of quality management practices and constructability problems are the five most occurring site management-related causes of rework in oil and gas construction projects.

The next paper by Ajiero and Ujene evaluated the effectiveness of various finance allocation strategies in public and private building projects in Akwa Ibom State. 120 copies

[1] akaninyeneumoh@uniuyo.edu.ng

of structured questionnaire were administered to construction professionals that have previously handled private and public building projects in Akwa Ibom state, out of which 103 (85.8%) were returned and analysed using descriptive statistic. Results indicated that the investigated milestone payment method and concession methods (BOOT, BOO, BOT), are more effective in the public building projects than in the private. In contrast, the direct labour (DL) payment method is inferred to be more effective in the private projects than in public projects. In addition, honouring of interim payment certificates (IPCs) has been established to be more delayed in public building projects than in the private projects; and overruns in time and cost are more experienced in public building projects than in the private projects.

The fourth paper by Akinradewo, Ojo and Oyefusi assessed the effects of communication among the professionals on building project delivery in terms of completion time, cost, client satisfaction and project management. A questionnaire survey that discuss the problem that may arise as a result of informal communication among the construction professionals, was conducted on in-house consultants and external contractors who had been involved on building projects at the Ministry of Housing, Lagos State in the past five years (2011-2016). Findings revealed that answers all questions asked is the most important characteristic of effective communication while specification is the most used communication mechanism; and that the four topmost effect of communication are time, client satisfaction, project management and cost.

The fifth paper by Ikurekong, Ananaba and Umunakwe examined change effects on land use and land cover in Aba Urban. In the study, spatial change variables were obtained from satellite imageries of 2001 and 2010 epochs and Area Analysis Technique was employed in calculating the area in hectare and percentages, while overlay method was used to identify the actual location, rate and pattern of change. Equally, paired Samples T-Test and Eta squared techniques were used to estimate the magnitude of effect as it is relatively independent of sample size. The result showed that increase in land cover was occasioned by population growth, and increased need of land for various uses.

The next paper by Ojo and Olukolajo elucidated the factors that inhibit formalization of land right registration. 150 professionals in the built environment within Akure, the capital of Ondo state, were involved in the study through administering of structured questionnaire, and Factor analysis by principal components was adopted in the data analysis. The results showed that six components accounted for 77.23% of the total variance explained and a total of six factors were extracted which converged in 10 iterations. Time taken in achieving land title registration, bureaucratic procedure involved, inappropriate document to work with, poor knowledge of ICT among officials and poor internet connectivity are among the inhibiting factors.

The seventh paper by Olubajo and Kuma investigated factors that significantly affect the pre-contract planning stages of building projects in Uyo, Nigeria. A survey approach was adopted in the collection of data among key professional consultants involved in building project planning and execution. A sample selection of Architects (32), engineers (43) and Quantity Surveyors (38) was drawn from 56 project sites and 9 consulting firms in the study area adding up to a sample size of 113 professional consultants. Findings indicated that factors such as client's demand, client's policy and planning procedures as the most significant factors influencing pre-contract building project planning efforts.

The next paper by Umoren and Inyangmme, assessed the effect of road connectivity pattern on the physical development in Akwa Ibom State. Two sets of data on road connectivity and physical development were collected. These data were length of roads in each local government area as independent variable (x) and data on the level of physical development in each local government area as dependent variables (y), and were analysed

using descriptive statistics and Pearson Product Moment Correlation. The result revealed that there is positive relationship between road connectivity and physical development.

Paper ninth by Allu and Emuze attempted to resound the importance of sustainable architectural education curricula for development in the built environment. Given that, the architectural profession has a supervisory role in the construction industry and has the capacity to re-orient other professions within its sector. This theoretical discourse presents; the challenges, potentials and the possible ways to advance sustainable architectural education in Nigeria, and find out that sustainable education is the most important medium required to transform, re-orientate and to build the capacity of future and current built environment practitioners.

The tenth paper by Ezeokoli examined the effect of property characteristics on the returns from event centres in Akure, Ondo State. 18 event centres were examined, noting their physical attributes through well-structured questionnaires, and data collected analyzed using multiple regression analysis. finding revealed that out of the selected property characteristics, the number of convenience i.e. toilet facilities in an event centre and distance of event centres to a major road significantly affect the returns from event centres at 0.007 and 0.030 levels of significance respectively.

The eleventh paper by Aka, Emuze, Kaase and Marafa investigated how a proactive approach such as action research (AR) can be effectively adopted as waste identification and reduction in the structural design phase of the construction process. An action research in five selected consulting engineering firms located in Bloemfontein, South Africa, in 2016 was used for the study. Findings indicated that AR is a reliable, structured, and rigorous research approach that can be adapted to identify and reduce waste such as waiting time, design error, over-processing, excessive vigilance, overproduction, and correction/rework in the structural design phase of the construction process.

The last paper by Omongbale and Ekop examined the strength and water absorption performance characteristics of earth made brick for low cost housing. Samples of earth made bricks were produced using cement at various percentages of 0%, 5%, 10%, and 15% content with the 0% as the control. The produced earth made bricks were cured and tested for compressive strength and water absorption at 7, 14, 21 and 28 days, respectively. The results indicated that the compressive strength increased as the percentage of binder increased; and that the water absorption of the earth brick did not exceed the maximum water absorption of 12% recommended by standards.

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SUPERVISORY FUNCTIONS OF CONSTRUCTION PROFESSIONALS AND THEIR INFLUENCING FACTORS: PROJECT MANAGERS' PERSPECTIVE IN UYO, NIGERIA

Anthony Okwogume Ujene[1] and Joseph Akpanamasi[2]
[1]Department of Building, University of Uyo, Akwa Ibom State, Nigeria
[2]Department of Architecture, University of Uyo, Akwa Ibom State, Nigeria

ABSTRACT

Purpose: The study provided insight into the required supervisory competencies of selected professionals and factors influencing quality of supervision, with a view to enhancing productivity and construction projects delivery in Uyo, Nigeria.
Design/methodology/approach: Evaluations were carried out on the extent of application of professional supervisory functions, and factors affecting the quality of supervision. Exploratory and deductive cross-sectional survey research design was employed and data obtained from 74 copies of structured mail questionnaire received from project managers. Data were analysed using descriptive, relative importance index, and Kruskal-Wallis tests.
Findings: It was found that supervisory functions and factors influencing their quality vary significantly among selected professionals. It is concluded that the competencies of project managers and the factors influencing their quality of supervision depend on the primary professional affiliation of a project manager. It was also concluded that if the primary professional affiliation is not considered before assigning supervisory function, projects may suffer up to 40% pitfall in terms of performance.
Research limitations/implications: This study is limited to the eighteen supervisory functions and twenty two influencing factors selected from literature and the views 74 project managers who returned their questionnaire. The contribution to knowledge is that this study established the vital supervisory competencies and their pitfalls.
Practical implications: It is recommended that developers should adequately assess the competence of a supervisor arising from the primary professional training before assigning supervisory functions. The provisions of the National building Code should be enforced, so that professionals can carry out roles in their area of competence to avoid professional incursion, while ensuring collaboration and eschewing corrupt practices.
Originality/value: The study established the vital supervisory competencies of project managers and the factors affecting quality supervision in Uyo metropolis.

Keywords: Construction professionals; factors; project manager; supervisory functions; Uyo

[1]ujenetony@yahoo.com

1. INTRODUCTION

From the beginning of creation, shelter has remained one of the basic necessities of life; hence the construction industry responsible for its production has always been given important recognition both in developed and developing nations. The industry in Nigeria impacts nearly every facet of the economy and is responsible for about 16.0% of Gross Domestic Product (GDP) and employment of approximately 25.0% of labour force in Nigeria (Bilau, Ajagbe, Kigbu and Sholanke, 2015). The successful execution of projects in the industry requires the input of enormous resources managed by various stakeholders who are either professionals or non-professionals (Anyanwu, 2013; Owolabi and Olatunji, 2014). According to Owolabi and Olatunji (2014) the roles of these professionals in the life cycle of a building span from inception through design, construction, completion, maintenance and to terminal demolition. The study identified the list of the professionals actively involved in the construction industry to include but not limited to, Architects, Builders, Estate Surveyors and valuers, Land Surveyors, Quantity Surveyors, Town Planners, Civil, Electrical, Mechanical and Structural Engineers. Anyanwu (2013) observed that a Builder is the professional at the hub of the physical construction of buildings. The Builder carries out his building production role by taking charge of the activities on a building construction site in translating designs, working drawings, schedules and specifications into a physical structure. The National Building Code (NBC) (2006) specifically stated that the management of the execution of the building works together with the supervision of artisans and tradesmen shall be carried out by a registered Builder. The code also stated that other professionals are expected to supervise what is being done by the Builder in line with the inputs which they made during design. However, studies have opined that most of the craftsmen and tradesmen employed during construction are unqualified, unskilled and lack the adequate knowledge for faultless execution of operations, hence the success of completing any construction project depends heavily on the quality of supervision given to them (Alwi, Keith and Sherif, 2001; Shinde, Gupta and Magdum, 2014). In corroboration Chukwuji (2012) observed that every construction operation especially in complex building projects usually have large number of craftsmen, artisans and labourers who must be properly supervised to ensure that they carry out their various jobs according to production drawings and specifications. Shinde, Gupta and Magdum (2014) opined that the quality of supervision is determined by the skill and competencies of the supervisor. For adequate accountability, authority and responsibility are usually given to the supervisor for planning, leading, coordinating and directing the work of others in order to achieve the overall objective of the group. However, Agwu (2013) reported that incidences of building failures associated with poor construction supervision have become an issue of foremost concern in Nigeria's major cities. The study noted the frequent collapse of residential and commercial buildings under construction while, many others crumble while being occupied, resulting in many lives being lost and properties worth billions of naira destroyed. The study also attributed some of the poor construction supervision to incompetent personnel, hence noted that during construction, the consultants and the contractors must have competent persons on site to monitor work as it progresses. Studies have observed that, improper construction site supervisions have led to problems on site including collapse of trenches, structural collapse and injuries arising from falling objects like tools, debris and equipment, poor quality, rework and abandonment (Agwu, 2013; Shinde, Gupta & Magdum, 2014; Hackman, Acheampong, Agyekum & Ayarkwa, 2015). The need for construction site supervisors to understand the requirements that have been established to supervise sites effectively provided the impetus

for this study aimed at providing insight into the required supervisory competencies and factors affecting them for effective projects delivery in Uyo, Nigeria.

1.1 Objectives of the study

For the purpose of achieving the aim of this study the objectives were to: firstly, evaluate the extent of application of supervisory functions by selected professionals, and secondly, assess the factors affecting the quality of supervisions of the selected construction professionals in Uyo, Nigerian.

1.2 Research hypotheses

The first hypothesis postulated for this study, states that there is no significant variation in the extent of application of supervisory functions among the selected professionals in Uyo. The second, states that there is no significant variation in factors affecting the quality of supervision by the selected professionals in the study area. The results of these hypotheses will provide an insight into the importance of supervisory functions in project delivery in the study area. The results will also enlighten the stakeholders in the construction industry on the supervisory functions that can enhance project delivery as well as their pit falls in Nigeria.

2. REVIEW OF RELATED LITERATURE

The literature review hereafter focused on explaining quality supervision, identifying some competencies requirement of construction supervisor and factors affecting effective supervision of building projects.

2.1. Quality supervision and competencies of a supervisors

Construction supervision is the planning, leading, coordinating and directing the work of others in order to ensure that the final product is in agreement with the conceived design (Ojo, Olabintan, Ojo and Salami, 2013; Shinde, Gupta and Magdum, 2014). Effective supervision encompasses all inspection, observations and actions taking on site to ensure that an erected building conforms to design and specification at various sub-stages of construction process, involving numerous and complex activities that only well trained professionals can handle (Ojo, Olabintan, Ojo and Salami, 2013). Alwi et al. (2001) observed that quality supervision ensures that available resources are effectively and efficiently used, as the effectiveness of supervisors' efforts is judged by how well each phase of the construction process is managed, and by the value of the end products or services produced.

Kadushin and Harkness (2002) similarly opined that supervisors can offer valuable educational, administrative, and social support which can contribute to worker effectiveness and translate into quality service delivery. The Institute of Cost Accountants of India (ICAI)(2014) identified the function of a supervisor to include; effective communication of orders, introduction of new methods of performing work, making the work interesting, selecting the workers, induction of new employees, training the employees, handling grievances, enforcing discipline, enforcing safety and enforcing

quality. Hardison, Behm, Hallowell and Fonooni (2014) Identified construction supervisors' competencies from many other studies to include; establishing effective communication, establishing positive leader/member exchanges, knowledge of routine/non-routine work tasks, knowledge and application of effective team building skills, assessing employee stress levels, directing worker tasks and responsibilities, disciplinary procedures and conflict resolution, job planning and organization of work flow and methods of safety promotion.

Similarly, Shinde, Gupta, and Magdum (2014) identified the role and responsibilities of a site supervisor to include; reading and understanding Designer or Architect's drawings; helping foremen and labours to understand the problem and providing solution; reading and writing reports for inward and outward of material as well as maintaining labour muster; planning labour and activities; understand quality specifications; mediating between designer and worker; and Maintaining co-ordination between other supervisors and managers. These studies therefore, served as sources of the supervisor's functions and used as a basis of evaluation of the professionals' supervisory competence in this study.

2.2. Factors affecting quality of site supervision

Some studies have found that the quality of supervision can be influenced by several factors which include: Unfavourable working conditions; lack of commitment of all project participants; supervisors' competence; lack of top management support; indecisiveness of project participants; improper monitoring and feedback systems; coordination among project participants; negative attitude of project participants; conflicts among project participants; bad weather condition; aggressive competition during tendering; improper site layout and improper tendering process (Hackman, Acheampong, Agyekum and Ayarkwa, 2015). Others include: acute shortage of skilled supervisors; lack of amenities on construction sites; experience of supervisors ; unsustainable carrier; poor staffing of firms; Poor projects design; vague or scanty contract documentation; inadequate procurement processes; late procurement of project supervisor ; unattractive working conditions; unclear or vague scope of supervision ; incompetence of supervisors; negligence and outright corruption, supervisor work load and project complexity (CrossRoad, 2015).

2.3. Some previous studies on construction supervision

Several studies have been carried out to establish the importance of supervision on construction projects. Alwi, Keith, and Sherif (2001) assessed the effects of quality supervision on rework in the Indonesian Context based on questionnaire targeted on large contracting organisations in Jakarta and interviews held with ten project managers and supervisors from ten building construction sites. The study found that the quality of site supervision in Indonesia is directly related to the supervisor's level of experience gained through formal training. Hence, the study explored the relationship between the quality of site supervision, expressed as training cost, and the rework cost borne by contractors in high-rise building construction, to suggest that the quality of site supervision, represented by the supervisors' level of experience gained from formal training, has a strong negative relationship with the rework cost on a construction project.

Hardison (2012) investigated the knowledge-based competencies necessary for the front-line construction supervisor, utilizing survey based research that is administered through subsequent rounds of data collection that included controlled and anonymous feedback (Delphi-technique). The study utilized a panel of fourteen construction safety

experts from American Society of Safety Engineers Construction Practice Specialty list served on LinkedIn.com to establish fifteen key knowledge-based competencies suggested to be most important to the construction supervisor with respect to improving construction site safety performance out of the thirty two identified knowledge-based competencies. Ojo, Olabintan, Ojo, and Salami (2013) carried out a study on design and construction supervision as structurally sustainable tools for building failure/collapse in Nigeria. The study examined records of some reported building failures/collapses, structural defects in some selected roofs and the extent of professional involvement in their design and construction in Nigeria. It also identified those factors responsible for the failure of building design and construction supervision process. The paper concluded that structural sustainability can be greatly improved upon through design and construction supervision by depending on highly skilled professionals with intention to minimize potential ambiguity, disputes, fraud, and building collapses/failures.

Hardison et al. (2014) carried out a study to prioritize the most important knowledge-based competencies for front-line construction supervisors for effective site safety in the United States using the Delphi technique. The study provided insight on additional competencies that should be included among the 30-hour OSHA training topics for the construction site supervisor. The study concluded that for effective management of construction site safety by supervisors, they must possess both the baseline 30-hour training and other competencies relating to pre job planning, organizing of work flow, establishing effective communication, and a knowledge of routine and non-routine work tasks. Shinde, Gupta and Magdum (2014) investigated the impact of quality supervision on rework in Indian construction industry based on a survey targeted on large contracting organizations in Pune and nearby area. The Study utilised questionnaire administered on contractors, designers, clients and interviews held with eight project managers and supervisors in order to supplement the findings of the questionnaire survey. The study found that unskilled site supervision is the principal cause of rework during construction, and concluded that supervision is more likely to be dependent on the experience, instead of the number of supervisors involved in a project. Agwu (2013) examined the relationship between poor construction supervision and unsustainable building construction practices with regard to incessant building failures in six major cities in Nigeria between September 2012 and August 2013. The paper adopted descriptive research design using questionnaire administered on 397stratified randomly and area clustered selected registered members of Nigerian Institute of Building (NIOB) from six major cities in Nigeria. Results of the study indicated that significant relationship exists between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures)/building failures in Nigeria.

Ling and Tan (2015) investigated the association between a site supervisor's attributes and project outcomes. The study identified the attributes of site supervisors that are significantly correlated with project outcomes (cost, time, quality and client satisfaction), and examined if site supervisors with different educational levels and job experience have different attributes. The study utilised questionnaire designed based on the attributes identified from the literature review and distributed among Singapore-based construction site supervisors. The results showed that site supervisors with IT skills are likely to have projects with good time, quality and satisfaction outcomes, while the projects of supervisors with longer work experience show significantly better time performance and higher client satisfaction. It was therefore recommended that contractors employ site supervisors who have at least a construction diploma, IT skills and possess job experience in order to optimise their project outcomes.

Hackman, Acheampong, Agyekum and Ayarkwa (2015) carried out a study to identify the factors affecting construction site supervision in Ghana. The study adopted a questionnaire survey approach to elicit information from seventy-six respondents. The data were analysed using descriptive statistics and presented in tables. The study showed that favourable working condition; commitment of all project participants; arrangement of site layout; top management support and indecisiveness of project participants were the most important factors affecting supervision of projects. The study which was based in Ghana did not consider some factors which are obtainable in Nigeria together with the expected competencies of the supervisors. The study on the nature of supervisory competencies of project managers and the factors influencing quality of supervision is therefore scarce in the study area, hence this study.

3. METHODOLOGY

This study adopted the exploratory and deductive cross-sectional survey approach utilizing structured questionnaire which was piloted by survey of professionals who are conversant with the topic. The adopted approach quickly helped to reveal, prevalence and relationships (and non-relationships) among variables at a particular point in time, a deductive approach which does not emphasize on processes or changes through time or differentiating cause and effect from simple association (Mann, 2003; Saunders, Lewis and Thornhill, 2009). The instrument was tested for reliability and validity and found to be of high level with Cronbach α of 0.82 and 0.76 for the supervisory roles and influencing factors. These values were considered highly acceptable, since the value of alpha is desirable with the range higher than 0.6 (Gliem and Gliem, 2003).

The study population consists of Quantity Surveyors, Architects, Builders and Engineers who practice as construction project managers (Ameh & Odusami, 2014) in Uyo metropolis. The sample frame comprised seventy four project managers obtained from the structured questionnaire returned out of a total of 105 administered on project managers in Akwa Ibom State. The choice of project managers as respondents is due to the view that the main role of the project manager is in the administration of the project. The project manager manages the clients and co-ordinates all other stakeholders which require adequate understanding of all the manpower related issues (Shibani and Sukumar, 2015).

This study identified eighteen supervisory functions from Hardison (2012), The Institute of Cost Accountants of India (ICAI)(2014), Hardison, Behm, Hallowell and Fonooni (2014), Shinde, Gupta, and Magdum (2014), Hardison et al. (2014) and Ling and Tan (2015), while twenty two factors affecting quality of supervision were identified from Hackman, Acheampong, Agyekum and Ayarkwa (2015) and Crossroad (2015). The project managers were classified as Architects, Builders, Quantity Surveyor and Engineers according to their first degree educational background. They were then requested to evaluate the extent of application of the identified supervisory functions as well as the factors affecting their quality of supervision.

The measurements were on a five point Likert-scale namely: poor=1, low=2, moderate=3, high=4 and very high=5. In analyzing the collected data, the total weight value (TWV) was then calculated for each of the variables. The TWV was arrived at from the summation of the products of the number of responses for the rating of each variable and the respective weight value for each rating. The relative importance index (RII) method was used in line with the formula used by Ugwu and Haupt (2007) and Enshassi, Mohamed and Abushaban (2009) as shown in Equation 1

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

Where W is the weight given to each variable by the respondents and ranges from 1 to 5; A – the highest weight = 5; N – the total number of respondents.

A cut-off score of RII computed was determined by summing the weights and dividing by the total number of weighting items and highest weight respectively: (1+2+3+4+5)/5/5 = 0.60. Thus, events that have RII that are higher than 0.60 are defined as important, those with RII equal to 0.60 are moderate, while those less than 0.60 are less important. The variation in the application of supervisory functions and the influencing factors were analysed using Kruskal Wallis tests.

4. PRESENTATION AND DISCUSSION OF RESULTS

The result and discussion are presented in this section.

4.1. Characteristics of respondents used for the study

For an understanding of the characteristics of the people whose perceptions were investigated, the sex, age, profession, qualification and experience of the respondents were evaluated and the result presented on Table 1.

Table 1: Descriptive results of Project managers Features

Features	Sub features	N	%
Sex	Male	63	85.1
	Female	11	14.9
	Total	74	100
Age	1-17yrs	0	0
	18-60yrs	60	81.1
	>60yrs	14	18.9
	Total	74	100
Professional affiliation of project manager	Quantity Surveyor	16	21.62
	Architect	19	25.68
	Builders	15	20.27
	Engineers	24	32.43
	Total	74	100
Qualification	OND	1	1.35
	HND	5	6.76
	B.Sc	20	27.03
	M.Sc	38	51.35
	P.hD	10	13.51
	Total	74	100
Experience	1-5yrs	06	8.11
	6-10yrs	13	17.57
	11-15yrs	17	22.97
	16-20yrs	24	32.43
	>20yrs	14	18.92
	Total	74	100

The result on Table 1 shows that majority of the project managers were male who are adults. Majority of the respondents equally have the basic qualification and experience expected of project managers. The result also shows that majority of professionals who practice project management were chosen in this study. Hence, the results generally imply that the selected respondents have the required features to provide reliable information for this study.

4.2. Evaluation of supervisory competencies application of selected professionals

The first objective is to evaluate the extent of application of supervisory functions during project execution. For this purpose, eighteen supervisory functions identified were presented to project managers to evaluate among selected professionals. The result presented on Table 2 shows that 41.12% of the supervisory functions attained the cut-off level among Quantity Surveyors, 55.55% for Architects, 66.67% for Engineers and, 83.33% for Builders. The result is an indication that there is variation in the level of application of supervisory functions among the various professionals. The result shows that the Quantity Surveyors were very good at communicating orders, selecting the workers, having good knowledge of work routine and enforcing discipline; Architects were very good at interpretation of drawings, safety assurance and effective communication of orders.

Table 2: Project managers' evaluation of supervisory competencies application of professionals

No of professional evaluated	Qty Svyors N= 16		Architect N=19		Engineers N=24		Builders N=15	
Supervisory functions of Builders	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Job planning & work flow organization	0.56	9	0.63	8	0.68	9	0.83	1
Good knowledge of work routine	0.60	6	0.64	7	0.70	6	0.80	2
Directing worker tasks and responsibilities,	0.50	15	0.66	4	0.77	1	0.80	2
Knowing & enforcing safety	0.64	3	0.71	2	0.68	9	0.77	4
Reading & understanding the drawings	0.62	4	0.73	1	0.72	5	0.77	4
Knowing & enforcing quality	0.52	11	0.44	17	0.68	9	0.77	4
Effective communication of orders	0.66	1	0.68	3	0.74	2	0.77	4
Making the work interesting	0.58	8	0.53	11	0.53	15	0.72	8
Reading and writing reports for work	0.60	6	0.63	8	0.69	8	0.72	8
Selecting the workers,	0.66	1	0.66	4	0.73	3	0.71	10
Introduction of new work methods	0.52	11	0.49	15	0.54	13	0.69	11
Induction of new employees,	0.40	18	0.40	18	0.41	18	0.68	12
Training the employees	0.52	11	0.51	13	0.54	13	0.67	13
Enforcing discipline	0.62	4	0.61	10	0.70	6	0.63	14
Establishing positive team work	0.54	10	0.52	12	0.66	12	0.61	15
Assessing workers stress levels	0.52	11	0.51	13	0.47	16	0.56	16
Co-ordination between workers & managers	0.44	17	0.65	6	0.73	3	0.49	17
Handling grievances	0.50	15	0.47	16	0.45	17	0.45	18

The result also shows that Engineers were better at directing worker tasks and responsibilities, knowing & enforcing quality and selection of workers, while builders were better at job planning & work flow organization, adequate knowledge of work routine and directing worker tasks and responsibilities. The results generally indicate that the implementation of supervisory functions increase from Quantity surveyors through the Architects and Engineers to Builders. The possible explanation for this finding is that in most institutions of learning where building is offered in Nigeria, significant concern is placed on construction programme, construction methodology, and quality and safety

management knowledge (Nigerian Institute of Building [NIOB], 2002). However, it can be seen that the percentage range of competencies obtained among the Professionals is up to 42.2%, and the implication of this is that if the competence of a Professional is not properly considered before assigning supervision as much as 42% loss in performance can be experienced. This is in line with the observation by Hardison *et al.* (2014) that selection of supervisor should be based of adequate competencies.

4.3. Comparison of supervisory competencies among professionals

In order to ascertain if the variation observed in the supervisory competencies among the selected professional is statistically significant and that the variation does not occur by chance the first hypothesis was postulated as earlier stated. The hypotheses were tested with Kruskal Wallis test at $p \leq 0.05$. The decision rule is that if p-value > 0.05, the hypothesis is accepted, but if p-value ≤ 0.05 the hypothesis is rejected. The result is presented on Table 3.

Table 3: Comparison of Professionals' supervisory competencies

Items compared among Professionals	Extent of use supervisory competencies
No of variables (N)	18
Mean Rank for Quantity Surveyors	24.00
Mean Rank for Architects	29.39
Mean Rank for Engineers	41.83
Mean Rank for Builders	50.78
Chi-Square	18.079
P-value	0.001
Significance level	0.050
Decision	Reject

Table 3 shows that the p-value for the first hypothesis is 0.001, which is less than the significance level of 0.05, thus the null hypotheses was rejected, indicating that there is significant variation in the extent of application of supervisory functions among the professionals and that the variation is not only caused by random effects of chance. The result implies that professional competence has significant impact on the extent of supervision. The importance of professional competence on the supervisory competencies may be attributable to the observation by Sarda and Dewalkar (2016) that the management of projects by consultants to overcome every possible error in the project depends on the application of skills, knowledge and experience. This is also supported by Shinde and Kulkarni (2016) which noted that the skillfulness and competence along with experience of supervisors play an important role in reducing the amount of rework in construction in India. The variation may also be attributable to the variation in the background education (regarding project management related courses) of different professional groups practicing project management (Ameh & Odusami, 2014).

4.4. Evaluation of factors affecting quality of supervision

The second objective assessed the factors affecting the quality of supervision by the selected professionals. For this purpose twenty two factors identified were presented to project managers to evaluate among the professionals. The result is presented on Table 4.

Table 4: Project managers' evaluation of factors influencing supervision

Professionals	Qty Svy		Architect		Engineers		Builders	
No of professionals	N= 16		N=19		N=24		N=15	
Factors influencing supervision	RII	Rank	RII	Rank	RII	Rank	RII	Rank
supervisors' competence/knowledge	0.72	1	0.65	4	0.65	1	0.70	2
Level of available resources	0.69	2	0.63	5	0.64	3	0.50	10
negligence and corrupt practices	0.68	3	0.61	11	0.51	21	0.44	18
Unfavorable working conditions	0.68	3	0.52	22	0.60	10	0.70	2
lack of top management support	0.68	3	0.68	1	0.60	10	0.66	5
poor commitment of project participants	0.65	6	0.53	18	0.47	22	0.46	12
improper monitoring and feedback systems	0.65	6	0.63	5	0.61	7	0.44	18
lack of amenities on construction sites	0.65	6	0.53	18	0.58	13	0.52	20
Effectiveness of communication	0.64	9	0.63	5	0.58	13	0.46	12
bad weather condition;	0.63	10	0.60	13	0.54	19	0.44	18
poor contract documentation	0.63	10	0.58	15	0.61	7	0.44	18
unclear or vague scope of supervision	0.61	12	0.61	11	0.62	6	0.46	12
Supervisor's work load	0.61	12	0.66	3	0.63	4	0.62	8
Poor projects design	0.61	12	0.55	17	0.60	10	0.70	2
experience of supervisors	0.61	12	0.68	1	0.65	1	0.72	1
unattractive working conditions;	0.61	12	0.62	8	0.61	7	0.64	6
project complexity	0.60	17	0.58	15	0.55	17	0.46	12
improper site layout	0.57	18	0.53	18	0.58	13	0.46	12
late engagement of project supervisor	0.57	18	0.62	8	0.63	4	0.64	6
Supervision time	0.57	18	0.62	8	0.54	19	0.48	11
shortage of skilled supervisors	0.56	21	0.60	13	0.56	16	0.42	22
inadequate procurement processes	0.53	22	0.53	18	0.55	17	0.46	12

Table 4 shows that the project managers who are quantity surveyors were significantly influenced by 77.27% of the factors identified, the project managers who are architects were significantly influenced by 63.64% of the factors identified. The result also shows that the project managers who are Engineers were significantly influenced by 54.55% of the factors identified, while the project managers who are Builders were significantly influenced by 36.36% of the factors identified. The Quantity Surveyors are mostly influenced by supervisors' competence/knowledge, level of available resources and negligence and corrupt practices. The Architects are mostly influenced by lack of top management support, level of experience, and extent of work load. The Engineers are mostly influenced by level of competence/knowledge, experience, and level of available resources. The Builders are mostly influenced by level of experience and knowledge, poor projects design and unfavourable working conditions.

The result showed decrease in total percentage influence of factors from the Quantity surveyors through the Architects and Engineers to Builders with up to 40.9% difference. The possible explanation for this finding is that most Builders who are project managers as part of their training are proficient in job planning & work flow organization, work routine, directing worker tasks and responsibilities as found in Table 2 in line with the findings of Ameh and Odusami (2014). The implication of this is that if primary disciplines of project managers are taken into consideration before assigning supervisors, then the expected quality of supervision may be reduced up to about 40.9%.

4.5. Comparison of factors influencing quality of supervision among professionals

In order to ascertain if variation in the factors influencing the quality of supervision of the professionals is significant, the second hypothesis was postulated as earlier stated. The hypothesis was tested with Kruskal Wallis test at $p \leq 0.05$. The decision rule is that if p-value > 0.05, the hypothesis is accepted, but if p-value ≤ 0.05 the hypothesis is rejected. The

results presented on Table 5 show that the p-value for the second hypothesis is 0.018, which is less than the significance level of 0.05, thus the null hypotheses was rejected, indicating that there is significant variation in influence of factors on the quality of supervision of the professionals and that the variation does not occur by chance. The variation in influence of the factor may be attributable to the variation in the supervisory competences of the Professionals. The result somehow supports Ling and Tan (2015), Sarda and Dewalkar (2016) and Shinde and Kulkarni (2016) that skillfulness along with experience of supervisors play an important role in resource management.

Table 5: Results of Kruskal-Wallis test for Comparison factors influencing supervision

Items compared	Effect of factors on supervision
No of variables (N)	22
Mean Rank for Quantity Surveyors	32.70
Mean Rank for Architects	41.77
Mean Rank for Engineers	46.98
Mean Rank for Builders	56.55
Chi-Square	10.078
P-value	0.018
Significance level	0.050
Decision	Reject

The result also suggests that the primary discipline of those who practice project management in Nigeria does determine the quality of supervision. This also supports Ameh and Odusami (2014) which attributed the variation in the background education (regarding project management related courses) of different professional groups practicing project management to their performance as project managers.

5. CONCLUSION AND RECOMMENDATIONS

The study has provided insight into the required professional supervisory competencies and factors affecting them for effective projects delivery in Uyo, Nigeria. The study has evaluated eighteen supervisory functions of construction project managers and twenty two factors influencing the quality of supervision of the managers. It was found that 41.12% of the supervisory functions evaluated attained the cut-off level among Quantity Surveyors, 55.55% for Architects, 66.67% for Engineers and, 83.33% for Builders. This is an indication that the competences of the practicing project managers vary according to their primary professions. This variation was found statistically to be significant and not caused by random effects of chance. The result is an indication that the percentage range of competencies obtained among the Professionals is up to 42.2%, and the implication of this is that if the competence of a Professional is not properly considered before assigning supervision, as much as 42% loss in performance can be experienced.

It was also found that the project managers who are quantity surveyors were significantly influenced by 77.27% of the factors identified; those that are architects were significantly influenced by 63.64% of the factors, those who are Engineers were significantly influenced by 54.55% of the factors, while the project managers who are Builders were significantly influenced by 36.36% of the factors identified. It was found that there was decrease in total percentage influence of factors from the Quantity surveyors through the Architects and Engineers to Builders with up to 40.9% difference. This variation was found to be statistically significant and not caused by random effects of

chance. The possible explanation for this finding is that in most Builders who are project managers are proficient in job planning & work flow organization, work routine, directing worker tasks and responsibilities. The implication of this is that if primary disciplines of project managers are taken into consideration before assigning supervisors, then the expected quality of supervision may be reduced up to about 40.9%

Consequent upon the findings of this study, it is concluded that the competencies of project managers depend on their primary profession, and the factors influencing the quality of supervision also depend on the primary professional affiliation of a practising project manager. It was also concluded that if the primary professional affiliation is not considered before assigning supervisory function, projects may suffer up to 40% pitfall in terms of performance. It is therefore recommended that developers and project managers should adequately assess the competence of a supervisor arising from the primary professional training before assigning supervisory functions on complex jobs. It is also recommended that the provisions of the National building Code be enforced, so that professionals can carry out roles in their area of competence to avoid professional incursion. Professionals should ensure mutual collaboration and eschew greed and corrupt practices.

6. LIMITATIONS OF THE STUDY

This study is limited to the eighteen supervisory functions and twenty two factors selected from literature and the views of project managers or their representatives who were considered as chief project administrators. Since the study was also limited to 74 project managers who returned their questionnaire, the result could be improved by further studies on other stakeholders and other competencies and factors not covered in this study as well as increased respondents. In spite of these limitations the result could provide reasonable insight into important supervisory competencies and factors influencing them with a view to enhancing construction projects performance in the study area, as well as guide for further studies.

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SITE MANAGEMENT-RELATED CAUSES OF REWORK AND THE PERFORMANCE OF OIL AND GAS PROJECTS IN NIGERIA

Jimmy Uso Wilson[1] and Isaac Abiodun Odesola[2]
[1]Head of Projects, Deep Sea, Exxon Mobil Producing Unlimited, Nigeria
[2]Department of Building, University of Uyo, Akwa Ibom State, Nigeria

ABSTRACT

Purpose: One of the factors that often contribute significantly to cost and schedule overruns is rework. This study aimed at determining the influence of site management-related causes of rework on the performance of oil and gas construction projects.
Design/methodology/approach: A survey research design approach was adopted using stratified random sampling of 555 contractors and 395 consultants involved in the execution of oil and gas construction projects in South-South Geo-Political Zone of Nigeria. Data were collected through structured questionnaire and analysed using Mean Item Score, Spearman Rank Correlation test, Kruskal Wallis test and One Sample T-test.
Findings: Results of the study showed that there is agreement between contractors and consultants on the frequency of occurrence of site management-related causes of rework. Ineffective site leadership, poor communication, poor planning and allocation of resources, ineffective use of quality management practices and constructability problems are the five most occurring site management-related causes of rework in oil and gas construction projects. The result also indicated that these causes of rework have significant influence on time and cost performance of oil and gas construction projects. In addition, the result revealed that the occurrence and influence of site management-related causes of rework do not depend on project location.
Research limitations/implications: The study focused on site management-related causes of rework among other causes of rework in oil and gas construction projects. It also relied on the experiences and good judgement of the respondents to evaluate the frequency of occurrence and influence of these causes of rework on the cost and schedule performance of construction projects.
Practical implications: Quality management training for project site team, adequate time and resources availability for site verification prior to construction execution are recommended to enhance knowledge and awareness of quality control and reduce errors and omission which subsequently result in rework during construction.
Originality/value: The study concluded that site management-related causes of rework have significant influence on the cost and schedule performances of oil and gas projects and this influence does not depend on project location.

Keywords: Site management; influence; rework; oil and gas; performance; projects

[1]jimmy2wilson@yahoo.com

1. INTRODUCTION

The construction industry in both developed and developing countries has been widely acknowledged as an important sector that contributes significantly to the economic growth of a nation. The industry which is project based is focused on the timely delivery of construction projects. However, due to significant amount of rework attributed to ineffective project management practices, project activities are extended beyond their scheduled deadline (Love and Edwards, 2004). Because of this, the industry has been criticized extensively for poor performance (Enshassi, Mohamed and Abushaban 2007). Previous studies (Alwi, Hampson and Mohammed, 2002; Josephson, Larson and Li, 2002; Oyewobi and Ogunsemi, 2010) recognised rework as a non-value adding activity, while Robin McDonald and LEED (2013) viewed rework as work that is made to conform to the original requirements by completion or correction at least one extra time due to non-conformance with requirements.

The need for rework normally occurs when construction deliverables fails to meet contractual requirement. Consequently, the deliverables are reworked in accordance with the contractual requirements. For this reason, Love and Smith (2003) opined that there is need to understand the root cause associated with rework, the reason why rework exist and the conditions that stimulate occurrence of rework within construction process. In response to this call, Love and Edwards (2004) reported that, poor project management practices contribute to the occurrence of rework in construction projects, these practices include those related to client, design team and site management. In addition, Palaneeswaran, Kumaraswamy, Ng and Love (2005) reported that site-management related factors are responsible for rework in construction project. These underlying causes among others are site specific constructability issues, poor planning and allocation of resource to construction activity, inadequate training of resources, setting-out errors and failure to provide protection for constructed works (Love, 2002).

To meet up with construction datelines, project activities in Oil and Gas are usually scheduled to run concurrently. As a result, errors and omission may likely occur due to poor coordination of interrelated activities thus resulting in rework. Since rework is performing a task more than once, it can occur at different stages throughout the project life cycle, either during design, fabrication, construction or installation phase. At the construction and installation stage, Love, Edwards Irani and Goh, (2011) reported that poor project management; poor scope management, unrealistic schedule and non-adherence to quality system are causes of rework in offshore projects. Consequently, when rework occurs in oil and gas construction projects, there is a significant influence on time and cost performance (Love, Edwards Irani and Goh, 2011). This therefore infers that the increase in time and cost overrun is correlated with the magnitude of rework cases in oil and gas construction projects.

Although site-management related factors featured prominently among those factors identified as causes of rework in construction projects, none of these studies considered the frequency of occurrence and influence of site-management causes of rework on time and cost performance across geographical demarcations by comparing the views of consultants and contractors – important project team members who are directly involved in construction execution. The south-south zone of Nigeria which comprises of six geographical states namely: Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers were the areas selected for this study. The choice of this area was influenced by the reported

increase in its volume of construction activities driven by increasing energy demand. Consequently, determining the influence of site-management related causes of rework on project performance would be pertinent to the successful delivery of construction projects in this zone, especially given that no such studies have been conducted in this region. In view of this, this study sought to determine whether the influence of site-management related causes of rework on cost and time performance varies across the geographical states in the south-south geo-political zone of Nigeria. An understanding of the influence of site management-related causes of rework on the performance of oil and gas projects across these geographical states would enable construction managers to better manage and execute oil and gas projects successfully across geographical locations. Therefore, comparing the perceptions of consultants and contractors would assist in emphasising site-management related causes of rework that significantly affect project performance and, on the other hand, help to present a holistic approach to addressing the causes of rework in oil and gas construction project in South-South, Nigeria.

1.1. Objectives of the study

The objectives of the study are to:

i. determine contractors and consultants' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects,
ii. evaluate the influence of site management-related causes of rework on project performance in terms of cost and time based on the perceptions of selected project team members, and
iii. assess the influence of project location on the frequency of occurrence of site management-related causes of rework and its impact on project performance as perceived by the selected project team members.

1.2. Research hypotheses

To achieve the objectives of the study, five hypotheses were formulated which state that:

H_1: There is no significant correlation between consultants' and contractors' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects,

H_2: The frequency of occurrence of site management-related causes of rework in oil and gas construction projects do not vary significantly across the states in South-South Geo-Political Zone of Nigeria.

H_3: There is no significant correlation between consultants' and contractors' perceptions of the influence of site management-related causes of rework on cost and time performance of oil and gas construction projects,

H_4: The influence of site management-related causes of rework on time and cost performance is not significant,

H_5: The influence of site management-related causes of rework on cost and time performance of oil and gas construction projects do not vary significantly across the states in South-South Geo-Political Zone of Nigeria.

2. REVIEW OF RELATED LITERATURE

2.1. Site management-related causes of rework

Majority of causes of rework arises due to lack of communication and supervision (Clough, Sears Sear, Segner and Rounds, 2015). Several researchers (Love and Edwards, 2004; Oyewobi and Ogunsemi, 2010) have identified site management-related factors contributing to rework in construction projects. According to Love and Edwards (2004), poor site leadership and ineffective communication among project team members result in rework. In line with this finding, Love, Edwards, Irani and Walker (2009) emphasized that the problems with leadership relate to ineffective management of the project team, poor communications, lack of safety, and lack of quality assurance or controls. Some of the errors and issues arising during construction can be remedied with better communication and more information sharing. Clough *et al.* (2015) suggests that project specifications, written guidelines and method statement on project work must be clearly communicated to and accessible by the workforce. In addition to this, Love, Edwards, Irani and Walker (2009) revealed that the underlying causes of ineffective site leadership are the decisions undertaken by top management which consequently lead to the adoption of inappropriate construction practices and processes.

Inadequate coordination of construction activities and resources has been noted as another site management related factor causing rework in construction projects. According to Palaneeswaran, Kumaraswamy, Ng and Love (2005), inadequate planning and coordination of resources are factors that contribute to the occurrence of rework in construction projects. A study by Josephson, Larsson and Li (2002) reported that changes due to improper planning contribute significantly to rework cost. As the workforce effects the changes and errors resulting from improper planning, the indirect consequence is stress and fatigue on the workforce (Mastenbroek, 2010). On the other hand, when the project is behind schedule or the need for rework arises, overtime is typically utilized to bring back the project on track. Such excessive overtime can cause fatigue to workers, reduces productivity which result in poor quality of work and consequently lead to rework. For this reason, emphasis must be laid on adequate planning to avoid unnecessary rework.

Poor quality management implementation in construction site has been a major cause of concern to the industry because of its contribution to rework (Jaafari, 1996). Alwi, Hampson, and Mohamed (2002) argued that quality management principles and tools are not strongly embedded in conventional construction management practice, although, the construction industry places emphasis on quality management systems implementation through the advancement of International Organization for Standardization (ISO) certification for construction contractors, This limitation results in substandard services and products, which inevitably produces rework (Love, Edwards, Irani and Walker, 2009). However, the implementation of an effective quality assurance system in a construction project leads to rework reduction and improvement in project performance (love and Edwards, 2004),

According to Fayek, Dissanayake, and Campero (2003), unrealistic construction schedule, non-compliance with specifications, use of wrong materials, untimely deliveries or lack of materials at the job site are factors that can potentially create rework in construction projects. A project with an unrealistic schedule may pose excessive schedule pressure on construction team and would inadvertently lead to working out of sequence, creating work defects and cutting corners, which may consequently lead to rework (Nepal,

Park and Son, 2006). A study by Love, Edwards and Irani, (2008) further revealed that schedule constraints and client pressure often lead to lack of attention by management resulting in poor quality of work which results in rework and poor performance.

Rework in construction project also originates from parties in the construction projects. According to Arain and Low (2006), the key project players contributing to rework in construction projects are client, consultant, and contractor. Even though contractor and consultant often plays different roles in the delivery of construction projects, Hwang, Thomas, Hass and Carlos (2009) stated that, they have significant influence on rework occurrence. The authors also reported that changes requested by client were the second largest contributor to the direct cost of field rework in construction projects. Furthermore, a study by Love and Edwards (2004) also considered client, contractor and design team as parties contributing to rework in construction. In view of this, consultants and contractors are considered to be an important member of the project team who are knowledgeable with the causes and impact of rework on oil and gas projects. Therefore, comparing consultants and contractor's perception of the occurrence and influence of site management-related causes of rework on project performance will provide a more holistic view of the frequency of occurrence and influence of site management-related causes of rework on project cost and time performance.

2.2. Influence of rework on project performance

Cost and time overrun are metrics frequently used to measure project performance within the construction industry. Studies have shown that rework contributes significantly to time and cost overrun of construction project (Love and Edwards, 2004, Hwang, Thomas, Hass and Carlos, 2009; Love and Sing, 2013). The varying interpretations and definitions of rework have led to lack of uniformity in rework data collation and quantification. Therefore, understanding the critical factors that causes rework has been posited to be necessary for the enhancement of project performance. Reflecting this perspective, Jergeas (2009) reported that there are undue cost overruns, delays and losses of productivity associated with the delivery of major capital construction projects everywhere in the world. Jergeas's study found that researchers and practitioners have identified poor management practices that lead to poor performance, such as scope changes, design errors and omissions, lack of proper planning and scheduling and improper management of tools, equipment, materials and labour, among many other factors.

In addition to several factors contributing to cost overrun mentioned in Jergeas (2009), Palaneeswaran (2006) highlighted that the cost and time overrun of projects attributed to rework were as a result of errors in design, omission during construction, failures of constructed part, changes initiated by client or his representative, poor communication and poor coordination. According to Love and Edwards (2004), rework in Australian construction projects consumes up to 6.5% of the total project cost and contributing significantly to schedule delay. Similarly, Rhodes and Smallwood (2003) stated that rework is capable of increasing the cost of construction project cost in South Africa by 13%. In Nigeria, Oyewobi, Oke, Ganiyu, Shittu, Isa, and Nwokobia (2011) reported that time overrun and cost overrun on building project were 37.26% and 9.88% respectively. They also reported that the cost of rework was 3.47% of the contract value. In the same study, cost of rework for new building and refurbished building in Nigeria was 5.06% and 3.23% of the contract value respectively. These findings show that the incidence of rework have impact on cost and time performance on construction projects.

Oil and gas projects also suffer from rework. The impact of rework on the performance of oil and gas project has been reported in previous studies, most notably, Love, Edward, Irani and Goh (2011) revealed that rework significantly impacts the performance of oil and gas project. The authors reported that rework costs in offshore hydrocarbon projects were estimated to range from 3% to 25% of capital expenditure. For offshore projects, Love and Edwards (2013) reported that rework arises due to errors and omissions, and this can significantly contribute to project cost and cause schedule overruns. The authors affirmed that these additional and unnecessary costs can account for 25% of capital expenditure for offshore platform projects. Hwang and Leong (2013) also noted that when construction work is subcontracted, and coordination between various activities is not effective, deviations from the requirements may result, leading to rework that can trigger cost and schedule overruns.

3. METHODOLOGY

Exploratory survey research design involving the use of structured questionnaire was employed in this study. The population of the study comprises contractors and consultants involved in the execution of oil and gas construction projects. A total of 667 contractors and 475 consultants were identified through pilot study and this served as the study population frame. The sample sizes for the two groups of respondents across the six states in South-South Geo-Political Zone of Nigeria were determined using Taro Yamane formula for finite population which states:

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

Where n = Sample size; N = Finite Population; e = Level of significance (0.05) and 1 = Unity (Udofia, 2011).

Table 1 shows the sampling frames and sample sizes for the two groups of respondents in the study area. To account for void questionnaire and non-response from respondents, a total of 950 copies of questionnaire comprising 555 contractors and 395 consultants obtained through simple proportion were administered on the study population randomly across the states in the study area. Table 2 shows the distributions of questionnaire for the groups of respondents in the study area and the valid questionnaire used for data analysis.

Table 1: Sample frames and sample sizes of contractors and consultants in the study area

Sampling Frame/Sample Size	Groups of Respondents	Location of Study						
		AKS	BYS	CRS	EDS	DES	RVS	Total
Sampling Frame	Contractors	193	152	32	71	85	134	667
	Consultants	116	57	85	45	134	38	475
Sample Size	Contractors	130	110	30	60	70	100	500
	Consultants	90	50	70	40	100	35	385

**AKS=Akwa Ibom State, BYS=Bayelsa State, CRS=Cross River State, EDS=Edo State, DES=Delta State, RVS=Rivers State*

Structured questionnaires were used to collect data on the frequency of occurrence and relative influence of sixteen identified site management-related causes of rework from two selected project team members who constitute the respondents for the study. The frequency of occurrence of the site management-related causes of rework and its influence on time and cost performance was measured on a five-point Likert-scale namely: nil, low, moderate, high and very high. Weights were assigned to the scale as follows: nil=1, low=2, moderate=3, high=4 and very high=5. Out of 950 copies of questionnaire administered on the sampled study population through stratified random sampling techniques, 902 correctly completed questionnaire comprising 510 contractors and 392 consultants were used for the analysis.

Table 2: Questionnaire distributions for respondents in the study area

Groups of Respondents	Location of Study						Total Questionnaire Distributed	Total Valid Questionnaire Used for Analysis
	AKS	BYS	CRS	EDS	DES	RVS		
Contractors	144	122	33	67	78	111	555	510
Consultants	92	51	72	41	103	36	395	392

Data collected were analysed using Statistical package for social science (SPSS) version 24. The frequency of occurrence of site management-related causes of rework and its influence on time and cost performance of oil and gas construction projects were analysed using Mean Item Score (MIS). Spearman Rank Correlation was used to test the agreement of contractors and consultants on the frequency of occurrence and influence of site management-related causes of rework on cost and time performance. Kruskal-Wallis H test was used to evaluate variation in frequency of occurrence and influence of site management-related causes of rework on cost and time performance across the six states that constitute the study area as perceived by contractors and consultants. The decision rule for testing hypothesis is that, if P-value is less than or equal to α at 5% level of significance, then the null hypothesis is rejected in favour of the alternate hypothesis. The decision rule used in this study is stated below: If $P \leq 0.05$, reject H_0 otherwise, If $P > 0.05$, then fail to reject H_0.

Likert scale data has been considered as ordinal scale data, however, previous studies have adopted parametric statistical methods such as the t-test for analysing the data (Hwang, Zhao and Goh, 2014; Zhao, Hwang Shan and Tan, 2016). Although, Zumbo and Zimmerman (1993) believed that there is no basis to analyse parametric statistics using ordinal level data when the assumptions are not met. Norman (2010) argued that parametric statistics can be used to analyse Likert data with unequal variances and non-normal distributions, without fear of coming to wrong conclusions. Therefore, this study adopts one sample t-test using a hypothesised mean ($\mu = 2.5$) to test the significance of the influence of site management-related causes of rework on cost and time performance in line with related previous studies (Adamu, Dzasu, Haruna and Bala, 2011; Durdyev and Mbachu, 2011). The decision rule is that if the Mean Score of all site management-related factors are equal or greater than the hypothesised MS then the factors are considered to have significant influence on cost and time performance (i.e. p-value ≤ 0.05). Otherwise it will be insignificant as will be indicated by p-value that is greater than the critical value of 0.05 (i.e. p-value >0.05).

Mean Item Score was obtained by dividing the total score by the number of the respondent for each of the site management-related causes of rework. The average of the (MIS) was used to determine the most frequently occurring site management-related causes of rework. Mean Item Scores equal to or above the average (MIS) was considered the most frequently occurring site management-related causes of rework. Similarly, the average of the (MIS) was used to determine the site management-related causes of rework having significant influence on cost and time performance. Mean Item Scores equal to or above the average (MIS) was regarded as significant.

4. PRESENTATION OF RESULTS

Data obtained on a five-point Likert scale from the structured questionnaire were collated and analysed using appropriate statistical tools as described in the methodology. The results of data analysis carried out to achieve the objectives of the study are presented below.

4.1. Contractors and consultants' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects

The first objective of the study is to determine consultants and contractor's perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas projects. Data collected on the perceptions of consultants and contractors on the frequency of occurrence of each of the sixteen site management-related causes of rework in oil and gas projects were analysed to derive their Mean Item Score and ranks. Results are presented in Table 3.

The result in Table 3 indicates that consultants and contractors considered eight (8) site management-related factors having (MIS) ≥ 2.93 as most frequently occurring site management-related causes of rework and the remaining eight (8) site management-related factors as least occurring site management-related causes of rework in oil and gas construction projects.

4.2. Test of correlation between contractors' and consultants' perceptions of the frequency of occurrence of site management-related causes of rework

To test the first hypothesis of the study, contractors and consultants' perception of the frequency of occurrence of site management-related causes of rework in oil and gas projects were compared for agreement using Spearman's Test of correlation. Result of the test of hypothesis is presented in Table 4.

The result in Table 4 shows high correlations between the perceptions of consultants and contractors on the frequency of occurrence of site management-related causes of rework in oil and gas construction projects ($r< 0.953$). Additionally, the *p*-value which is less than the critical value ($p< 0.001$) further confirms that the correlation is significant. Therefore, the first hypotheses which stated that there is no significant correlation between consultants' and contractors' perceptions of the frequency of occurrence of site

management-related causes of rework in oil and gas construction projects is rejected. The implication of this result is that both contractors and consultants agree and have similar views on the frequency of occurrence of each of the site management-related causes of rework in oil and gas construction projects in Nigeria.

Table 3: Consultants and contractors' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects

Site management-related causes of rework	Consultant (N=392)			Contractor (N=510)		
	Sum	Mean Item Score	Rank	Sum	Mean Item Score	Rank
Ineffective site leadership	1508	3.85	1*	1977	3.88	1*
Poor communication	1426	3.64	2*	1833	3.59	2*
Poor planning and allocation of construction resources	1347	3.44	3*	1789	3.51	3*
Ineffective use of quality management practices	1208	3.08	6*	1645	3.22	4*
Constructability problem	1267	3.23	4*	1629	3.19	5*
Unrealistic schedule	1202	3.07	7*	1607	3.15	6*
Setting-out errors	1185	3.02	8*	1580	3.10	7*
Non-compliance with specification	1216	3.10	5*	1520	2.98	8*
Failure to provide protection to constructed works	1074	2.74	11	1415	2.78	9
Unforeseen site condition	1050	2.68	12	1413	2.77	10
Unclear instructions to workers	1132	2.89	9	1405	2.76	11
Excessive overtime	1096	2.80	10	1341	2.63	12
Wrong construction methodology	987	2.52	13	1317	2.58	13
Use of damaged or obsolete material	961	2.45	14	1219	2.39	14
Ineffective use of information technology	925	2.36	15	1144	2.24	15
Lack of safety	797	2.03	16	1065	2.09	16
Average Mean Item Score		2.93			2.93	

* = *Most Frequently Occurring*

Table 4: Spearman test of correlation between contractors and consultant's perception

Parameter Correlated	N	r	*p*-value	decision
Contractors' and consultant's perception of the frequency of occurrence of site management-related cause of rework on oil and gas projects	16	0.953	0.000	Reject

r = correlation coefficient

4.3. Selected team members' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects

Having concluded that there is agreement between consultants and contractors' perception of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects, data collected from the two selected project team members were combined and analysed to form selected team members' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas projects. Results are presented in Table 5.

Table 5: Selected team members' perceptions of the frequency of occurrence of site management-related causes of rework in oil and gas construction projects

Site Management-related causes of rework	Sum	Mean Score	Item Rank
Ineffective site leadership	3482	3.86	1*
Poor communication	3256	3.61	2*
Poor planning and allocation of construction resources	3139	3.48	3*
Ineffective use of quality management practices	2895	3.21	4*
Constructability problem	2850	3.16	5*
Unrealistic schedule	2814	3.12	6*
Setting-out errors	2769	3.07	7*
Non-compliance with specification	2733	3.03	8*
Failure to provide protection to constructed works	2535	2.81	9
Unforeseen site condition	2490	2.76	10
Unclear instructions to workers	2462	2.73	11
Excessive overtime	2435	2.70	12
Wrong construction methodology	2309	2.56	13
Use of damaged or obsolete material	2183	2.42	14
Ineffective use of information technology	2066	2.29	15
Lack of safety	1858	2.06	16
Average Mean Item Score		2.93	

*N = 902; * = Most Frequently Occurring*

The result in Table 5 indicates that out of eight (8) site management-related factors having (MIS) $\geq$ 2.93, 'ineffective site leadership', 'poor communication', 'poor planning and allocation or resources', 'ineffective use of quality management system' and 'constructability problems' are the five most frequently occurring site management-related causes of rework in oil and gas construction projects.

4.4. Test of variation in the frequency of occurrence of site management-related causes of rework across states in south-south, Nigeria

Having determined the combined views of the two project team members on the frequency of occurrence of site management-related causes of rework in oil and gas construction projects, the variation in frequency of occurrence of site management-related causes of rework across states in South-South as perceived by contractors and consultants was assessed using Kruskal-Wallis test. The result is presented in Table 6.

The result of Kruskal-Wallis H test in Table 6 shows that the variation in frequency of occurrence of site management-related causes of rework across the States in South-South, Nigeria as perceived by consultants and contractor is not significant, $X^2(5) = 1.251$, $p = 0.940$ and $X^2(5) = 3.184$, $p = 0.672$ respectively. Arising from this, the test fails to reject the second hypotheses which states that, the frequency of occurrence of site management-related causes of rework in oil and gas construction projects do not vary significantly across the states in South-South Geo-Political Zone of Nigeria. The implication of this result is that

the frequency of occurrence of site management-related causes of rework is the same across all the states.

Table 6: Kruskal-Wallis (H) test of variation in the frequency of occurrence of site management-related causes of rework across states in south-south, Nigeria

Location of Study	N	Frequency of Occurrence as perceived by consultants				Frequency of Occurrence as perceived by contractors			
		Mean Rank	Test Statistic	*p*-value	Decision	Mean Rank	Test Statistic	*p*-value	Decision
AKS	16	51.88				49.69			
BYS	16	49.91				48.06			
CRS	16	52.47	1.251	0.940	Accept	52.47	3.184	0.672	Accept
DES	16	44.06				56.22			
EDO	16	47.47				42.50			
RVS	16	45.22				42.06			
Total	96								

**AKS=Akwa Ibom State, BYS=Bayelsa State, CRS=Cross River State, EDS=Edo State, DES=Delta State, RVS=Rivers State, N=Number of Factors*

4.5. Contractors and consultants' perceptions of the influence of site management-related causes of rework on performance of oil and gas construction projects

The second objective of the study is to evaluate the influence of site management-related causes of rework on performance construction projects in terms of cost and time. Data collected on the perceptions of consultants and contractors on the influence of twenty-two site management-related factors on project time and cost were analysed to derive their Mean Item Score and ranks. Results are presented in Table 7.

The result in Table 7 indicates that consultants and contractors considered eight (8) site management-related factors having (MIS) $\geq$ 2.95 and (MIS) $\geq$ 2.97 respectively to have significant influence on project time performance. Similarly, consultants and contractors considered eight (8) site management-related factors having (MIS) $\geq$ 3.05 and (MIS) $\geq$ 3.07 respectively to have significant influence on project cost performance.

4.6. Test of correlation between contractors' and consultants' perceptions of the influence of site management-related causes of rework on project performance

To test the third hypothesis of the study, contractors and consultants' perception of the influence of site management-related causes of rework on project time and cost performance were compared for agreement using Spearman's Test of correlation. Result of the test of hypothesis is presented in Table 8.

The result shows high correlation between the perception of consultants and contractors on the influence of site management-related causes of rework on project time and cost performance ($r< 0.989$) and ($r< 0.986$) respectively. Addionally, the *p*-value which is less than the critical value ($p< 0.001$) further confirms that the correlations are significant. Therefore, the null hypothesis which stated that, there is no significant correlation between consultants' and contractors' perceptions of the influence of site management-related causes of rework on cost and time performance of oil and gas construction projects is

rejected. This result implies that both contractors and consultants agree and have similar views on the influence of site management-related causes of rework on time and cost performance of oil and gas projects in Nigeria.

Table 7: Consultants and contractors' perceptions of the influence of site management-related causes of rework on project time and cost performance

	Time Performance				Cost Performance			
	Consultant (N=392)		Contractor (N=510)		Consultant (N=392)		Contractor (N=510)	
Site management-related causes of rework	MIS	Rank	MIS	Rank	MIS	Rank	MIS	Rank
Ineffective site leadership	3.82	1*	3.82	1*	3.71	2*	3.91	1*
Poor communication	3.54	2*	3.56	2*	3.82	1*	3.82	2*
Poor planning and allocation of construction resources	3.49	3*	3.50	4*	3.68	3*	3.67	3*
Ineffective use of quality management practices	3.44	4*	3.51	3*	3.58	4*	3.60	4*
Constructability problem	3.28	5*	3.24	5*	3.53	5*	3.57	5*
Unrealistic schedule	3.08	7*	3.22	6*	3.43	6*	3.46	6*
Setting-out errors	3.05	8*	3.15	7*	3.28	7*	3.24	7*
Non-compliance with specification	3.13	6*	3.07	8*	3.02	8*	3.07	8*
Failure to provide protection to constructed works	2.74	9	2.78	10	2.65	13	2.78	11
Unforeseen site condition	2.68	10	2.77	11	2.74	10	2.78	9
Unclear instructions to workers	2.65	12	2.78	9	2.73	11	2.74	10
Excessive overtime	2.66	11	2.70	12	2.72	12	2.73	12
Wrong construction methodology	2.49	13	2.45	13	2.80	9	2.63	13
Use of damaged or obsolete material	2.45	14	2.39	14	2.49	14	2.45	14
Ineffective use of information technology	2.35	16	2.30	15	2.45	15	2.39	15
Lack of safety	2.36	15	2.24	16	2.13	16	2.30	16
Average (MIS)	2.95		2.97		3.05		3.07	

* *Significant Influence*

Table 8: Spearman test of correlation between contractors and consultant's perception of the influence of site management-related causes of rework on project performance

Parameter Correlated	N	r	*p*-value	Decision
Time Performance	16	0.989	0.000	Reject
Cost Performance	16	0.986	0.000	Reject

r = correlation coefficient; N= Number of factors

4.7. Selected team members' perceptions of the influence of site management-related causes of rework on cost and time performance of oil and gas projects

Having established that consultants and contractors' perception of the influence of site management-related causes of rework on time and cost performance of oil and gas construction projects is the same, the data collected from the two selected groups of project team members were combined and analysed to determine the perception of selected project

team members on the influence of site management-related causes of rework on time and cost performance in the study area. Results are presented in Table 9.

The result in Table 9 indicates that out of eight (8) site management-related factors having (MIS) ≥ 2.96 and (MIS) ≥ 3.06 ,'ineffective site leadership', 'poor communication', 'poor planning and allocation or resources', 'ineffective use of quality management system' and 'constructability problems' are the top five site management-related factors having influence on time and cost performance of oil and gas construction projects. Ranks of influence of other site management-related causes of rework on cost and time performance of oil and gas construction projects according to selected team members' perceptions are shown in Table 9.

Table 9: Selected Team Member's perceptions of the influence of site management-related causes of rework on cost and time performance.

	Time Performance		Cost Performance	
Site management-related causes of rework	MIS	Rank	MIS	Rank
Ineffective site leadership	3.82	1*	3.83	1*
Poor communication	3.55	2*	3.82	2*
Poor planning and allocation of construction resources	3.50	3*	3.68	3*
Ineffective use of quality management practices	3.48	4*	3.59	4*
Constructability problem	3.26	5*	3.56	5*
Unrealistic schedule	3.16	6*	3.45	6*
Setting-out errors	3.11	7*	3.26	7*
Non-compliance with specification	3.10	8*	3.05	8*
Failure to provide protection to constructed works	2.73	10	2.76	9
Unforeseen site condition	2.73	11	2.74	10
Unclear instructions to workers	2.76	9	2.73	11
Excessive overtime	2.69	12	2.72	12
Wrong construction methodology	2.47	13	2.70	13
Use of damaged or obsolete material	2.42	14	2.47	14
Ineffective use of information technology	2.32	15	2.42	15
Lack of safety	2.29	16	2.23	16
Average MIS	2.96		3.06	

*N = 902 * Significant Influence*

4.8. T-test of significance of the influence of site management-related causes of rework on cost and time performance

The influence of sixteen site management-related causes of rework on time and cost performance was tested using One-Sample t-test. Results are presented in Table 10. The positive mean differences in Table 10 shows that the average MIS of the perceptions of selected project team members' influence of site management-related factors on time and cost performance is greater than the hypothesized mean value of 2.5 respectively. Furthermore, *p*-values (0.002 and 0.001) obtained from the analysis are less than the critical value of 0.05 ($p < 0.05$). This also confirms that the difference between the average MIS and the hypothesised mean is significant. Therefore, the fouth hypothesis which stated that, the influence of site management-related causes of rework on time and cost performance is

not significant is rejected. The result implies that site management-related causes of rework have significant influence on project time and cost performance of oil and gas construction projects.

Table 10: Results of one sample t-test of the influence of site management-related causes of rework on cost and time performance

Test value = 2.5					95% confidence interval of the difference		
	Performance Variables	N	Mean	Mean Diff	Lower	Upper	*p*-Value
Influence of site management-related causes of rework	Time	16	2.96	0.462	0.207	0.717	0.002
	Cost	16	3.06	0.563	0.279	0.848	0.001

N = numbers of factors

4.9. Test of variation in the influence of site management-related factors on time and cost performance across the states in south-south, Nigeria

The influence of site management-related causes of rework on time and cost performance across the states in South-South region as perceived by contractors and consultants were assessed using Kruskal-Wallis test. The result is presented in Table 11.

Table 11: Kruskal-Wallis (H) test of variation in the influence of site management-related causes of rework on cost and time performance across states in south-south, Nigeria

Respondents	Location of Study	N	Time Performance				Cost performance			
			Mean Rank	Test Statistic	*p*-value	Decision	Mean Rank	Test Statistic	*p*-value	Decision
Contractors	AKS	16	50.59				50.97			
	BYS	16	47.34				46.84			
	CRS	16	51.66	1.547	0.990	Accept	54.31	1.210	0.944	Accept
	DES	16	48.91				46.09			
	EDO	16	46.78				45.56			
	RVS	16	45.72				47.22			
Consultants	AKS	16	50.59				40.81			
	BYS	16	47.34				45.38			
	CRS	16	51.66	2.733	0.741	Accept	52.56	2.170	0.825	Accept
	DES	16	48.91				52.97			
	EDO	16	46.78				48.09			
	RVS	16	45.72				41.19			

**AKS=Akwa Ibom State, BYS=Bayelsa State, CRS=Cross River State, EDS=Edo State, DES=Delta State, RVS=Rivers State, N=Number of Factors*

The result of Kruskal-Wallis H test in Table 11 shows that the difference in influence of site management-related causes of rework on time and cost performance as perceived by contractors and consultants is not significant, X^2 (5) =1.547, p=0.990; X^2 (5) =1.210, p=0.944; X^2 (5) =2.733, p=0.741 and X^2 (5) =2.170, p=0.825 respectively. Arising from this, the test fails to reject the fifth hypothesis which stated that, the influence of site management-related causes of rework on cost and time performance of oil and gas

construction projects do not vary significantly across the states in South-South Geo-Political Zone of Nigeria.

5. DISCUSSION OF RESULTS

The results of this study revealed that there is agreement between contractors' and consultants' perceptions of the frequency of occurrence of site management-related causes of rework in the study area. Implying that contractors and consultants agree on the site management causes of rework that frequently or rarely occurs in oil and gas construction projects. This result agrees with Love and Edwards (2004) who reported that the perceptions of respondents on the occurrence of rework causes in construction projects are the same. Their agreement regarding the occurrence of rework pertaining to site management will guide construction professional towards effective rework mitigation at construction site. Consequently, the combination of their opinion in this study reveals that "ineffective site leadership", "poor communication", "poor planning and allocation of resources", "ineffective use of quality management practices" and "constructability problems" are the five most frequently occurring site management-related causes of rework in oil and gas construction projects. On the contrary, Love and Smith (2003) reported variations in the perceptions of contractors, consultants and project managers regarding the occurrence of 'poor planning and allocation of resources' as factor contributing to rework in construction projects. Along the same line, Love and Edwards (2004) noted that, although, there is variation in the perceptions of the three groups of respondents, their combined views revealed that poor planning and allocation of resources ranked first and was thus considered the most occurring causes of rework.

Furthermore, this study indicated that contractors' and consultants' perception of the influence of site management-related causes of rework on project performance is the same. This implies that the selected project team members who constitute respondents for the study agrees on the site management-related causes of rework that influence cost and time performance of oil and gas projects in Nigeria. This result corroborates findings from previous studies (Palaneeswaran, 2006; Wasfy, 2010; Simpeh, 2012 and Zaiter, 2014) where contractors', consultant' and owner' perceptions of the effect of site management-related factors on project performance of building projects was reported to be the same. The result of this study has also shown that site management-related causes of rework that frequently occurs in Oil and Gas construction project also have significant influence on time and cost performance. Based on this, the selected project team members were seen to consider "ineffective site leadership", "poor communication", "poor planning and allocation of resources", "ineffective use of quality management practices" and "constructability problems" as the five most significant site management-related causes of rework having influence on cost and time performance of oil and gas projects. This result corroborate the findings in Love, Edwards, Irani and Walker (2009) who reported that rework occurrence in heavy industrial projects as perceived by contractors have significant impact on cost performance.

When a construction project is not performing as expected, it is the site leadership team who is questioned because they have greater responsibility to ensure that the project delivers benefit to the customer. According to Palaneeswaran, Love, Kumaraswamy, and Ng (2008), poor site management which stems out from ineffective site leadership contributes significantly to rework occurrence in construction projects. In line with Palaneeswaran *et al*., (2008), avoiding defects and non-conformance in building and

construction projects depends on the effectiveness of site leadership (Jarkas, Kadri and Younes, 2012). In the same vein, Oyewobi, Abiola-Falemu and Ibironke (2014) reported that ineffective site management may result in improper separation of work or line of authorities which might lead to poor performance. For this reason, Zaiter (2014) and Mahamid (2016) reported that poor site management have severe impact on project performance and they ranked this factor first and fourth respectively. In line with this agreement, "ineffective site leadership" ranked first among other site management-related causes of rework having influence on project performance in this study.

According to Fayek, Dissanayake, and Campero (2003), Lack of standard communication procedure causes poor communication which consequently leads to rework. The authors reported that poor communication contributed 0.25% to the overall causes of rework in construction project. In line with Fayek, Dissanayake, and Campero (2003), Love, Edwards, Smith and Walker (2009) reported that poor communication during project execution was associated with frequent rework occurrence in civil and building projects. Mahamid (2016) opined that poor communication between client and other construction parties also may lead to conflicts between parties as well as misunderstanding of the contract document requirements, thereby negatively affecting the work flow. Consequently, the author ranked poor communication first among causes of rework having significant impact on residential building project. In view of this, "poor communication" ranked second among site management causes of rework affecting project time and cost performance in this study. This result corroborates findings from previous study (Love and Smith, 2003; Fayek, Dissanayake, and Campero, 2003; Oyewobi and Ogunsemi, 2010; Masterbroek, 2010 and Mahamid, 2016).

The ranking of poor planning and allocation of resources among the most significant factor affecting project time and cost performance supports the findings in previous studies which emphasised the importance of this factor (Fayek, Dissanayake, and Campero, 2003; and Love, Edwards, Smith and Walker 2009). In line with the adage "Failing to plan is planning to fail, Preis, Burcham, and Farrell (2014) emphasised that lack of appropriate project planning often results in the setting of unrealistic, overly aggressive goals which become serious delivery issues. Fayek, Dissanayake, and Campero (2003) opined that experience and technical knowledge is required for job planning and resource allocation to be effective and successful. The authors further reported that this factor contributes 2.51% to the overall causes of rework in construction projects. Simpeh (2012) also added that inadequate pre-project planning and poor resource allocation to project activities can increase errors, defects and poor workmanship. For this reason, the author ranked poor resource coordination third among causes of rework affecting project performance. However, failure to appropriately consider external factors such as cycles of extreme weather in offshore location can result in significant rework which consequently affects project performance. Hence the findings from previous studies support the results of this study which ranked "inadequate planning and resource allocation" third of all the site management-related causes of rework affecting project performance.

This study ranked "ineffective use of quality management practices" fourth among other site management-related causes of rework. This result agrees with findings of Love, Edwards Irani and Walker (2009) and Zaiter (2016) who noted that the implementation of an effective quality management practices reduces rework and consequently improve cost and time performance.

This study ranked "constructability issues" fifth among other causes of site management-related causes of rework in oil and gas projects. Constructability problems arising from safety issues and work environment are prevalent in construction projects.

Following this, Fayek, Dissanayake, and Campero (2003) reported that constructability problems stems out from inadequate access to work location. Their study further revealed that constructability issues contributed 0.31% to the overall causes of rework in heavy industrial projects in Alberta. Along the same line, Oyewobi, Abiola-Falemu and Ibironke (2014) opined that improper site investigations or unforeseen circumstances are largely responsible for causing rework in many projects. According to the authors, time exigencies preclude some contractors to perform comprehensive site investigation prior to execution. Instead, contractors therefore rely on visual inspection and, or unreliable feedback from people around. Hence, deficiencies in construction may occur as a result of failure of design or contract documents to capture such unforeseen circumstance.

Furthermore, this study has shown that both the frequency of occurrence and the influence of site-management related causes of rework on cost and time performance of oil and gas projects across the six states in the South-South zone of Nigeria as perceived by contractors and consultants are the same. The implication of this is that consultant and contractors do not consider project location as having influence on the way site management-related causes of rework affects project time and cost performances. Similarly, the two groups of respondents do not also consider the frequency of occurrence of site management-related causes of rework to differ across different states in the Zone. In other words, project location do not appear to moderate the influence of site management-related causes of rework on project performances. Moreover, that the opinions of contractors and consultants are not affected by project location agrees with the findings of Hwang, Thomas, Hass and Caldas (2009) where it was reported that there was no significant difference in the impact of rework on construction cost performance across different locations. Along the same vein, the report of Forcada, Gangolells, Casals and Macarulla (2017) – that there is no evidence of significant disparities in cost of rework across several regions in Spain also lends credence to the findings of this study. The significance of the result of this study is that it will encourage construction professional not to concern themselves with the influence of location on site management-related causes of rework as it affects time and cost performances, especially where projects are to be executed in different locations.

6. Conclusion and Recommendations

By comparing the perceptions of consultants and contractors, this study concludes that their opinion on the frequency of occurrence of site management-related causes of rework is the same. This implies that both contractors and consultants agree on the site management-related causes of rework that frequently occurs in oil and gas projects. In view of this, “ineffective site leadership”, “poor communication”, “poor planning and allocation of resources”, “ineffective use of quality management practices” and “constructability problems” were considered the five most frequently occurring site management-related causes of rework in oil and gas construction projects in Nigeria.

This study also concludes that the top five frequently occurring site management-related causes of rework have significant influence on cost and time performance of oil and gas projects in Nigeria. The implication of this result is that, their combined opinion on the frequency of occurrence and influence of site management-related causes of rework on cost and time performance may well serve as input in the development of strategies that will prevent the occurrence of site management-related rework in oil and gas project.

This study further concludes that the influence of site management-related causes of rework on cost and time performance of oil and gas construction projects in South-South Geo-political zone of Nigeria is significant. This implies that site management-related causes of rework affect time and cost performances. Therefore, mitigating site management-related causes of rework would result in an improvement in time and cost performance of Oil and Gas construction projects. This result suggests that construction professional in oil and gas sector of Nigeria should make concerted effort to prevent the occurrence of rework in oil and gas construction projects.

In this study, frequency of occurrence and the influence of site management-related causes of rework on project time and cost performances are the same across the states of South-South, Nigeria as perceived by contractors and consultants. Therefore, this study concludes that location has no effect on the frequency of occurrence and the way site management-related causes of rework affect time and cost performances of oil and gas projects. This implies that oil and gas projects could be sited anywhere in the region without entertaining concerns about project location contributing to the occurrence of site management-related causes of rework which in turn affect project costs and time performances.

Based on these conclusions, it is recommended that project owners and construction professional should develop and implement quality management training for project site team across the industry to enhance their knowledge and awareness on quality control as this would reduce the occurrence of rework and improve project performance. Furthermore, adequate time and resources should be made available for site verification prior to construction execution, as this would significantly reduce errors and omission which subsequently result in rework during construction. This study also suggests the need for effective resource allocation and optimisation during early project planning and execution to avoid fatigue and stress on labour resources which subsequently lead to rework.

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EFFECTIVENESS OF FINANCE ALLOCATION STRATEGIES: A COMPARATIVE EVALUATION OF PUBLIC AND PRIVATE BUILDING PROJECTS IN AKWA IBOM STATE

Ikenna Reginald Ajiero[1] and Anthony Okwogume Ujene[2]
[1&2]Department of Building, University of Uyo, Uyo, Nigeria

ABSTRACT

Purpose: Given the indispensability of finance to any construction process, this research aimed at carefully evaluating the effectiveness of various finance allocation strategies in public and private building projects in Akwa Ibom State. The set objectives of this study include to discretely assess the effectiveness of major financing allocation strategies in public and private building projects, and comparatively deduce which strategies are more effective in each sector.
Design/methodology/approach: To collect the data required for analyses, 120 copies of structured questionnaire were administered to construction professionals that have previously handled private and public building projects in Akwa Ibom state. Out of the 120 copies of questionnaire purposively distributed, 103 (85.8%) were returned. Descriptive statistical methods were used to carry out the data analysis.
Findings: Results of this study indicate that the investigated milestone payment method and concession methods (BOOT, BOO, BOT), are more effective in the public building projects than in the private. In contrast, the direct labour (DL) payment method is inferred to be more effective in the private projects than in public projects. In addition, honouring of interim payment certificates (IPCs) has been established to be more delayed in public building projects than in the private projects; and overruns in time and cost are more experienced in public building projects than in the private projects.
Research limitations/Implications: Whereas, the three major towns (Uyo, Ikot Ekpene and Eket) where assessed, the study would have preferred to cover more local governments and compare their financing strategies in the public and private projects. However, the three local governments are considered to have greater construction works and data collected from them were significant.
Practical implications: Consequent on the findings of this research, though the milestone payment method is more effective in the public sector, its use in the private sector enables a more organised scheme of construction activities. This will also help in guiding both the client and contractor on when to expect funds – in milestones.
Originality/value: Previous researches on the project finance allocation strategies, focused on Nigeria as a whole; whereas, this study assessed how public and private building projects are financed in Akwa Ibom state.

[1]ajieroikenna@yahoo.com

Keywords: Financing strategies; public building projects; private building projects; Akwa Ibom State

1. INTRODUCTION

Management of the financial aspect of any project is one key aspect of project management that involves planning, budgeting, financial reporting, auditing, and control of the physical progress of the project, with the aim of achieving predetermined objectives of cost, time, quality, scope and client satisfaction (Claudia, 2005).

Whereas, finance is the circulatory system of every economic project, Kamoche (1996) posited that it is the force that brings about the cooperation and coordination of the various interrelated units of a project. It directs the smooth flow of construction activities and plays a catalytic role of promptly accomplishing the set goal(s) of any project. More so, Anthony (2002) opined that the top three reasons for construction failure are: faulty project estimation, inadequate working capital and lack of requisite expertise. These factors collectively denote poor cash management.

Further, a study by Oyedele (2013) revealed that in building cities of developing countries, construction project finance constitutes a herculean task. Accordingly, research by Jonathan (2001) revealed that there are several construction project financing methods used in the Nigerian construction industry. These range from the Direct Labour Payment method; The Milestone Payment Method and The Concessions [The Build-On-Operate-Transfer (BOOT), Build-Own-Transfer (BOT), Build-Own-Operate (BOO)]. Unfortunately, as these financing methods are basically project-specific (Abdul Rashid et al., 2006), some have worked well in some projects, while in others, they have failed. This, according to Oyedele (2013), has placed the industry in a state of uncertainty regarding the most appropriate financing method for each project type; and underscored the need to tackle this problem by identifying means of financing construction projects to meet set project objectives. Hence, selection of the most appropriate financing method is critical for both the client and other project participants, as it is an important factor that contributes to the overall client's satisfaction (Muriro & Wood, 2010) and can shape the performance of the project (Mustapha, Naoum, & Aygun, 1994).

Suffice it that private and public building projects have discrete financing prospects and problems; hence, the need to appraise the financing activities of both sectors separately. Understanding the construction financing strategies and defining what to do with available funds, in both the public and private projects, constitute the beginning of the process of managing the finance needed for the delicate process of building construction.

According to Reddy (2011), financial management is concerned with three activities: (i) anticipating long-term and short-term funds; (ii) acquiring the requisite financial resources, and (iii) allocating the available funds to best options that are capable of maximizing shareholders' goals.

Also, as noted by Zuofa & Ochieng (2014), in appreciating the importance of a thorough understanding of the finance anticipation, acquisition and allocation strategies in Nigerian project delivery, Section 4 (2) (b) of the Nigerian Public Procurement Act 2007 stipulates that all procurements shall be based only on procurement plans supported by prior budgetary appropriations; and no procurement proceedings shall be formalized until the procuring entity has ensured that funds are available to meet the

obligations. Despite this provision, Okereke (2012) and Ewa (2013) still highlighted varying levels of failure, partly attributable to inadequate budgetary allocations in most government projects.

To this end, in view of the cost failures of projects attributable to poor financial management in Nigeria, this study seeks to provide insight into how effective the finance allocation methods are in Akwa Ibom State. The required data shall be sourced from Ministries of work, Construction companies, Contractors and Consultants in Akwa-Ibom State.

1.1. Objectives of the study

The aim of this study is to evaluate the effectiveness of various financing strategies in public and private building projects in Akwa Ibom State. To achieve this, the study shall concentrate on the following objectives:

i. To evaluate the setbacks associated with planning, acquiring and allocation of construction funds in both the private and public sectors
ii. To evaluate the effectiveness of the finance allocation strategies in public and private projects.
iii. To undertake a comparative assessment of the finance allocation strategies in public and private projects in Akwa Ibom State.

1.2. Research hypotheses

H_o: There is no significant variation in the effectiveness of the finance allocation strategies between the public and private building projects.

2. LITERATURE REVIEW

The concept of finance is as old as mankind. From history, the trade by barter method of giving a good or service for goods or services was once the main means of transaction. However, as cowries where introduced, transactions gradually gained a more defined pattern, eventually leading to the use of cash, as seen today. In the construction industry, finance is one of the top preconditions for realizing any set goal or objective. It is an indispensable requirement for any successful construction process.

Several definitions and explanations have been given to the concept of finance. According to Ojiuko (2001), finance as a term can be defined as the management of the flow of money through an organisation, which could be a Corporation, School, Bank, Church or Government agency, as well as claims against money. More so, finance, according to Osubor (2003), is money, how it is acquired and used. Thus, a study of finance shall include the study of the elements of finance including its nature, creation, regulation and problems. On the other hand, financial Management is concerned with anticipating long-term and short-term assets; acquiring financial resources; and allocating funds in business – the three key activities of finance as discussed hereafter (Reddy (2011).

2.1. Finance anticipation

A careful financial planning or forecasting of cash flow makes possible the smooth flow of funds during a construction period, and avoidance of any financial setback that may arise. Since all phases of financial planning are interrelated, financial planning ensures a

systematic optimum use of finance. If a forecast indicates that a shortage of cash will develop at a certain point within the contract period, the financial plan should incorporate how to borrow or sell real asset to supplement the cash flow. In more explicit terms, financial planning aims at laying down the direction in which a financial move should be made, taking into account the resources that are available and projecting towards supplementing the unavailable resources.

2.2. Finance acquisition

As opined by Hendrickson & Au (2003), funding of building projects differs sharply by types of owner and the type of facility under construction. Accordingly, building project funding may be separated into two distinct groups namely: public funding and private funding (Jonathan, 2001). Public Sources of funds for building projects may include: allocations from higher levels of governments, special bonds, loans, tax receipts, general revenue collections, donations, sponsorships, lease agreements, parking fees, amongst other sources. For the private sources of funds for building projects, individuals or corporations planning to undertake a construction project may use their retained or personal earnings, bonds, donations from relatives or friends, sponsorship from Non-Governmental Organizations or Government, pension funds, insurance companies, investment trusts, commercial banks, *etc*. As inferred by Jonathan (2001), Ojiuko (2001) and Kanu & Okezie (2005), there are two main approaches to accessing finance for building projects: Traditional and Modern.

2.2.1 Traditional approach

According to Jonathan (2001), prior to the colonial periods, several informal approaches to financing building projects were adopted in different parts of the country. In the old Cross River State, there existed the Itu Age Grade Association (IAGA), village development schemes and Town Unions of people living outside their places of birth. Others were the social club contributions, and the lbiaku Uruan moneylenders association, who contributed either by cash or mainly by providing labour on members' construction sites, following the association circle of turns. Today, most of these areas have been traced to the present Akwa lbom State. These approaches were successful in providing finance for construction and its delivery in the traditional setting. However, with the complexity of economic activities, these methods faded away and were replaced by the modem methods Akanji (1998).

2.2.2 Modern methods

For both the public and private sectors, building construction is mainly funded using existing cash reserves, periodic cash acquisitions or sourcing funds from external sources. In Nigeria, finance houses that support construction projects operate within the statutory guidelines stated by the Federal Government. Among these are:

a. The Federal Mortgage Bank of Nigeria (FMBN) – they regulate the real estate development market, and are empowered by the Federal Government's promulgation of Decree no. 3 of 1991, through the adoption of the National Housing Policy in 1990 (Ojiuko, 2001).
b. Commercial banks – These mainly lend on short-term basis (with relatively high interest rates), because they have to meet up with withdrawals of customers at no

notice. This has generally limited their success in financing building project (Jonathan, 2001).

c. Merchant Banks – They hold little cash reserves, and unlike commercial banks they offer bridging loans or interim funds to real estate developers at very competitive rates of interest, usually on short-term basis (Kanu and Okezie, 2005).
d. Specialized Development Bank – According to Kanu and Okezie (2005), this category includes the Nigerian Industrial Development Bank (NIDB), Urban Development Banks, etc. They are established to grant long-term loans that could last up to 25 years for industrial, commercial, agricultural and housing developments. Though perfect for building project funding, their success has also been very limited, due to inadequate funding and diversion of the available funds into the short-term projects that yield quicker interest.
e. Insurance Companies – Life funds of Insurance companies are long-term savings in form of amenities or endowment policies that can only mature at the occurrences of certain known events like death, accident or retirement. The long-term sources of funds enable insurance companies to primarily invest on long-term capital assets like investments in real estate, mortgage and debentures (Ojiuko, 2001). Unfortunately, insurance companies have not played a significant role in housing schemes in Nigeria (Kanu and Okezie, 2005).
f. Pension Fund – The National Pensions Fund collects funds from employers and employees towards employee's retirement. This gives them access to long-term funds and put them in good position to finance building projects (Kanu, 2001).
g. International Financial Institutions – The World Bank is a multinational lending organization, consisting of several closely related institutions, including the International Bank of Reconstruction and Development (IBRD), and The International Finance Corporation (IFC) (Anyanwu, 2003). The World Bank provides loans to developing countries to help reduce poverty and financial investments that contribute to economic growth. The World Bank has financed several Housing estates in Nigeria and these are mainly large public building Projects.
h. Housing Schemes – By 1979, it had become evident that despite the huge profit made by big companies in Nigeria, there was total neglect of the need for the companies to provide shelter for their workers (Onabule, 1992). This compelled the promulgation of employees housing scheme (special provision) decree 54 of 1979. The main provision of the decree is that any employer with up to 500 employees should provide a minimum of 50 housing units out of which three quarters shall be available to non-executive staff. The decree put in place a structure for identification of such category of employees and implementation of the decree. It also provided for the establishment of a housing loan bank by the state. This program was considered very laudable in the sense that it improved the provision of housing to the middle and lower ranked workers in Nigeria. Unfortunately, satellite town in Lagos is the only reminiscent of the implementation of the decree. The problem of ownership, after retirement of staff occupying properties, made nonsense of the decree (Ojiuko, 2001).

Generally, it is advisable to borrow as little as possible, as no financing mechanism is always unambiguously without some inherent risks (Hendrickson and Au, 2003).

2.3. Finance allocation

As noted by Jonathan (2001), in Nigeria, the major finance allocation strategies include: The Direct Labour Payment method; The Milestone Payment Method and The Concessions [The Build-On-Operate-Transfer (BOOT), Build-Own-Transfer (BOT), Build-Own-Operate (BOO)].

2.3.1 The milestone payment method

As the name "milestone" goes, payments are made at concrete or key segments/stages called milestones. This payment method requires that a contractor/constructor commences a construction process with a mobilization advance or a personal income. As noted by Akpabio (2003) the Nigeria Institute of Architect (NIA) Form of Contract does not require the employer to mobilize the contractor with funds before commencement of work; though some employers (especially Government) grant mobilization advances (usually 10% or more of the contract sum), to enable the contractor procure materials and equipment for the job. To avoid the risk of misappropriation, employers often demand and obtain from the contractor, a performance bond, issued by a reputable insurance company, to the effect that should the contractor fail to satisfactorily execute the contract, the employer will be indemnified by the insurance company up to the value stated in the bond. These arrangements must be spelt out in the contract for effective implementation.

The interim payment certificate (IPC)

As contained in the NIA Form of Contract (Clause 30.l.l), the employer shall pay the contractor regularly, once a month or as often as may be prescribed by the contract (Akpabio 2003). In addition, for any payment to be made, the architect is required to issue a certificate stating the amount due to the contractor. This certificate is called Interim Payment Certificate or IPC for short. At each project milestone, work progress must be valued by a quantity surveyor, before any Interim Certificate is honoured. The contractor is entitled to payment of the certified sum within 28 days or the period stated in the "Agreement for honouring certificates" (Akpabio 2003). Prompt payment of IPC is good for any contract, because the contractor needs steady cash flow. If the IPC is delayed, the contract may be delayed or abandoned, and by the time the contract eventually resumes, prices may have gone up and the employer would require to pay even more.

Valuation of IPC

The aim of contract administration is not only to ensure that buildings are erected in accordance with the design and specifications, but also that money paid out to the contractor at any stage is commensurate with the work done or materials delivered to the site. Before an IPC is prepared, it is the duty of the Quantity Surveyor to visit the site and measure works done or materials brought to site or stored in an approved store outside the site. The Quantity Surveyor's valuation certificate should not be confused (even if it looks like) the Architects payment certificate (Akpabio, 2003). The Quantity Surveyor's valuation is only a recommendation, since the Architect will eventually use same to issue the IPC.

2.3.2 Concession financing strategies

In the concession financing strategies, also known as the "total package options" (Walker and Hampson, 2003), the owner of a building project either receives the completed building or derivable services from the property. In the concession procurement method, the building

owner normally delegates all responsibilities of design, construction and finance to an outside consultant in a Concession arrangement. As noted by Ramus, Birchall & Griffiths (2007), within this method is a payment mechanism to allow the contractor to be reimbursed the construction finance and maintenance costs. As noted by the authors, "*the payments will not normally commence until the work is finished and operational*" (Ramus, et. al., 2007, p. 43). In addition, as defined by Merna and Smith (as cited in Merna & Njiru, 2002, p.92), the concession method entails:

> *"the granting of a concession by a principal, usually a government, to a Promoter, sometimes known as a Concessionaire, who is responsible for the construction, financing, operation and maintenance of a facility, over a period of the concession before finally transferring the facility, at no cost to the principal, in a fully operational condition. During the concession period the Promoter owns and operates the facility and collects revenues in order to repay the financing and investment costs, maintain and operate the facility and make a margin of profit."*

Thus, in order for a concession operation to succeed, the client shall provide a set of unambiguous performance specifications to the contractor and have confidence in the capacity of the contractor to carry out the project (Claudia, 2005). The concession method is carried out through the mechanism of the Build-On-Operate-Transfer (BOOT), Build-Own-Transfer (BOT), Build-Own-Operate (BOO), etc. In all the three concession methods, the "B" represents "build", the first "O" represents "operate", the second "O", "own", and the "T", "transfer" (Walker and Hampson, 2003). In the BOOT, the client contracts to design, build, operate, own for some time and transfer the facility back to the owner. Furthermore, in the BOT arrangement, the facility is built, operated to the point where a transfer of the facility will not affect its performance, then a transfer is made to the client for full ownership and operation. The last concession method (BOO) involves operating the designed and built facility to a point where the facility is eventually owned by the contractor, only when certain set conditions of ownership and operation are fully met.

2.3.3 The direct labour payment method

This is where a client uses the services of in-house human resources to carry out a construction process, that is, workers of an organisation, instead of contracting the service or the project out. The direct labour payment system thus involves engaging the tradesmen directly, without necessarily forming a team, and paying for their services, based on their work output. As noted by Oyedele (2013), the client takes all the project risks and manages the cash flow. According to the author, the deficiency of direct labour is that the client may not be knowledgeable about construction and will end up spending more than a professional would have. In contrast, the benefit of this method is that in-house professionals gain more practical experience and exposure, thereby becoming more proficient in their various fields. It also helps to save time that would have been used writing tenders and negotiating with contractors. It suffices to state that payments in this method is not limited to labour, but to materials, ancillaries, amongst others.

3. METHODOLOGY

Primary data were exclusively used for this assessment, and the research instrument was questionnaire. Specifically, 120 structured copies of the questionnaire were administered to construction professionals who have handled private and public building projects in Akwa Ibom state, 40 for each major town in Akwa Ibom State, namely: Uyo, Eket and Ikot Ekpene, as shown in Table 1. The questionnaire copies were given to Architects, Builders, Engineers and Quantity Surveyors, as these were considered to have knowledge of the subject. The 120 copies were administered across the three senatorial districts of Akwa Ibom State to ensure that a significant number of construction professionals responded to the questionnaire. In each town, construction professionals in the Ministry of Works and Construction companies, as well as Contractors and Consultants, were administered the questionnaire.

The questionnaire has three segments. The first part captured the details of the respondents such as the field of specialization, if they previously handled any buildings project; if yes, which sector – private or public building projects, etc. The second part of the questionnaire helped to collect data on setbacks associated with finance anticipation, acquisition and allocation; while the third part of the questionnaire focused on the effectiveness of the various finance allocation methods.

The summated four-point scale was used to measure the degree of effectiveness of the finance allocation strategies. They are: "E" for Effective (4 points), "P" for Partially effective (3 points), "U" for Undecided (2 points), and "I" for Ineffective (1 point). It is noteworthy that the degree of effectiveness were actually measured on three main parameters: "Effective", "Partially Effective", and "Ineffective". The fourth parameter "Undecided" was included to cover respondents who may wish to be neutral or choosing not to select any of the three major parameters of effectiveness; thus the use of the four-point scale.

4. DATA PRESENTATION AND ANALYSIS

4.1. Data presentation

Given that copies of the questionnaire were distributed to construction professionals in the three senatorial districts of Akwa Ibom State, Table 1 reveals a summary of the outcome of this exercise, in terms of the number of towns covered, the construction sectors visited, number and percentages of questionnaires administered and returned.

It can be seen from Table 1 that out of the 120 copies of the questionnaire distributed, 103 were returned and these represent 85.8% of the distributed copies of the questionnaire. In Uyo, out of the 40 copies of the questionnaire distributed, 38 were returned, representing 94.43%. In Eket, 30 out of the 40 copies of the questionnaire were returned, representing 73.33%, and lastly 35 of the 40 copies of the questionnaire distributed in Ikot Ekpene were returned, signifying 87.77% of the number distributed.

Table 1: A summary of the responses to the questionnaire distributed in the three major towns of Akwa Ibom State

Towns	Construction Sectors	No. of Copies of the questionnaire distributed	No. Returned	Percentage returned (%)	No. not returned	Percentage not returned (%)
Uyo	Ministry of Work	10	9	90	1	10
	Construction companies	15	14	93.3	1	6.7
	Consultancy firms	15	15	100	0	0
Uyo Total =		**40**	**38**	**94.43**	**2**	**5.57**
Eket	Ministry of Work	10	6	60	4	40
	Construction companies	15	10	66.7	5	33.3
	Consultancy firms	15	14	93.3	1	6.7
Eket Total =		**40**	**30**	**73.33**	**10**	**26.67**
Ikot Ekpene	Ministry of Work	10	9	90	1	10
	Construction companies	15	11	73.3	4	26.7
	Consultancy firms	15	15	100	0	0
Ikot Ekpene Total =		**40**	**35**	**87.77**	**5**	**12.23**
Grand Total =		**120**	**103**	**85.18**	**17**	**14.82**

Table 2: Summary of the responses to the questions on the effectiveness of the finance allocation strategies in public building projects

Public Building Projects	**E**	**I**	**P**	**U**
Effectiveness of the milestone payment system in public building projects	56	18	10	7
Effectiveness of the direct labour payment system in public building projects	33	26	24	8
Effectiveness of the BOOT in public building projects	29	20	17	25
Effectiveness of the BOO in public building projects	32	13	11	35
Effectiveness of the BOT in public building projects	25	20	16	30

Table 3: Summary of the responses to the questions on the effectiveness of the finance allocation strategies in private building projects

Private Building Projects	**E**	**I**	**P**	**U**
Effectiveness of the milestone payment system in private building projects	32	4	29	26
Effectiveness of the direct labour payment system in private building projects	58	19	10	4
Effectiveness of the BOOT in private building projects	13	17	25	36
Effectiveness of the BOO in private building projects	16	18	22	35
Effectiveness of the BOT in private building projects	8	25	19	39

Tables 2 and 3 depict a summary of the responses to how effective the finance allocation strategies are in the public and private building projects respectively.

4.2. Data analysis

Two methods of analysis were adopted for the analysis of the collected data, they include:

i. The sample mean
ii. The Chi-Square

4.2.1 Sample mean

The sample mean is calculated for each scaling item by multiplying the frequency of response under each category with the nominal values of the responses and dividing the sum of the values obtained under each response category with the number of respondents who gave response to the item. That is:

$$M_r = \frac{\sum nF}{Nr}$$

Where Mr = Mean of response, ∑ = Summation, n = Nominal Value, F = Frequency of response under each category. Nr = Number of respondents to the item; that is, number of valid questionnaires (103). The nominal values for this analysis are based on the Code; thus: Effective (E) = 4, Partially effective (P) = 3, Ineffective (I) = 2, and Undecided (U) = 1.

Based on the above information, the sample mean calculation was carried out, and results of the analysis for both the public and private sectors are revealed below.

Table 4: Summary of the sample means revealing the effectiveness of various finance allocation strategies in public building projects

Public Building Projects	***nF***				$\sum nF$	**Sample Mean**
Effectiveness of the milestone payment system in public building projects	224	54	20	7	305	2.96
Effectiveness of the direct labour payment system in public building projects	132	78	48	8	266	2.58
Effectiveness of the BOOT in public building projects	116	60	34	25	235	2.28
Effectiveness of the BOO in public building projects	128	39	22	35	224	2.17
Effectiveness of the BOT in public building projects	100	60	32	30	222	2.16

As revealed in Table 4, the highest mean score is 2.96, this indicates that the milestone payment system is more effective than the direct labour payment system (with a sample mean of 2.58) in public building projects. In addition, the table shows that the three Concession systems (BOOT, BOO and BOT) are less effective in the public building projects.

Table 4: Summary of the sample means revealing the effectiveness of various finance allocation strategies in private building projects

Private Building Projects	*nF*				$\sum nF$	Sample Mean
Effectiveness of the milestone payment system in private building projects	128	12	58	26	224	2.17
Effectiveness of the direct labour payment system in private building projects	232	57	20	4	313	3.04
Effectiveness of the BOOT in private building projects	52	51	50	36	189	1.83
Effectiveness of the BOO in private building projects	64	54	44	35	197	1.91
Effectiveness of the BOT in private building projects	32	75	38	39	184	1.79

Table 4 shows that the direct labour payment system with a mean score of 3.04, is more effective than the milestone payment system (with a mean score of 2.17), in private building projects. Accordingly, the table reveals that the three Concession systems (BOOT, BOO and BOT) are less effective in private building projects.

4.2.2 The Chi-Square method

The chi-square method is adopted to test the variation of effectiveness among the assessed finance allocation strategies in the public and private building projects. The Chi-square formulae is revealed below:

$$x^2 = \sum \left\{ \frac{(F_0 - F_e)^2}{F_e} \right\}$$

Where x^2 = Chi-square, $\sum$=Summation, F_o = Observed frequency and F_e = Expected frequency. The degree of freedom = (df) = (r – 1) (c – 1) at 0.05 (i.e. 95% level of significance). x^2T = Chi-square Table, while x^2C = Chi-square Calculated.

Decision rules

If $x^2T > x^2C$ = Accept

If $x^2C > x^2T$ = Reject

The degree of freedom = (r – 1) x (c -1) = 4.

From the chi-square table, the x^2C = 9.49

Table 5: Chi – square analysis table

F_o	F_e	$(F_o - F_e)$	$(F_o - F_e)^2$	$(F_o - F_e)^2/F_e$
305	280.76	24.24	587.68	2.09
266	307.29	-41.29	1705.25	5.55
235	225.03	9.97	99.38	0.44
224	223.44	0.56	0.32	0.00
222	215.48	6.52	42.54	0.20
224	248.24	-24.24	587.68	2.37
313	271.71	41.29	1705.25	6.28
189	198.97	-9.97	99.38	0.50
197	197.56	-0.56	0.32	0.00
184	190.52	-6.52	42.54	0.22
				17.65

Table 5 shows a x^2T of 17.65. This is higher than the table chi-square value (x^2C) of 9.49. This result supports the position that there is significant variation in the effectiveness of the finance allocation strategies between the public and private building projects. Thus, we reject the null hypothesis (H_o) and accept the alternative (H_1).

5. DISCUSSION OF RESULTS

Findings of the study revealed that in public projects, financial planning is relatively poor, and deviation of the actual cash flow from the projected is often significant. In addition, honouring of interim certificates (IPCs) has been established to be often delayed in public building projects than in the private projects. Further, overruns in time and cost are more experienced in public building projects than in the private projects.

Accordingly, the findings of this research show that the milestone payment method and the concession methods investigated (BOOT, BOO, BOT), are more effective in the public building projects than in the private. This finding that the concession methods are more effective in the public sector is consistent with the result of a study conducted by Vives & Benavides (2009) that conceded that the concession procurement strategies were more effective in Turkey's public construction projects than in the private projects.

In generals, the major reason why the public sector mainly adopts the milestone payment system as a principal means of funding its projects is because of its highly regulated and inflexible structure (Herbert, 2013). The goal being to ensure transparency in the public sector, where financial audits are carried out periodically. This does not mean that private sectors do not adopt the milestone method as a means of funding its project, rather, because of its more flexible structure, some transactions are carried out based on trust instead of following formal conditions of contracts. Thus, as established from the findings of this research, and consistent with the opinion of Oladiran, Ogunsanmi and Onukwube (2007), the direct labour (DL) payment system is more effective in the private projects than in the public projects. This is because most clients consider the direct labour payment system as a way of measuring the performance of work and controlling potential financial misappropriations.

6. CONCLUSION

This study succinctly identified and explained the project finance allocation strategies or the various methods of paying for construction works, both in the public and private sectors. These strategies include the milestone payment method, the Direct labour payment system and the Concession methods (BOOT, BOO, BOT), etc.

It suffices to note that though project procurement entails the process of acquiring various resources (work, materials and cost) for the delivery of the project, this study focused only on an aspect of the financial management of a project – finance allocation strategies. This helped to comprehensively study how projected and acquired funds are spent to deliver construction projects, and who actually pays for the final product (the client or the contractor).

Based on the results of the data collected, it is established that the milestone payment method is more effective in the public sector; the direct labour (DL) payment method is more effective in private projects; and lastly, the three Concession methods under consideration (BOOT, BOO, BOT) are more effective in the public building projects than in the private.

7. RECOMMENDATIONS

Based on the findings of this research, it is recommended that before embarking on any building construction project, proper financial planning should be carried out, especially using a project management software, to ensure precision and comprehensive financial assessment. Whereas, the aim of every construction project is to complete the project within set cost, time, etc., clients and contractors should not commence any project that does not have certainty of enough cash (available or projected) to complete such project. From the research, though the milestone payment method seems to be more effective in the public sector, however, this method should also be more adopted in the private sectors, to enable a more organised scheme of construction activities. This will also help in guiding both the client and contractor on when to expect the release of funds – in milestones. Also, the private sector is considered to mostly use the direct labour payment method because it is considered the most convenient and less expensive finance allocation strategy. However, more frequent application of the direct labour payment system in the public sector will help in-house professionals gain more practical experience and exposure, in so doing, become more proficient in allocation of funds for construction purposes.

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EFFECTS OF COMMUNICATION AMONG PROFESSIONALS ON BUILDING PROJECTS DELIVERY IN NIGERIA

O.F. Akinradewo[1], L.D. Ojo and O.N. Oyefusi
Department of Quantity Surveying, Federal University of Technology, Akure, Nigeria

ABSTRACT

Purpose: Effective communication is an essential ingredient that can help in achieving the set goal of a construction project. Therefore, the study aimed at assessing the effects of communication among the professionals on building project delivery with a view to developing models for determining the effects of communication on completion time, cost, client satisfaction and project management.
Design/methodology/approach: A questionnaire survey that discuss the problem that may arise as a result of informal communication among the construction professionals, was conducted on in-house consultants and external contractors who had been involved on building projects at the Ministry of Housing, Lagos State in the past five years (2011-2016).
Findings: The results demonstrated that answers all questions asked is the most important characteristic of effective communication while specification is the most used communication mechanism. The results also show that the four topmost effect of communication are time, client satisfaction, project management and cost.
Research limitations/implications: The limitation of the study is that data was collected from participants that were involved in construction projects executed by a Ministry in Lagos State in the last five years. This implies that the research is a case study of an establishment. Future study could be extended to cover the whole State in particular or Nigeria in general.
Originality/value: The characteristics of an effective communication and most effective communication mechanisms established through the study will improve construction stakeholder's delivery strategies of building projects. The models developed will also assist in predicting accurately the communication mechanisms that are germane to completion time, client satisfaction, project management and cost of building projects.

Keywords: Client satisfaction; communication mechanisms; completion time; cost; project management

1. INTRODUCTION

Construction project requires effective collaboration and coordination among diverse construction professionals and participant (client). As such coordination and

[1]fakol30@yahoo.com

collaboration helps to achieve quality standards and cost maximisation (Villagarcia and Cardoso, 1999). Construction project participants include client, project managers, architects, quantity surveyor, contractors, government representative and community amongst other. The numbers of construction participants involve on a project depend on the type of contract. Regardless of the type of contract that is being undertaken, Goh, Goh, Toh and Peniel-Ang (2014) opined that effectiveness of communication between the client and contractor will determine the time and quality of the construction project. Alshawi and Ingirige (2002) opined that effective communication, evaluation and feedback to project team at each stage of construction project could help to achieve project goal. Calvert, Bailey and Coles (2003) observed that construction projects involve great number of people interacting to achieve set goals which is heavily dependent upon inflow and outflow of information. Knipe (2002) identified different communication tools used in construction industry. They include; specifications, reports, manuals, schedules, calculations, drawings, site photographs, agenda's and minutes of meetings. These communication tools are used by different construction professionals at various stage of construction.

Tipili, Ojeba and Sa'adiya-llyasu (2014) observed that during a project, communication can occur in various directions depending on who is communicating. They concluded that there are three channels of communication which includes lateral or horizontal, upward and downward channel in construction projects. (Huczynski and Buchanan (2001) submitted that though managers in different industries and sectors undertake diverse tasks and activities, it was observed that most managers' task hovers around communication. The communication activities could include engaging in conversations; listening to colleagues; networking; collection of information; directing subordinates; writing letters or transferring information through electronic devices such as telephones and/or computers. Communication is germane to all business activities; it is an integral part of any construction process. Inter-organisation and intra-organisation communication contribute to construction project success and possible improve morale of the participants and level of understanding of job's requirement (Mehra, 2009).

Communication can therefore be seen as one of the important factors that could contribute to overall success of any construction project. Communication is crucial to the running of any construction project and for successful accomplishment of construction project, Olarewaju, Tan and Kwan (2017) observed that well-communicated information on project location, type, class and type of clients pre-empts overruns on both cost and time, would help to improve the project performance in terms of quality, sustainability and comfort. Dainty, Moore and Murray (2006) opined that communication is multifarious and complex term, which could mean different things in different context and situations. Aiyewalehinmi (2013) opined that construction productivity is directly related to the quality of information that flows between the people who are managing and those that are doing the work. Andrew, David and Michael (2006) also observed that regardless of much effort put into design and planning process, construction work related issues arise which often calls for urgent attention. Olarewaju, Tan and Kwan (2017) explained that poor communication affects ordering and payment with material suppliers. In such working environment with probability of production problems due to non-availability of communication patterns that are dynamic, spontaneous and often informal. In an attempt to solve the problem that could arise in informal passage of information among construction professionals, the study set to assess the effect of communication among construction professionals on building project delivery in Nigeria.

2. LITERATURE REVIEW

Building projects are always multidisciplinary, often large, and require participation of many parties during execution phase. Building project often arise with uncertainty of the number of professionals and participants that would be involved. The uncertainty increases with the size of the project. The size of large projects and the desire to shorten the duration of the delivery process always require simultaneous communication on the project. During execution stage of construction, some activities may be undertaken simultaneously, requiring major efforts in terms of coordination and communication between the participants (Shohet and Frydman, 2003). Emmitt and Gorse (2003) lamented the failure of construction industry to focus on improving human communication which is critical to success of a construction project. The study concluded that efforts were always concentrated on process and production improvement at the expense of improving complex inter-organisational and interpersonal relationships that define the industry's culture. Gomez-Ferror (2017) concluded that the most relevant problem is to work with documents that are not updated and the subsequent loss of time and money that involves correcting errors on site.

In recent years, the value of effective human and organisational communication has been recognised with establishment of alliance structures within organisations. Project Management Institute (2013) found that construction businesses that emphasise communication perform five times better compare to those that did not prioritise effective communication. Businesses that communicate effectively compete more than 80% of their construction projects within budget, on time, in high quality, and achieve other client value systems (PMI 2013). According to Gayeski and Russell (2005), communication could be regarded as a professional practice, where appropriate rules and tools could enhance utility of information. Heath and Palenchar (2008) viewed communication as a tool that fall into different zones of meaning that enable interaction between organisations. The people in the organisations translate the meanings, disseminate, comprehend, receive and utilise the information (Checkland and Howell, 2003). Clearly, it is essential that organisations have established and proven business processes that could support effective and efficient inter and intra-organisational communication alliance structure. Information is a general term and embraces meanings such as knowledge, processed data, skills, technology, etc. Inter-organisational relationships are used to improve the flow of information, and share knowledge, learning and experience.

Emmitt and Gorse (2003) explored interpersonal communication during construction progress meetings. The study explained further that management and design team interaction is task-based that is capable of inculcating emotional interaction which could influence group behaviours are not available. The study also concluded that individualized nature of communication dynamics is common within the construction sector, and the propensity of people within the industry to act in ways which do not necessarily support interaction requirements. Loosemore (2000) observed the patterns of behaviour that occurred during crises and unforeseen events within the construction industry are in complex patterns of communication which are unnecessary or counterproductive. Therefore, there is need for a study on the effect of this complex communication pattern on project delivery.

3. RESEARCH METHODOLOGY

The research design adopted for the study was survey method. Table 1 shows the population for this study which includes in-house consultants (quantity surveyors, architects, engineers and builders) and external contractors who had been involved on building projects at the Ministry of Housing, Lagos State in the past five years (2011-2016). The study population for this study is finite and it falls within manageable size. Therefore, census method was adopted. Census means that the entire population was used as sample. In this case, the sampling frame constitutes the sample size. The census method is superior to all other sampling methods in that it virtually eliminates sampling error and provides data on almost all the population components. Fifty-five comprehensive copies of questionnaire were administered, fifty-two copies of questionnaire (representing 95% of administered questionnaire) were returned which was found suitable for analysis.

Percentile was used to assess demographic distribution of respondents. Mean Score was used to assess characteristic of effective communication and effect of communication on delivery of construction project. Friedman test was used to assess level of usage of communication mechanism among professionals and test the mean rank between communication mechanisms. Friedman test ranking is peculiar in that it ranked assessed variables higher than the likert scale used. Multiple regression analysis was used to develop models for the four topmost affected construction project delivery variables by communication.

Table 1: Sample Frame of Respondent

S/N	In-House Consultants/External Contractor	Population
1	Architects	8
2	Quantity Surveyors	11
3	Builders	13
4	Engineers	13
5	Contractors	15
	Total	55

Source: Ministry of Housing, Lagos State (2016)

4. DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1. Demographic distribution of respondents

Background information of the respondents reveals that majority of the respondents 40 (76.9%) works in a public organization while the remaining 12 (23.1%) works in a contracting organization. 40 (76.9%) of the respondents are construction professionals (quantity surveyors, architects, builders and engineers) and 12 (23.1%) are contractors. 10 (19.20%) of the respondents have between 1-5 years working experience, 19 (36.5%) have between 6-10 years working experience, 23 (44.2%) of the respondents have working experience of over 10 years. 7.7% of the respondents are OND holders, 21.2% are Higher National Diploma holders, 40.4% are holders of Bachelor in Degree and 30.8% are Master's degree holder. No respondent have Ph.D. academic qualification. Furthermore, 46.15% of the respondents are graduate member of a professional body, 40.38% are corporate members while 13.46% are fellows of professional bodies. This could be due to the established fact that being professionally qualified is rated higher in determining promotion in construction firms than having postgraduate academic certificates.

Considerable percentage of the respondents had handle over 20 construction projects. This demographic distribution of the respondents makes the data collected fit for analysis as the respondents are all educated, professionally qualified and have practical experience of construction work.

4.2. Characteristics of effective communication

Table 2 shows response of respondents on the characteristics of effective communication. The table reveals that the most important characteristic of effective communication is answers all questions asked with a mean score of 4.37. This is followed by give something extra when desirable and includes only relevant statements with mean score of 4.15 and 4.08 respectively. The least of the characteristics of communication is choose non-discriminatory expression with a mean score of 3.62. All the variables in table 2 have a mean score of above 2.5; this implies that each of the variables is an important characteristic of effective communication.

Table 2: Characteristics of effective communication

Characteristics of Communication	Mean	Rank
Answers all questions asked	4.37	1
Give something extra when desirable	4.15	2
Include only relevant statements	4.08	3
Avoid unnecessary repetition	4.04	4
Achieve appropriate readability	4.02	5
Emphasis on pleasant facts	3.98	6
Include examples. illustrations and other visual aids when desirable	3.96	7
Choose vivid, image-building words	3.90	8
Use specific and accurate works, facts and figures	3.88	9
Apply integrity and ethics	3.87	10
Choose short, familiar, conversational words	3.85	11
Be sincerely tactful, thoughtful and appreciative	3.83	12
Achieve appropriate readability	3.83	13
Use the right level of language	3.75	14
Show interest in the reader	3.71	15
Omit expressions that irritate, hurt or belittle	3.63	16
Maintain an acceptable writing mechanisms	3.63	17
Choose nondiscriminatory expression	3.62	18

4.3. Level of usage of communication mechanisms

Table 3 shows the level of usage of communication mechanisms as ranked by respondents. The table reveals that the most used communication mechanism is specification with mean score of 12.21 followed by project plan and report with mean score of 12.04 and 11.01 respectively. The least communication mechanism used is gestures with mean score of 3.56. Less used communication mechanisms are facial expression, postures,

pitch, pacing of voice and gestures are with mean scores of 5.78, 4.75, 4.45, 3.89 and 3.56 respectively.

Table 3: Level of usage of communication mechanisms

Communication Mechanisms	Mean	Rank
Specification	12.21	1
Project plan	12.04	2
Report	11.01	3
Memos	10.80	4
Presentation	10.65	5
Metric	10.47	6
Speeches	9.92	7
Conversations	9.68	8
Site meetings	9.64	9
Note	8.58	10
E-mail	8.56	11
Facial expressions	5.78	12
Postures	4.75	13
Pitch	4.45	14
Pacing of voice	3.89	15
Gestures	3.56	16

4.4. Effects of communication on building projects delivery

Table 4 shows the effects of communication on building projects delivery. Time is ranked first, with a mean score of 4.54 while client satisfaction, project management was ranked second and third respectively with a mean score of 4.48 and 4.19 respectively. Cost is the fourth ranked effect with mean score of 4.12.

Table 4: Effects of communication on building projects delivery

Variables	Mean	Rank
Time	4.54	1
Client satisfaction	4.48	2
Project management	4.19	3
Cost	4.12	4
Sustainability	3.73	5
Quality	3.71	6
Health and safety	3.54	7
Functionality	3.50	8
Maintainability	3.35	9

Communication mechanisms were further analysed using regression analysis to predict the probable time, client satisfaction, project management and cost to construction project. Since these variables (time, client satisfaction, project management and cost) were ranked best with mean score of above 4.00.

4.5. Effect of communication mechanisms on the completion time of building projects

Table 5 shows the multiple regression model summary and overall fit statistics. R with value of 0.661 can be considered to be a measure of the quality of the prediction of time of completion of building project. This indicates a good level of prediction. The adjusted R^2 of the model is 0.179 with R^2 (coefficient of determination) = 0.437. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 43.7% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.631. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting residual variables to be correlated. This further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 5: Model summary of the effect of communication mechanisms on completion time of building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.661	0.437	0.179	0.633	1.631

4.5.1 Test of Hypothesis

$H_0$1: Communication mechanism is not a significant determinant of the completion time of building project.

H_A1: Communication mechanism is a significant determinant of the completion time of building project.

Decision Rule: Reject H_0, if p-value is less than 0.05.

Table 6 shows the F-ratio test to indicate whether the overall regression model is good/fit for the data. The multiple regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variable statistically predicts the dependent variable, F (16, 35) = 1.695, p-value = 0.004 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 6: ANOVA table for completion time

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Regression	10.880	16	0.680	1.695	0.004
Residual	14.043	35	0.401		
Total	24.923	51			

Table 7 shows coefficients of the independent variables on time with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

From Table 7, metric, facial expression and site meetings have p-value that is less than 0.05. These three communication mechanisms are significant variables in predicting effect of building project delivery in terms of time. Thus, the general form of the model to predict the effect of communication mechanisms on completion time of building project delivery from pacing of voice, speeches, specification, note, site meetings, metric, presentation,

gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

MODEL 1: COMPLETION TIME = 4.376 + (0.309*Metric***) + (0.391****Facial expression***) + (0.443****Site meetings***)**

Table 7: Coefficients of the independent variables on completion time

Communication Mechanisms	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant)	4.376	1.234		3.545	0.001		
Project plan	0.047	0.214	0.040	0.220	0.827	0.480	2.084
Specification	-0.046	0.239	-0.032	-0.191	0.849	0.563	1.777
Report	-0.358	0.223	-0.337	-1.605	0.117	0.365	2.743
Metric	0.309	0.173	0.301	1.787	0.012*	0.567	1.763
Presentation	0.161	0.175	0.163	0.919	0.364	0.512	1.951
Speeches	-0.030	0.129	-0.037	-0.232	0.818	0.635	1.575
Memos	-0.191	0.186	-0.189	-1.029	0.311	0.475	2.104
E-mail	-0.174	0.188	-0.195	-0.928	0.360	0.366	2.735
Note	0.326	0.193	0.367	1.693	0.099	0.344	2.911
Site meetings	0.443	0.253	0.421	1.748	0.017*	0.278	3.599
Conversations	0.411	0.344	0.335	1.197	0.239	0.206	4.858
Facial expressions	0.391	0.219	0.424	1.783	0.023*	0.285	3.511
Postures	0.088	0.166	0.120	0.528	0.601	0.311	3.218
Gestures	-0.143	0.129	-0.220	-1.116	0.272	0.414	2.418
Pitch	-0.336	0.198	-0.451	-1.692	0.100	0.226	4.418
Pacing of voice	-0.007	0.211	-0.008	-0.031	0.975	0.248	4.039

4.6. Effect of communication mechanism of client satisfaction on building projects

Table 8 shows the multiple regression model summary and overall fit statistics. R with value of 0.493 can be considered to be one measure of the quality of the prediction of client satisfaction. This indicates a good level of prediction. The adjusted R^2 of the model is 0.103 with R^2 (coefficient of determination) = 0.243. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 24.3% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.813. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 8: Model summary of the effect of communication mechanism of client satisfaction on building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.493	0.243	0.103	0.673	1.814

4.6.1 Test of hypothesis

$H_0$2: Communication mechanism is not a significant determinant in building project delivery in term of client satisfaction.

H_A2: Communication mechanism is a significant determinant in building project delivery in term of client satisfaction

Decision Rule: Reject H_0, if p-value is less than 0.05

In Table 9, the F-ratio test whether the overall regression model is a good fit for the data. The multiple regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words R^2 = 0). The F-test shows that the independent variables statistically significantly predicts the dependent variable, F (16, 35) = 0.703, the p-value (0.011) is less than 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 9: ANOVA Table for Client Satisfaction

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	5.105422	16	0.319089	0.703	0.011
Residual	15.87535	35	0.453581		
Total	20.98077	51			

Table 10 shows coefficients of the independent variables on client's satisfaction with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

From Table 10, postures and gestures have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of client satisfaction. Thus, the general form of the model to predict the effect of building project delivery in terms of client satisfaction from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is;

MODEL 2: CLIENT SATISFACTION = 4.78 + (0.01**Postures***) + (0.28****Gestures***)**

Table 10: Coefficients of the Independent Variables on Client Satisfaction

Communication Mechanisms	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
(Constant)	4.78	1.31		3.64	0.00		
Project plan	-0.08	0.23	-0.07	-0.35	0.73	0.48	2.08
Specification	-0.09	0.25	-0.07	-0.37	0.71	0.56	1.78

Report	-0.12	0.24	-0.12	-0.49	0.63	0.36	2.74
Metric	0.023	0.18	0.02	0.13	0.90	0.57	1.76
Presentation	-0.01	0.19	-0.01	-0.05	0.96	0.51	1.95
Speeches	0.05	0.14	0.07	0.38	0.71	0.63	1.58
Memos	0.07	0.20	0.08	0.38	0.71	0.48	2.10
E-mail	0.13	0.20	0.16	0.67	0.51	0.37	2.73
Note	-0.04	0.20	-0.04	-0.18	0.86	0.34	2.91
Site meetings	-0.20	0.27	-0.20	-0.73	0.47	0.28	3.60
Conversations	0.25	0.37	0.23	0.70	0.49	0.21	4.86
Facial expressions	0.26	0.23	0.31	1.11	0.27	0.28	3.51
Postures	-0.01	0.25	-0.01	-0.04	0.01*	0.31	3.22
Gestures	0.28	0.13	-0.48	2.08	0.03*	0.41	2.42
Pitch	-0.12	0.21	-0.18	-0.58	0.56	0.23	4.42
Pacing of voice	0.01	0.22	0.01	0.03	0.97	0.25	4.04

4.7. Effect of communication mechanism of project management on building projects

Table 11 shows the multiple regression model summary and overall fit statistics. R with value of 0.530 can be considered to be one measure of the quality of the prediction of project management. This indicates a good level of prediction. The adjusted R^2 of the model is 0.048 with R^2 (coefficient of determination) = 0.281. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 28.1% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), is 1.586. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 11: Model summary of effect of communication mechanism on project management of building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.53	0.281	0.048	0.759	1.586

4.7.1 Test of hypothesis

$H_0$3: Communication mechanism is not a significant determinant in building project delivery in term of project management

H_A3: Communication mechanism is a significant determinant in building project delivery in term of project management

Decision Rule: Reject H_0, if p-value is less than 0.05

In Table 12, the F-ratio test whether the overall regression model is a good fit for the data. The linear regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variables statistically significantly predicts the dependent variable, F (16, 35)

= 0.85, p-value = 0.02 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in the model.

Table 12: ANOVA table for project management

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	7.89	16	0.49	0.85	0.02
Residual	20.19	35	0.58		
Total	28.08	51			

Table 13 shows coefficients of the independent variables on project management with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

Table 13: Coefficients of the Independent Variables on Project Management

	Unstandardized Coefficients		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	4.24	1.48		2.86	0.01		
Project plan	-0.20	0.26	-0.16	-0.76	0.45	0.48	2.08
Specification	-0.17	0.29	-0.11	-0.60	0.55	0.56	1.78
Report	0.09	0.27	0.08	0.35	0.73	0.36	2.74
Metric	-0.03	0.21	-0.03	-0.16	0.88	0.57	1.76
Presentation	0.07	0.21	0.06	0.32	0.75	0.51	1.95
Speeches	0.13	0.15	0.15	0.85	0.40	0.63	1.58
Memos	-0.05	0.22	-0.05	-0.24	0.81	0.48	2.10
E-mail	0.55	0.23	0.58	2.44	0.02*	0.37	2.73
Note	0.43	0.23	-0.45	-1.86	0.07*	0.34	2.91
Site meetings	-0.04	0.30	-0.04	-0.13	0.89	0.28	3.60
Conversations	0.04	0.41	0.03	0.09	0.93	0.21	4.86
Facial expressions	0.38	0.26	0.39	1.44	0.16	0.28	3.51
Postures	-0.14	0.20	-0.18	-0.68	0.50	0.31	3.22
Gestures	-0.13	0.15	-0.19	-0.85	0.40	0.41	2.42
Pitch	-0.05	0.24	-0.06	-0.20	0.84	0.23	4.42
Pacing of voice	-0.03	0.25	-0.03	-0.11	0.91	0.25	4.04

From Table 13, email and note have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of project management. Thus, the general form of the model to predict the effect of building project delivery in terms of project management from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

***MODEL 3: PROJECT MANAGEMENT = 4.24 + (0.55 * *E-mail*) + (0.43**Note*)**

4.8. Effect of communication mechanism on construction cost of building projects

Table 14 shows the multiple regression model summary and overall fit statistics. R with value of 0.664 can be considered to be one measure of the quality of the prediction of cost for building project. This indicates a good level of prediction. The adjusted R^2 of the model is 0.185 with R^2 (coefficient of determination) = 0.440. This explains the proportion of variation accounted for by the regression model. This means that the multiple regressions explain 44.0% of the variance in the data. The Durbin-Watson statistics, which checks for independence of observations (i.e. independence of residuals), d= 1.848. This fall between the two critical values of 1 and 3 that is generally accepted to be normal for accepting that considered residual variables are correlated. It further suggests that there is no first order linear auto-correlation in the multiple regression data.

Table 14: Model summary of the effect of communication on cost for building projects

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.664	0.44	0.185	0.495	1.848

4.8.1 Test of hypothesis

$H_0$4: Communication mechanism is not a significant determinant in building project delivery in term of cost

H_A4: Communication mechanism is a significant determinant in building project delivery in term of cost

Decision Rule: Reject H_0, if p-value is less than 0.05.

In Table 15, the F-ratio test whether the overall regression model is a good fit for the data. The linear regression F-test has the null hypothesis (H_0) that there is no linear relationship between the variable (in other words $R^2 = 0$). The F-test shows that the independent variables statistically significant predicts the dependent variable, F (16, 35) = 0.85, p-value = 0.022 < 0.05, thus we reject H_0 and then conclude that there is a linear relationship between the variables in our model.

Table 15: ANOVA table for cost

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	6.743	16	0.421	1.722	0.022
Residual	8.565	35	0.245		
Total	15.308	51			

Table 16 shows coefficients of the independent variables on cost of building project with the intercept and the significance levels of each variable. The table also helps in determining the significant predictors among the variables.

Table 16: Coefficients of the independent variables on cost

Communication Mechanisms	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.159	0.964		3.277	0.002		

Project plan	0.486	0.167	0.531	2.911	0.006	0.480	2.084
Specification	-0.033	0.186	-0.030	-0.179	0.859	0.563	1.777
Report	0.020	0.174	0.024	0.112	0.911	0.365	2.743
Metric	0.288	0.135	0.358	2.131	0.040	0.567	1.763
Presentation	-0.081	0.137	-0.105	-0.592	0.558	0.512	1.951
Speeches	0.143	0.101	0.225	1.415	0.166	0.635	1.575
Memos	0.004	0.145	0.005	0.027	0.979	0.475	2.104
E-mail	0.226	0.147	0.322	1.541	0.132	0.366	2.735
Note	-0.250	0.151	-0.358	-1.658	0.106	0.344	2.911
Site meetings	0.041	0.198	0.050	0.210	0.835	0.278	3.599
Conversations	-0.162	0.268	-0.168	-0.602	0.551	0.206	4.858
Facial expressions	-0.147	0.171	-0.204	-0.859	0.396	0.285	3.511
Postures	0.194	0.130	0.340	1.498	0.143	0.311	3.218
Gestures	-0.044	0.100	-0.086	-0.438	0.664	0.414	2.418
Pitch	-0.120	0.155	-0.206	-0.774	0.444	0.226	4.418
Pacing of voice	0.268	0.165	0.413	1.627	0.113	0.248	4.039

Table 16 project plan and metric have p-value that is less than 0.05. These two communication mechanisms are significant variables in predicting effect of building project delivery in terms of cost. Thus, the general form of the model to predict the effect of building project delivery in terms of cost from pacing of voice, speeches, specification, note, site meetings, metric, presentation, gestures, memos, project plan, e-mail, postures, report, facial expressions, pitch, conversations is:

$$\textbf{*MODEL 4: COST} = 3.159 + (0.486 * \boldsymbol{Project\ plan}) + (0.288 * \boldsymbol{Metric})$$

5. DISCUSSION OF RESULTS

5.1. Characteristics of effective communication

The essential characteristics of an effective communication are answers all questions asked, give something extra when desirable, include only relevant statements, avoid unnecessary repetition and achieve appropriate readability. This result corroborates Asemah (2011) conclusion that for meaningful communication among persons or groups, there has to be an agreed signs or symbols that is comprehended by all actors particularly, between the sender and receiver of the message. Completeness of a communication lies in ability to give all needed answers to a receiver at a go with clear stated instructions and illustrations. The willingness to give additional information at the point of request spiced communication. These are critical to regarding a communication to be complete.

5.2. Level of usage of communication mechanism

Specification and project plan which are classified as formal writing were ranked highest among the communication mechanisms that are often used among construction professionals. Report and memos were ranked high also. While presentation which is classified as formal verbal communication mechanisms was ranked next to the

aforementioned. The findings above are corroborated by Maslej (2006) submission that, scope of work and details of construction are communicated by means of drawings, contract document addenda and specifications. There are various ways and methods of communicating information in the construction industry, which could be formal or informal. Mailabari (2014) also reported that though a vast majority of information is exchanged verbally and delegated, most data is exchanged in written format either as hard copy or electronically. Both verbal presentation and formal means of communication are essential in actualizing fruition of construction projects. In construction site, most communication are written down for record purpose, contractors also ensure that client or client's representative verbal instruction are made formal in the instruction book for record purpose and for effective communication of financial implication of such verbal instruction.

5.3. Effects of communication mechanisms on building projects delivery

This study examined the effect of communication mechanisms on building projects delivery. The findings show that time, client satisfaction, project management and cost were highly ranked variables and has an important effect on project delivery. Clients' satisfaction is a function of the project being finished to quality specified, time and budgeted cost. These are critical factors that constitute success of any construction project. As stated by Mehra (2009), communication is very essential in project execution as it plays vital role in all stages of construction. Based on these high ranked effect of communication mechanisms on building project delivery, regression analysis was carried out to develop models for future use.

Model one (1) predicts effect of communication mechanisms on completion time of building projects is based on metric, facial expression and site meetings. This result is in consonance with the observation made by Wofford, Gerloff and Cummins (1977) that, construction professional communicate informally under some conditions. Also, Furst, Abrams, MacKenzie, Tissue and Citrin (2002) opined that facial expressions help the recipient(s) of a message to interpret that message as the speaker intends it on time. However, according to Davis (2014), facial expressions are very important part of communication. Though nothing is said verbally, much could be passed across and understood. Bowden and Thorpe (2002) also submitted that construction personnel transfer information on paper based files (drawings, data collection forms, correspondences, progress information and specifications) at site meetings.

From Model 2, effect of communication on client satisfaction for building projects is predicted by posture and gestures. According to Jacklyn (2011), posture and gestures are attached view which allows the professionals to take actions the way a client wants. This assertion is reinforced by Block (2004) that consultants and clients make influence on each other by sharing information, emotions and feelings. As a matter of fact, it forms particularly diverse and complex clients-consultants relations, which can be determined as the transfer and reception of information for finding the best possible solution, for making influence on each other, changing attitudes, feelings and behaviour in the process of consultation.

Model 3 predicts effect of communication mechanisms on project management for of building projects to be through e-mail and note. This result is in conformity with Handy (1999) opinion that communication through e-mail can provide substantial benefits to the project team in terms of productivity and management of building projects.

Model 4, shows the effect of communication mechanisms on cost for of building projects, the prediction rest on project plan and metric. According to (Kamara Anumba and Evbuomwan, 1996), in order to satisfy client's needs in terms of cost and ensure that the design is constructable, the project plan must not only have the client's requirements as input, but also information about construction and the operation and maintenance of the facility. This assertion is also reinforced by Rajhans (2013) that, arranging the documents of the construction contract, negotiating with the qualified design professionals, providing the qualified design professionals with the needed information, updating and reviewing design documents, negotiating contract price with qualified contractor, interpreting and clarifying ambiguities in the contract documents etc. are important communication activities.

6. CONCLUSION

The study was conducted with an intention to assess the effect of communication on building project delivery. Deducing from the results of the questionnaire survey and data analysis, the results of this study clearly reflect that efficiency in communication plays a key role in successful implementation of building projects and also affects performance of the entire life cycle of construction projects. The most effective characteristic of communication is that sender answers all questions asked. Completeness of communication will help receiver understand the expectation of the giver and also helps in carrying out professional task expected by all participating professionals on the project. To be able to perform the expected communication functions, specification is the most used communication mechanisms among professionals for successful building projects delivery. Specification must be complete, clearly stating all expected qualities of all items of work in appropriate clauses and avoidance of any ambiguity.

Communication has effect on time, client's satisfaction and cost. All these variables helped to achieve the stated quality expected. Cost, time and quality of work done are the main target for success of construction project. Client's satisfaction is regarded to base on fulfillment of expected quality that birthed the project. Uncertainty in any communication mechanism (working drawing, specification etc.) if not clarified could lead to delay and delay claims. Overall quality of the work could also be affected as enthusiasm of workers when working with poor communication mechanism or medium on any aspect of work could be reduced. The study recommended that the application of communication mechanisms model would ensure successful building projects delivery to time, project cost and client's satisfaction. Further study can be carried out to cover Lagos State in particular and the Nigeria in general.

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LAND USE CHANGE EFFECTS ON ABA URBAN SPATIAL EXPANSION PATTERN

Edet E. Ikurekong[1], Lawson A. Ananaba[2] and Henry C. Umunakwe[3]

[1]Department of Urban and Regional Planning, University of Uyo, Uyo, Nigeria
[2]Ministry of Physical, Urban Planning and Infrastructural Development, Umuahia, Abia State, Nigeria
[3]Department of Urban and Regional Planning, Abia State University, Uturu, Nigeria

ABSTRACT

Purpose: Land uses and Land cover, over time, have undergone changes due to various urban developmental activities, occasioned by socio-economic growth of an area. This paper attempted to examine land use and land cover change effects in Aba Urban.
Design/methodology/approach: To accomplish this Aba urban land use and land cover spatial change variables were obtained from satellite imageries of 2001 and 2010 epochs. The Area Analysis Technique was employed in calculating the area in hectare and percentages, while overlay method was used to identify the actual location, rate and pattern of change. Equally, paired Samples T-Test and Eta squared techniques were used to estimate the magnitude of effect as it is relatively independent of sample size.
Findings: The study among other things discovered that increase in land cover was occasioned by population growth, and increased need of land for various uses.
Originality/value: Hence, it is therefore recommended that the government of the state should initiate, prepare and implement master plan for the urban area to check the rate and pattern of the land use and land cover change.

Keywords: Urban land use; land cover; land use change; change effects; satellite imagery

1. INTRODUCTION

The use of land for residential, commercial, industrial, recreational, institutional, Agricultural, forestry, and other uses has modified the natural environment into built environment. These land uses over time have undergone changed occasioned by the socio-economic growth in Aba Urban. Therefore, the use of land by man has changed the structure and functioning of the natural ecosystems, thereby causing unprecedented changes in bionetwork and environmental process at various scales of time. They affect population, biodiversity loss; climate change, pollution of water, soil and air (Ellis, 2013).

[1]ikurekong@yahoo.com

The change in structure and functioning of the ecosystems and environmental processes impact on the natural, economic, and social landscape, water quality, land and air resources, ecosystem process and function, climate, biodiversity, the ability of natural systems to support life (Abbas, Muazu and Ukoje, 2010; Igbokwe and Chigbu, 2011 and Ellis 2013). The sequences of these effects are deforestation, desertification and Stalinization, soil erosion and land degradation. Population growth and urbanization pressures force man to invade the undeveloped environment thereby tampering with the landscape and disturbing the natural habitat. Demographic and Scio-economic factors have had increasing pressure on the landscape of Aba Urban due to man's quest for food, water shelter and fuel.

Aba urban population growth is phenomenal due to rural-urban migration, commercial and industrial activities and of recent increase in educational – institutional land use development. The rapid growth and development contribute to land use change, population increase, urban economic developments, spatial urban form and related land used change with attendant effects (Abdullah, 2016).

The alteration of the earth's landscape from natural vegetation to any other land use activity results in habitat loss, environmental degradation, fragmentation and leapfrogging with devastating effects on biodiversity and the general environment of Aba at local level as well as regional or global scales. The conversion of land from one use to another is the greatest cause of extinction of terrestrial spaces especially deforestation that converts land from agricultural to other uses.

The advent of the Geographic Information System (GIS) has made it possible to monitor and manage rural and urban land use changes spatially. The GIS aids researchers to capture, manage, manipulate analyze model and display spatially referenced remote sensed data at different points in time.The GIS has been applied in several studies on land use change effect on urban spatial expansion (Oluseyi, 2006 and Angel, Et.al., 2011).

The rapid growth of Aba urban without development plan calls for the assessment of the urban spatial expansion as to detect the land use spatial change effects over a period of time 2001 and 2010.The objectives of the study was to identify the existing major land uses in Aba urban, to determine the extent of urban spatial land use changes in Aba urban and to determine the rate and pattern of urban land use spatial expansion in Aba Urban.

2. LITERATURE REVIEW

The study on land use and land cover change concern the human modification and conversion of earth's terrestrial surface (Chukwu, 2015). Man has been in the business of modifying and converting land resources to meet his insatiable need for generations. The extent, current rates, magnitude and intensities of land use and land cover changes are enormous. Man's use of land has changed the structure and functioning and patterns of the ecosystem, affected population, brought climatic change, loss of biodiversity, pollution of water, soil and air (Ellis, 2013).

Urban growth, concentration of people and activities in urban areas have led to unprecedented urban spatial expansion creating extensive urban landscapes. Many farm lands, wetlands, forests and deserts that formed the natural environment have been changed into human settlements over the years (United States Geological Surveys USGS. 1991). The USGS, reported that one hundred years ago, approximately 15% of the world's

population was living in the urban areas. In 1991 over 50% live in the urban areas and that last 200years, world population increased six times, stressing ecological and Scio-economic systems. Urban population has increased astronomically, concentrating more people on the land, which leads to urban spatial expansion.

The spatial expansion has its attendant effects of urban sprawl, loss of natural vegetable and open spaces and a general deadline in the extent and connectivity of wetlands and wildlife habitat and conversion of one lad use to another (like residential areas to commercial uses). Abdullah (2016), observed that changing population size and commercial needs often necessitate demand for land and change in land use and that pressure on land due to same changing population size leads to urbanization fives room for demand for housing, infrastructure and social services. According to Ellis and Pontius (2006) and Abba, Muazu and Ukoje (2010), human alteration of landscape from primary forested land to other uses, result loss of forest species or habitat, climatic change, degradation and fragmentation. All these have devastating affected on biodiversity.

The studies of (Oluseyi, 2006); Burchfield, Overman, Puga and Tunner (2006), (Angel *et.al*, 2011), (Hepps, 2011) among others applied GIS and remote sensing on assessing the impacts of land use and land cover change on urban land use spatial development in their localities. The studies noted that urban growth and expansion have increased built-up areas, decreased open spaces and contiguous areas and that growth is by succession and invasion. The authors in this paper intend to identify the impacts of land use change in Aba urban spatial expansion pattern with a view to making appropriate mitigative measures.

3. RESEARCH METHODOLOGY

The study area, Aba Urban lies between latitudes 5o05'N and 6 o 33'N, and longitude 7007'E and 8 015'E and covers about 38380.61 hectares. Aba is located on a transportation node where Port-Harcourt-Enugu railway lines meet with the Aba-Owerri-Ikot-Ekpene arterial route. The Port-Harcourt – Enugu Express way traverses the city on north to south direction while Owerri Road, IKot-Ekpene Road and Port-Harcourt Road divide the city in three parts in radial pattern. The growing population and socio-economic activities have exerted physical, social and economic influence on the land use mechanisms in the area. This growth has affected the land use and spatial structure of Aba urban.

The study employed the GIS technique in acquisition, processing and analysis of data. The Landsat images of ERDAS Imagine and ArcGIS software acquired from Federal College of Land Resources Technology (FECOLART), Owerri were used for land use classification for the two-time periods (2001 and 2010) in terms of metropolitan spatial changes. The Landsat image acquired from Natural Space Research and Development Agency (NARSDA) was digitised on-screen using ArcGIS 10.3 software. The features were digitised in layers, i.e. each group of features occupying each layer. For example, water body (Aba River) was digitised as a layer. The image as a result was first digitised, then ortho-rectified and geo-referenced. Four ground control points were established using Ground Positioning System (GPS) with an internalised coordinate system assigned and different data sets were extracted via digitizing. Polygonised imageries were classified using bilinear interpolation system. The Minimum Distance (MD) supervised image classification method was used for sampled imageries while the manual unsupervised classification was used for the Polygonised and sampled base map based on minimum distance algorithm. This was carried out because the MD algorithm offered the best output in terms of details of land use and land cover classification as it defined the distance

between two distinct codes (pixels) (Igbokwe 2010; Chigbu, Igbokwe and Orisakwe, 2011). Using the ERDAS imagine 9.2 software, various classes of urban spatial changes were developed and colours were assigned appropriately to depict the result in cartographic format for visual interpretation.

Urban land use and land cover spatial change variables obtained from the satellite imageries were urban built-up area, urban open space, rural built-up area, farm land, forest, water body, urban land cover and rural land cover for both 2001 and 2010.This variables were measured within these two period to ascertain any changes within the land use structure. The area analysis technique was employed in calculating the area in hectare and percentages, overlay method was used to identify the actual location, rate and pattern of change. The overlay approach way adopted because it is best fit for data description, selecting alterative and identifying impacts (effects) and showing some of the factors (Igbokwe, 2010). Equally, paired Samples T-Test was used in repeated measure as each subject was tested twice on the same variable and the Effect-Size Sample T-Test known the Correlation Ratio (R^2) as the most frequently used Effect- Size for T-Test, ANOVA and Regression. It was used to estimate the magnitude of effect as it is relatively independent of sample size. The eta squared Index guideline of n^2 = .01 (small effect), n^2 =.06 (moderate effect), and n^2 =.13 (large effect) was engaged.

4. DATA ANALYSIS

4.1. Land use and land cover distribution

In examining the urban Land Use Change Effects on Aba urban spatial expansion, the land use and land-cover distribution for the study as derived from the two-time remote sensing satellite imagery of Aba metropolis for 2001 and 2010 periods, was presented in Table 1 and Figures 1, 2 and 3. Therefore, objectives one (1) and two (2) were considered simultaneously.

Table 1: urban land use changes distribution - 2001 and 2010, in Aba urban

Nos	Land Use	2001		2010	
		Area (Ha)	Area (%)	Area (Ha)	Area (%)
1	Urban built-up	4997.28	26.02	6709.84	34.94
2	Urban open space	3572.87	18.60	3095.00	16.12
3	Rural built-up	2910.13	15.15	3749.63	19.53
4	Farm land	4468.51	23.27	2767.93	14.41
5	Forest	3227.00	16.80	2859.76	14.89
6	Water body	29.03	0.15	19.82	0.11
7	Urban land cover	8570.15	44.62	9804.84	51.06
8	Rural land cover	10605.64	55.22	9377.32	48.83

Source: Land Sat Imagery Analysis, 2013.

The Urban Land Use variables listed on Table 1. Was also use in the Study by (Angel, *et al*., 2011). The land use and land cover distribution statistics in Aba metropolis is represented in the Table 1 and Figure 3. The land use area was determined and presented in hectare (Ha) and percentage (%).

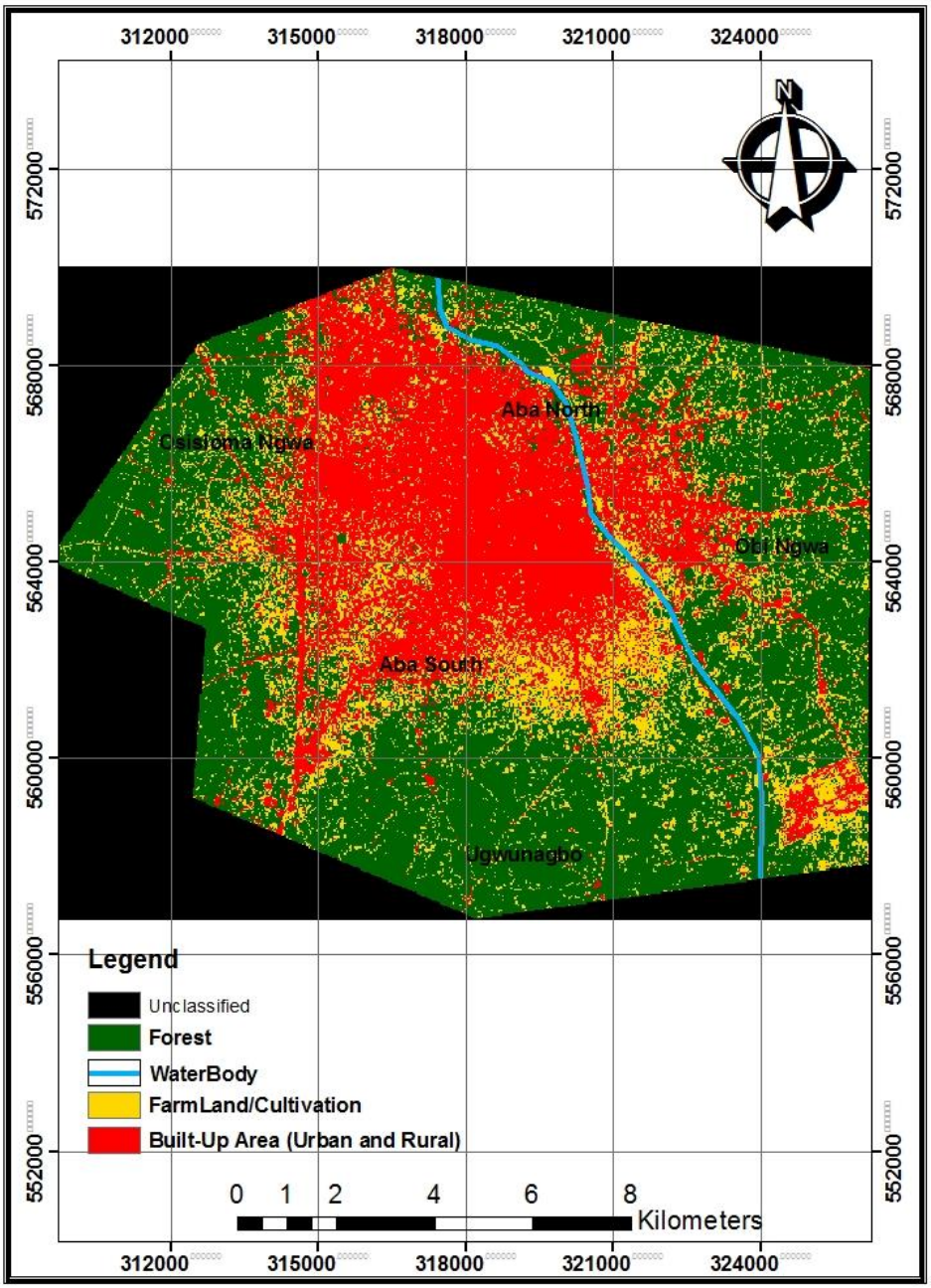

Figure 1: Land use and land cover image of Aba, 2001

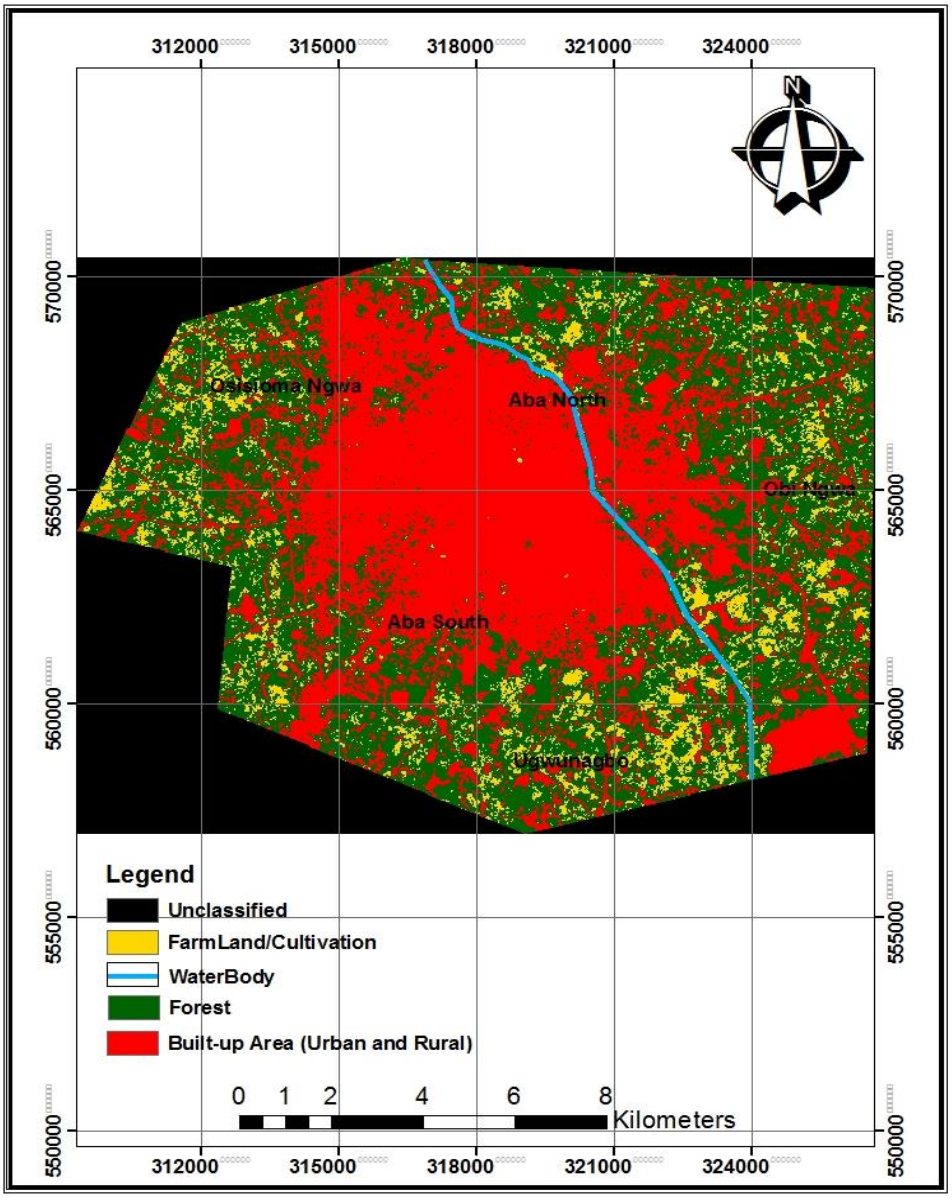

Figure 2: Land use and land cover image of Aba, 2010

4.1.1 Urban built-up area

The urban built-up area in 2001 was 26.02% (4997.28 hectares) of the total classification and in 2010; it was 34.94% (6709.84 hectares). The urban built-up area is the highest class in the urban land use expansion. The increase in the built-up area is as a result of population increase, urbanisation, and increase in infrastructural development and political activities in the study area.

4.1.2 Urban open space

The urban open spaces land use activity had 18.60% (3572.87 hectares) in 2001 and by 2010 it decreased to 16.12% (3095.00 hectares). The land use spatial difference showed a negative difference as the urban open spaces reduced subject to increase in the demand for

land space for developmental activities of various categories.

4.1.3 Rural built-up area

The rural built-up area which is development within the contiguous area of the metropolis was 15.15% (2910.13 hectares) of the total land cover in 2001 and in 2010 it was 19.53% (3744.63 hectares). The rural built-up land use spatial difference showed an increased in the rural built-up area. This increase in rural built-up was associated with the natural increase in rural population, provision of facilities and services.

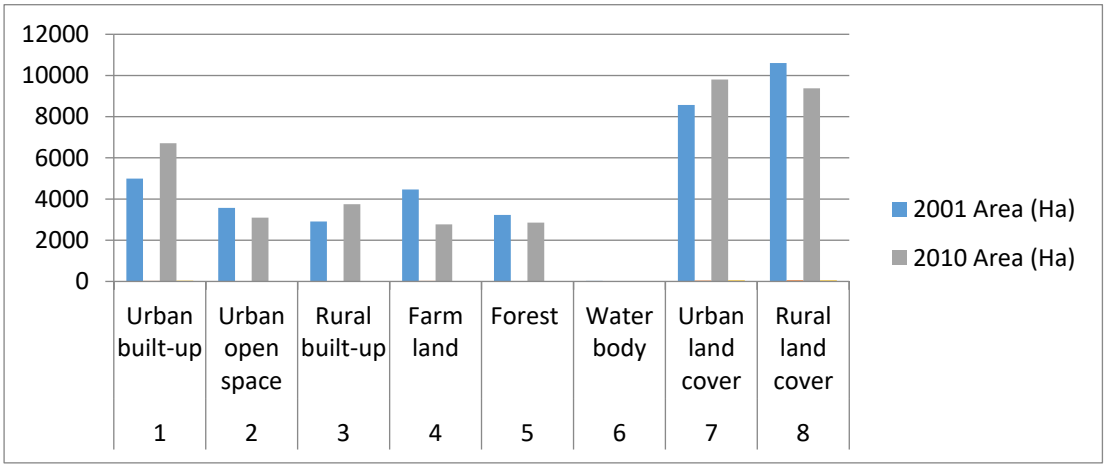

Figure 3: Clustered column showing urban land use spatial distribution 2001 and 2010

4.1.4 Farm land

The farm land or crop land is the cultivated land which circumscribed the built-up area. In 2001, the total farm land area was 23.27% (4468.51 hectares). In 2010, farmland was 14.41% (2767.03hectares) and had decreased by 8.86% (1701.15 hectares) spatially. This land use decrease was occasioned by the built-up areas that increased, which is primarily consequent upon population growth of the Aba metropolis.

4.1.5 Forest

The forest is the bush land left to fallow. Forest made up 16.80% (3227.00 hectares) of the total land area in 2001 and 14.89% (2859.76 hectares) in 2010. The spatial land use difference between forest in 2001 and 2010 was a sign of the ecological foot print of the urban area for forest products like timber for building construction works and for fossil fuel, among others.

4.1.6 Water body

The only drainage basin in the area is the Aba River. In 2001, the water body (Aba River) had a total land area of 0.15% (29.03 hectares) and in 2010, it was 0.11% (19.82 hectares). The cause of this negative spatial difference in the volume of Aba River was due to urban population growth as the water is used for recreation, domestic, commercial and industrial uses and climate change that reduced the volume of water discharged into the river. Also, industrial discharge of effluence into the river and soil erosion, aided silting of the water body in the study area.

4.1.7 Urban land cover

The total land cover for the urban area in 2001 was 44.62% (8570.15 hectares) and in 2010 it increased to 51.06% (9804.84 hectares). This increase in land cover was caused by population growth, increase in the demand of land for various uses like institutional, commercial, residential, industrial, etc that made the urban land cover to expand into the contiguous area.

4.1.8 Rural land cover

The total rural land cover in 2001 was 51.06% (9804.84 hectares) and 48.83% (9377.32 hectares) in 2010. The rural land cover spatial change (decrease) was naturally as a result of the factors that are responsible for the increase in the urban land cover mentioned earlier.

4.2. Land use and land cover changes, rate and patterns

The land use and land cover change; rate and pattern for the study area are shown in Table 2 and objective 2 of the study are considered here.

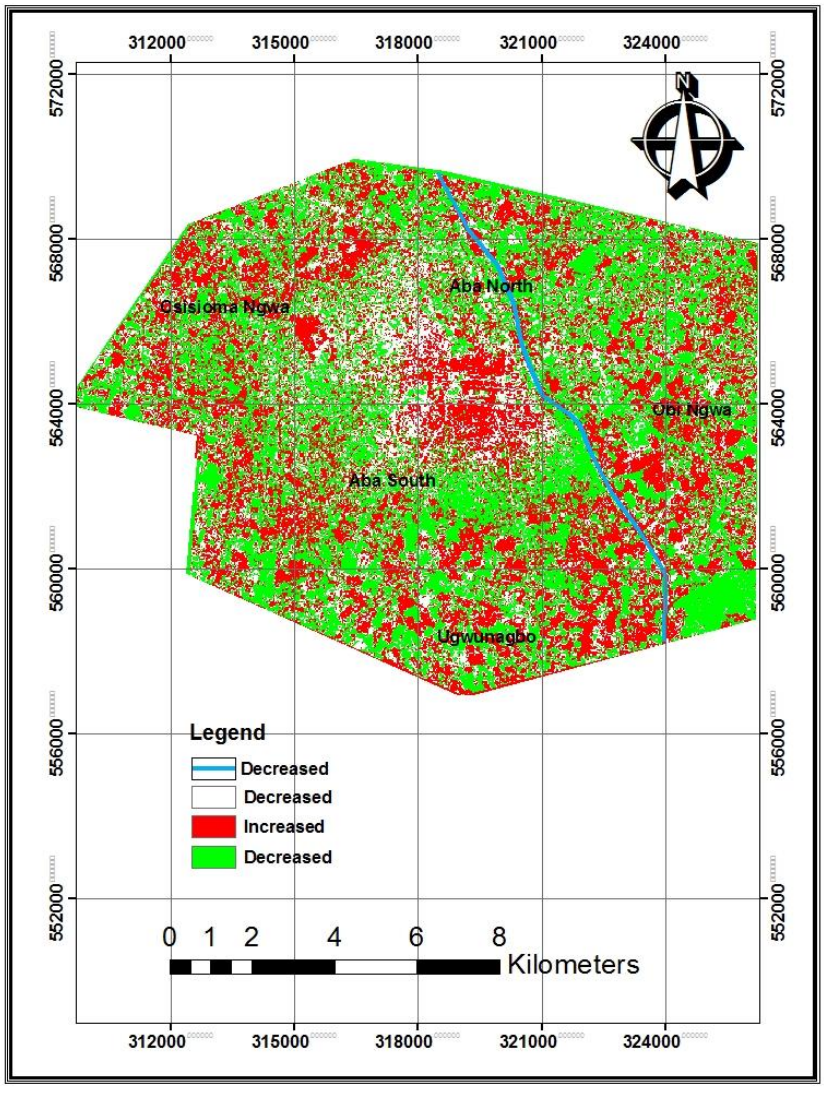

Figure 4: Land use and land cover image (change detection) of Aba, 2010

Table 2: Land use and land cover change, rate and pattern

Nos	Land Use	2001		2010		Change	Change
		Area (Ha)	Area (%)	Area (Ha)	Area (%)	(Ha)	(%)
1	Urban built-up	4997.28	26.02	6709.84	34.94	1712.96	8.92
2	Urban open space	3572.87	18.60	3095.00	16.12	-477.87	-2.48
3	Rural built-up	2910.13	15.15	3749.63	19.53	839.50	4.38
4	Farm land	4468.51	23.27	2767.93	14.41	-1701.15	-8.86
5	Forest	3227.00	16.80	2859.76	14.89	-367.24	-1.91
6	Water body	29.03	0.15	19.82	0.11	-9.21	-0.04
7	Urban land cover	8570.15	44.62	9804.84	51.06	1234.69	6.44
8	Rural land cover	10605.64	55.22	9377.32	48.83	-1228.32	-6.39

Source: Landsat imagery analysis, 2013

In Table 2, the land use and land cover change rate and pattern showed how a land use type and land cover changed relative to the other classes. It was observed that an increase in urban built-up area, rural built-up area and urban land cover, increased. Conversely, urban open spaces, farmland, forest, water body and rural land cover decreased. These are caused by urbanisation and population dynamics. As noted earlier on, Aba has attracted an influx of people into the city. The population of Aba urban has experienced fast growth due to in-migration and natural increases. This increase has led to various human activities associated with land use like building construction works, socio-economic activities and urban spatial expansion. This is manifest in the steady rise in the built-up areas in the city.

Table 2 indicated that the various urban land use spatial changes varied, changed and expanded as follows in descending order: urban built-up area 8.92% urban land cover 6.44% and rural built-up area 4.38%. On the other hand, land use and land cover variables decreased as follows: water body -0.40%, forest -1.91%, urban open spaces -2.48%, rural land cover -6.39%, and farm land -2.48%. These percentages show the rate and pattern of urban land use and land cover spatial changes and their impacts on the land use activities in Aba metropolis is discussed in section 5.

The urban built-up area had the fastest rate of change. The rate of change of urban built-up area between 2001 and 2010 was 8.92%, urban land cover rate of change was 6.41% and rural built-up area changed by 4.38%. the increase in the area of urban built-up, urban land cover and rural built-up accounted for about 10.77% (2068.39 hectares) of reduction in the farm land and forest and 0.15% (9.21 hectares) of water body decrease as observed between 2001 and 2010. It then can be inferred that about 2068 hectares of land available for farming and forest had been converted to other uses between 2001 and 2010. This may be a threat to farming and food supply and availability of forest products, as farm land and forest land is reduced at a high rate. This increase thus contributed to the physical expansion of Aba urban as seen in the increase of urban built-up, urban land cover and rural built-up areas respectively. The increases and decreased in the spatial change, rate and pattern, had been dictated in Figure 4.

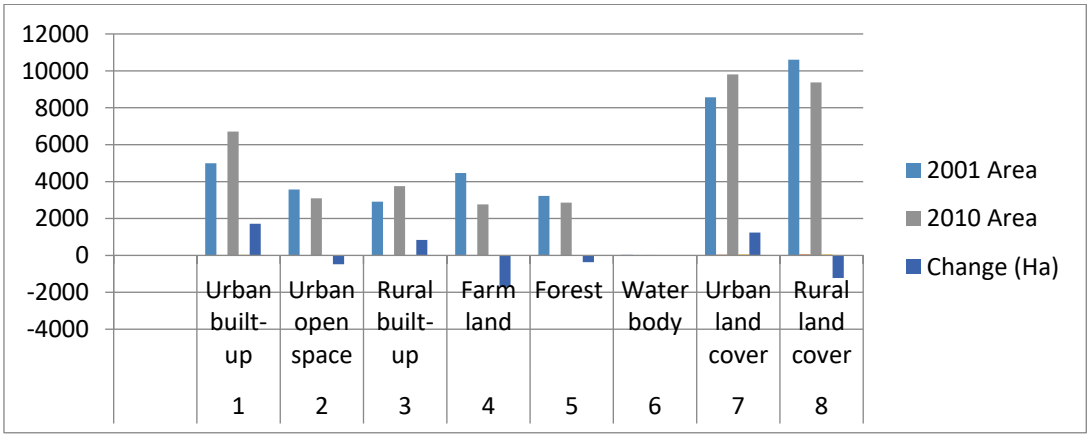

Figure 5: Stacked column (2D) indicating land use and land cover change in Aba Metropolis, 2001 and 2010

It was equally observed from Table 2 that there was a change in other land uses. Urban open spaces reduced by -477 hectares (-2.48%), farmland by 1701.15 hectares (8.86%), forest 367.24 (-1.91%) water body - 9.21 hectares (0.04%) and rural land cover by -1228.32 hectares (6.39%). These show that rural land cover and forest were the fastest in depletion.

Therefore, agrarian land is seriously losing its place in Aba metropolis. This apparently means that the contiguous area of the Aba urban lost about -2068.39 hectares of the rural land cover to the influence of Aba urban growth, and rural need of land for infrastructure (built-up) development. It also means that the agricultural land is equally under threat by man's quest for increased need of land for survival and development.

4.3. Impacts of urban spatial changes on urban land use activities in aba urban

The impacts of urban spatial changes on urban land use activities in Aba urban in 2001 and 2010. was captured using imagery data shown on Table 3.

Table 3: Urban spatial changes on land use activities in Aba Urban

Nos	Land Use	2001 Area (Ha)	2010 Area (Ha)
1	Urban built-up	4997.28	6709.84
2	Urban open space	3572.87	3095.00
3	Rural built-up	2910.13	3749.63
4	Farm land	4468.51	2767.93
5	Forest	3227.00	2859.76
6	Water body	29.03	19.82
7	Density	112.76	120.26
8	Compactness	2.43	1.83

Source: Landsat imagery analysis, 2013

Note: the variables – density and compactness were added to Table 3 due to their significance in land use spatial analysis.

The paired samples t-test; was used in testing whether there is a statistically significant difference in the mean scores for 2001 and 2010 (Tables 4 and 5).

Table 4: Paired samples statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	2001	2415.0013	8	2068.25979	731.24026
	2010	2415.5088	8	2324.95054	821.99415

Table 5: Paired samples test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	2001 - 2010	-.50750	992.32474	350.83977	-830.11174	829.09674	-.001	7	.999

From Table 5, the table labelled Paired Sample Test is the probability value. If the probability is less than 0.05 it can be concluded that there is a significant difference between the two scores. The result of the analysis therefore showed the probability value of 0.999 (Table 5) which is substantially greater than the specified alpha value of 0.05. Therefore, there is no significant difference in the urban spatial changes in Aba urban within the 2001 and 2010 time periods .The implication of these result is that there is no significant impact of urban spatial changes on land use activities in Aba metropolis. This therefore implies that the variation in urban built-up, urban open space, rural built-up, farm land, forest, water body, density and compactness in 2001 and 2010 time periods has no significant impact on urban land use activities in Aba urban.

The t-value (in this case -.001) and the degrees of freedom (df) = 7, shows no significant difference in the relationship between 2001 and 2010 of the imagery analysis. This is further supported by the mean variation in urban spatial changes on land use activities of -.50750 hectares, with a percentage confidence interval stretching from a Lower bound of -.830.11174 hectares to upper bound of 829.09674 hectares. Having established that there is no significant difference, the study took a step further to find out which set of scores is higher (2010 or 2001). In Table 5 the mean score for 2010 is 2415 .5088 hectares and the mean score in 2001 is 2415. 0013 hectares, therefore, it was concluded that there was an insignificant decrease in urban spatial land use activities from 2001 to 2010.

Having established that there was no significant difference in the relationship between the two-time periods of the imagery analysis, the result obtained, therefore, showed that the difference in the two set of scores likely occurred by chance, as a result of meaningful difference or change in less number of variables tested that consisted of the urban built-up area (8.92%) and rural built-up area (4.38%) as indicated on table 2. It does not however, indicate much about the magnitude of the change effect. The most reliable way of calculating the magnitude of change effect is to calculate an effect-size statistic, often referred as Eta Squared (eq. 5). Therefore, substituting with the appropriate values from the t – test output:

$$\eta^2 = \frac{(-.001)^2}{-.001^2 + (8-1)} = \frac{-.000001}{6.99999} = -1.4285$$

Eta Squared is 0.001. Using the guidelines proposed by Cohen (1988) for interpreting Eta Squared values shows: 0.01 = small effect, 0.06 = moderate effect, 0.14 = large effect. Given the calculated Eta Squared value of 0.084, it was concluded that there is a small effect, with a marginal difference which is not quite significant in the urban land use activities between 2001 and 2010 periods of the land sat imageries.

4.4. Summary of findings

The following findings emanated from the study:

The increase in the built-up area is as a result of population increase, urbanisation, and increase in infrastructural development and political activities in the study area;

The land use spatial difference showed a negative difference as the urban open spaces reduced subject to increase in the demand for land space for developmental activities of various categories. The rural built-up land use spatial difference showed an increased in the rural built-up area. This increase was associated with the natural increase in rural population, provision of facilities and services;

Rural farmland decreased by 8.86% (1701.15 hectares) spatially;

The spatial land use difference between forest in 2001 and 2010 was a sign of the ecological foot print of the urban area for forest products like timber for building construction works and for fossil fuel, among others;

The cause of this negative spatial difference in the volume of Aba River was due to urban population growth that used the water for recreation, domestic, commercial and industrial uses and climate change that reduced the volume of water discharged into the river. Equally, industrial discharge of effluence into the river and soil erosion, aided silting of the water body in the study area;

This increase in land cover was caused by population growth, increase in the need of land for various uses like institutional, commercial, residential, industrial, etc. that made the urban land cover to expand into the agrarian land;

The rural land cover spatial change (decrease) was naturally as a result of the factors that are responsible for the increase in the urban land cover.

5. Discussion of Results

The analysis shows that the pattern of land use and land cover change in Aba in 2001 indicates Aba North and South Local Government areas, shows that the pattern of land use and land cover change show that in 2001 Aba North and South Local Government Areas (L.G.A) had open spaces which had been converted into urban built-up area in 2010. The conversion was more intense in Aba North LGA than in Aba South LGA as it has land cover and population less than that of Aba South Local Government Council. Urban built-up in Osisoma Ngwa LGA is greater than that of Obi Ngwa LGA and Obi Ngwa LGA is greater than that of Ugwunagbo LGA. This is as a result of the influence of Osisoma Ngwa industrial and Ariaria International Market areas together with Port-Harcourt-Enugu expressway that traversed the LGA, thereby converting most rural land to urban. Obi Ngwa urban built-up was influenced by the teaming rural population, Ehere Market, NINLAN,

and industrial layout of Aba and agro-based industries located along Ikot-Ekpene Road. While Ugwunagbo axis is influenced by the Asa Nnetu Motor Spare Parts Market.

The rural built-up area was highest in Obi Ngwa LGA followed by Osisioma Ngwa LGA and Ugwunagbo LGA. This was due to the amount of rural land cover, rural population size and influence of the Aba urban area. Figure 5 (2010) shows how the metropolis is drifting into the rural area with increased land use activities.

The result of the analysis from Table 5 therefore showed the probability value of 0.999 which is substantially greater than the specified alpha value of 0.05. This therefore confirms that there is no significant difference in the urban spatial changes in Aba metropolis within the 2001 and 2010 time periods; likewise there is no significant impact of urban spatial changes on land use activities in Aba metropolis. This further implies that the variation in urban built-up, urban open space, rural built-up, farm land, forest, water body, density and compactness in 2001 and 2010 time periods has no significant impact on urban land use activities in Aba Metropolis.

Furthermore, result from Eta Squared analysis indicated a small effect, with a marginal difference which is not quite significant in the urban land use activities between 2001 and 2010 periods of the land sat imageries.

6. CONCLUSION

Land use and land cover change is a continuous process in land use spatial development. Fast land use spatial changes caused by anthropogenic activities may lead to negative impacts such as deforestation, loss of flora and fauna, climatic change, reduction in food supply and underground water recharge, interalia.

This study examined the impacts of land use and land cover change in Aba Metropolis. The results revealed that urban spatial development and population growth has resulted in land use negative and positive spatial difference. The positive spatial difference shows that urban built-up, rural built-up and urban land cover increased; this means that built-up area will continue to expand while the negative spatial difference is fundamental in the reduction in urban open space, farm land, forest and rural lands cover between 2001 and 2010. This implies that built-up areas will continue to increase while land for farming and forest reservation will continue to reduce. This calls for physical planning intervention and control of depletion of contiguous areas to ameliorate urban ecological food prints in the rural areas. Furthermore, result from Eta Squared analysis indicated a small effect, with a marginal difference which is not quite significant in the urban land use activities between 2001 and 2010 periods of the land sat imageries.

7. RECOMMENDATIONS

From the study, it was observed that built-up areas and urban land cover changed, while urban open space, farm land, forest, water body and rural land cover decreased negatively within the prescribed periods. Since there is increase in the built-up areas bringing about reduction in other land use types particularly farmland and forest, which is an off-shoot of master plan for Aba metropolis; it is therefore recommended that the government of the state initiates, prepares and implements master plan for the metropolis to checkmate the rate and pattern of the land use and land cover change.

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INHIBITORS TO SECURE ACCESS TO PROPERTY RIGHTS REGISTRATION IN AKURE, NIGERIA

Babajide Ojo[1] and Michael Ayodele Olukolajo[2]
[1&2]Department of Estate Management, Federal University of Technology, Akure, Nigeria

ABSTRACT

Purpose: The objective was to elucidate the factors that inhibit formalization of land right registration with the view to form a panacea for improve and healthy land market development in the study area. There are still constraints with access to secure property rights registration in many states of Nigeria in contrast with the experience in developed economies.
Design/methodology/approach: The paper elicited data form 150 professionals in the built environment within Akure, the capital of Ondo state, using a structured questionnaire. Factor analysis by principal components was adopted in the data analysis.
Findings: The results show that six components accounted for 77.23% of the total variance explained and a total of six factors were extracted which converged in 10 iterations. Time taken in achieving land title registration, bureaucratic procedure involved, inappropriate document to work with, poor knowledge of ICT among officials and poor internet connectivity are among the inhibiting factors.
Research limitations/implications: The implications of the result are the need to introduce modern Land Information System (LIS) and Geographic Information System (GIS) into property rights registration process to make data more secured, enhance huge data storage, easy access and retrieval.
Practical implications: It is hoped this study would inform the practitioners and policy makers on the major inhibitors to secure access to property rights registration with the view of addressing them in order to accelerate land market development.
Originality/value: It is an original thought of the researchers that produce a new knowledge by solving existing problems. There are no conflicts of interest or plagiarism.

Keywords: Factor analysis; land access; land registration; property rights; security

1. INTRODUCTION

Access to secure property rights in Nigeria contrast the experience in developed worlds. Land market in Nigeria is still adversely affected by inability of the land market being actively supported with improved and complete formalization of land rights registration. The processes involved in recording of land rights in the forms of deeds

[1]bojo@futa.edu.ng

registration or registration of title are still encumbered with prolong processes that discourage prospective property owners. Mabogunje (2006) rightly observed that constraints with access to secure property rights registration inhibit real estate property market development in Nigeria.

In advance economy of the world, the use of modern techniques and tools such as Geographical Information System (GIS), Land Information System (LIS), Satellite Imageries and Remote Sensing are highly integrated into the processes and procedures of land rights registration. These enhanced easy storage and retrieval of land information. However, there are lacks of synergy among institutions saddled with land rights registration in Nigeria. There is existence of practices that hampered effectiveness with which individual access secured property rights; among them are legal and extra-legal procedures (Enemark, 2001)

The formal access to Land rights registration in majority of our urban centres is not only costly but involves complicated processes that is devoid of simplified procedures (Omirin, 2003). Majority of people find it difficult to formalize their informal land right due to difficult procedures involved. Formalization of property rights in Nigeria presents different social, economic and political constraints. There are unclear land rights, weak land governance, and dysfunctional Land administration. There are further legal and institutional framework challenges compounding the process. (Mabogunje, 2006; Ukaejiofo, 2007)

Omirin (2009) observed that formalization of land rights in Nigeria involve passing through some complicated procedures. Besides, titling procedures and rights registration are characterized with widespread corruption and weak information management system. Like many developing nations of the world, the bulk of land in Nigeria are still supplied through customary land tenure system despite enactment of Land Use Act in 1978 that brought all land in each state of the federation under the state governor; to hold in trust for common use of the populace.

Access to secure land rights in urban and peri - urban areas are further compounded, most especially among low and medium income earners, by wide spread poverty and increase in urban population (UN-Habitat, 2010). The vast majority of the populations are excluded from access to secure property rights registration by regulatory framework. There exist a wide gap between lay down rules and practices. The land administration lacked the capacity to cope with demand for secure tenure or formalization of rights. Furthermore, there are widespread reports on corrupt practices associated with tenure rights registration and the inability of government to realize the fact that improved access to land rights is highly political (International Federation of Surveyors (FIG), 2007; Törhönen, 2006, UN/Habitat, 2004)

The objectives of this paper is to empirically analyse the various factors that are perceived to be obstacles to achieving secured access to property rights registration in the study area and profound solutions to the factors that inhibit secured access to property rights registration.

2. LITERATURE REVIEW

Literature abounds on secure access to land and security of tenure, most especially on how to make tenure and property rights more secure for the urban poor. Rakodi and Leduka (2003) observed that good governance and the rule of law are closely correlated with successful implantation of processes of improved access to tenure security and property

right. Mathieu, (2006) opined that equitable and transparent land administration process are most often facilitated by good governance and that land issues are profoundly political.

Secured access to land according to Oxfam (2007) empowers the holder of rights in land to raise and stabilize their income, and also influence participation in economic growth. Furthermore, it is an essential requirement for sustainable agriculture, poverty elimination, preserving people's culture and attainment of property market development. It is observed that there are links between food security, peace and security, reduction of poverty and secure access to land rights. Sometimes to achieve these, there are need for a political process of negotiation, conflict resolution and vested interest management according to International Land Coalition, (2007). Similarly, Deininger (2003) argued that secured property rights would increase the incentives of households and individuals to invest.

Food and Agriculture Organisation (FAO) (2006) opined that inadequate rights of access to land and insecure tenure often entrench poverty and impediment to rural development. The International Federation of surveyors (FIG) argued for the need for transparency and measures against corruption in land sector (FIG, 2007, pp6, 9). As a measure against corruption in the land sector, FIG suggested the following measures:-

- Inventory on creation of land tenure;
- Open access to information on ownership;
- Standardization of procedures for land information determination, recording and dissemination; and
- Land operations computerization.

The risk of corruption and inequalities in land allocation and management were found to be real. The consequences on the poor takes the form of difficult access to land assets, lacks of awareness on land policies and legal framework, misallocation of land rights, land grabbing and abuse (FIG, 2007, Bisiriyu, 2008).

In Africa generally, the frameworks for property rights protection for the displaced on account of poverty, discrimination and conflicts are very weak; unrealistic and not adequate. According to Payne (2002) standards restriction and complex procedures also complicate land security access. UN-Habitat (2004) estimated that 924 million people are presently without secured tenure in informal settlements in urban areas of developing countries. This was further supported by Deininger, (2003) who asserted that more than 50 per cent of the peri-urban population in Africa and about 40 per cent in Asia were under informal tenure that is highly characterise with insecured land rights.

In a bid to resolving the issues of tenure security, Raphodi and Leduka (2003) were of the opinion that rather than arguing against informal land delivery systems which are often effective in delivery of land for housing because of its user-friendly characteristics and social legitimacy, they are to be tolerated and accommodated while its weakness be identified and addressed in Africa as a means of secure access to land rights. Furthermore, the public sector agencies that manage land are to accept innovations in procedures and documentation.

3. STUDY AREA

Akure is a traditional Nigerian city and like other traditional Yoruba towns in the country, it exists before the advent of the British Colonial rule in the country. Akure, the capital city of Ondo state is located in South Western part of Nigeria and one of the 36 states of Nigeria. It lies approximately on latitude $7^{0}17^{1}$North of the Equator and longitudes $5^{0}14^{1}$ East of Greenwich Merdian. The population of the city according to National

Population Commission as at 2006 is 353,211 (NPC, 2006). This population is made up of civil servants, professionals, artisans, traders', farmers and students. Being a state capital, Akure is the hub of economic, social and political activities. The Akure land registry is situated at the Ministry of Lands and Housing of state. The figures 1 show the geographic location of Akure city

Despite the fact that Akure is a capital city, most of the land ownership rights are characterized by informality. The informal private sector in Akure comprises of people of different income background resulting to self-help housing/land ownership strategy (Aribigbola, 2007).

This sector takes risk of buying untitled land from informal market dominated by a cabal called "omo-onile" (land owners). After the purchase of the land, majority of these people take it upon themselves to construct their own roads, provide water and extend electricity into their own neighborhood.

The resultant effects of lands ownership under this arrangement are lack of standardization, distorted urban planning system and lack of secured property rights registration. This phenomenon is further observed to be permitted because of weak institutional framework, implementation; and paucity of reliable data for effective planning, monitoring and management of land ownership rights.

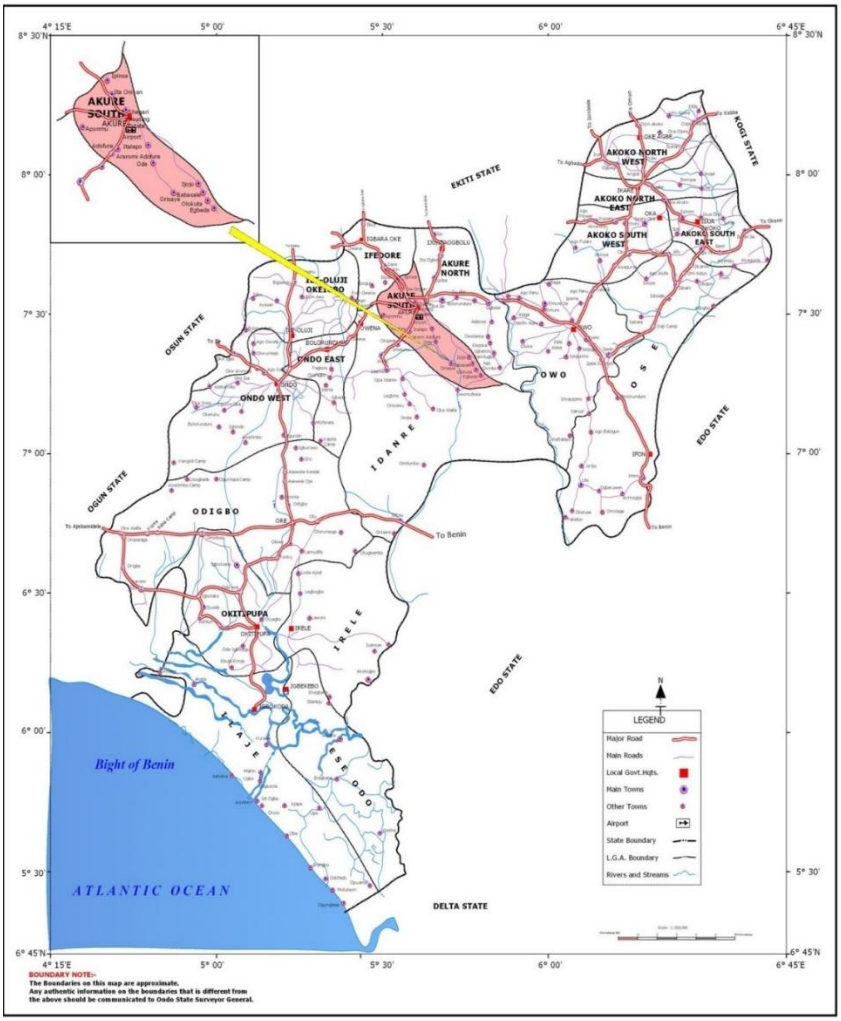

Figure 1: Map of Ondo State showing position of Akure
Source: Abuja Geographic Information System, Maitama, Abuja.

4. RESEARCH METHODS AND MATERIAL

The data employed for the study was sourced through questionnaire on 150 professionals in the built environment within Akure, the state capital of Ondo state, these professionals engage in processing of land title/rights registration with the Ministry of Lands and Housing, Akure. They are made up of 35 Architects, 20 Estate surveyors and valuers, 28 land surveyors, 52 lawyers and 15 town planners who are based and have their practices in Akure. Census method of sampling was adopted for the study because the population which comprise of architects, estate surveyors and valuers, land surveyors, lawyers and town planners whose sample size of 150 was considered to be sizable and manageable. The study is a survey research. The questionnaire design centred on the demographic characteristics of the respondents and twenty one (21) variables that constitute constraints to property rights registration in the study area. The factors for investigation were extracted from the review of literatures. Regarding the numbers of the variable adopted, Hair, Anderson, Tatham and Black (1998) opined that factor analysis is suitable for 20-50 variables, as the extraction of common factors becomes inaccurate if the number of variables exceeds this range. However, study have shown that less number of variables can be used when the sample size is large enough (Ahadizie, Proverbs & Olomplaiye, 2008).

Factor analysis by principal components was adopted in the data analysis. The factor analysis summarize the interrelationship and establish levels of variance in decision variables as they influence the given phenomenon. A factor is a linear combination of variables. Factor analysis uses the correlation or covariance among a set of observed variables to describe them in terms of a smaller set of unobservable variables.

According to Tucker and MacCallum, (1993) and Olorunleke, (2006), factor analysis requires a set of data points in matrix form with the row and colum identifying the matrix

The factor analysis model is given as:

$$(x_i / \tilde{y}, \lambda, f_i, m) = \tilde{y} + \lambda f_i; + \varepsilon_i$$
$$(P \times 1)(P \times 1)(P \times m)(m \times 1)\ (P \times 1)$$

Where $\tilde{y}$ is the overall populations mean Vector
λ is the factor – loading matrix,
f_i is the factor score
m is the number of factors
p is the observed variables
ε_i is the error variance, and
i is the number of observation.

Here, attention is paid to the central limit theorem. The errors (ε_i) are assumed to be normally distributed with mean 0 and constant variance. Factor scores and errors are independent. Factor analysis also assumes that all variables are dependent and there are no independent variables.

5. RESULTS AND DISCUSSION

In this section, the findings of this study are related with existing literature and discussed in line with the finding of the study.

5.1. Factor analysis

The following variables were used as indicators by the professionals, as suggested by the following literatures (Enemark, 2001; Rakodi & Leduka, 2003; Mabogunje, 2006; Ukaejiofor, 2007; FIG, 2007; Bisiriyu, 2008; Omirin, 2009), in investigating the constraints associated with access to secure property title registration in Akure Land Registry. Therefore, the variables that were used in factor analysis are as presented below:

i. High cost of processing –(COST)
ii. Prone to official corruption- (CORRUPTION)
iii. Time taken too long- (TIME)
iv. Cumbersome procedures- (PROCEDURE)
v. Loss of interest by the owner- (INTEREST)
vi. Bureaucratic delay- (BUREAUCRACY)
vii. Lack of proper record keeping- (RECORDS)
viii. Lack of e-Land transaction process- (e-LAND)
ix. Defective organizational approach- (ORGANIZATION)
x. Lack of establishment of geo-spatial data base- (DATABASE)
xi. Lack of networking and logistics- (NETWORK)
xii. Insufficient technical expertise in ICT- (EXPERT)
xiii. Lack of transparency in working process- (TRANSPARENT)
xiv. Inadequate cadastral coverage and out dated maps- (CADASMAP)
xv. Non utilization of satellite imagery and GIS (GIS)
xvi. Unreliable topo- maps and out dated aerial photographs- (AERIAL)
xvii. Lack of automation of process- (AUTOMATION)
xviii. Non provision of textual and graphic data on land – (GRAPHICD)
xix. Prolong and delayed process – (DELAY)
xx. Shortage of training and manpower – (MANPOWER)
xxi. Inadequate physical infrastructure - (INFRASTRUCTURE)

The Bartlett's test of sphericity was used to test for the appropriateness of the sample from the population and the suitability of factor analysis. As observed by Alese and Owayemi, (2004), the Bartlett's test for the adequacy of the sample was a true representation of the population under study. The Table 1 shows the SPSS Output- the Kaiser-Meyer –Olkin which measures sampling adequacy and Bartlett's test of sphericity. The Table 1 also shows a Chi-square of 1764.592 and a significant level of 0.000, which is an indication of the adequacy of the sample. The Kaiser-Meyer-Olkin (KMO) test is another measure of sample adequacy. It is an index for comparing magnitudes of the observed correlation coefficients all pairs of variables. It is small when compared to the sum of squared correlation coefficient. A KMO value of 1 represents a perfectly adequate sample. A KMO of 0 represents a perfectly inadequate sample. The KMO value in Table 1 is 0.667, which shows that the sample is reasonably adequate. Kaiser- Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were employed to test the factorability of the data gathered using the statistical package for social sciences (SPSS) 22.0. KMO is a measure of homogeneity of variables used in testing whether the partial correlations among variables are small (Sharma, 1996). KMO index ranges from 0 to 1, with 0.6 suggested as the minimum value for a good factor analysis (Eiselen, Uys & Potgieter, 2007; Tabachnick & Fidell, 2007). In similar manner, the Bartlett's test of sphericity shows whether the correlation matrix is an identity matrix. George and Mallery

(2003) suggested that a $p<0.05$ is an indication that the data does not produce an identity matrix and are thus acceptable for factor analysis. Pallant (2005) opined that the Bartlett's test of sphericity should be significant ($p<0.05$) for the factor analysis to be considered as appropriate.

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.667
Bartlett's Sphericity	Test of Approx. Chi-Square	1764.592
	df	210
	Sig.	0.000

Table 2 presents the communalities before and after extraction. It shows the proportion of the variances explained by the common factors. The communalities are in the range of 0 and 1, with 0 indicating that the common factors (extracted) explain none of the variance in the variables and 1 indicating that the common factors explain all of the variance in the variable. It could also be expressed as a percentage. For instance, the variable 'high cost of processing' (**COST**) is 0.746 which indicates that 74.6% of the variances in this variable is accounted for by common factors while the remaining 25.4% is accounted for by unique (unexplained) factors. The initial communalities are always 1.00 before the extraction of factors because at that stage every variable is regarded as a factor with a mean of 0 and standard deviation of 1.

Tables 2: Communalities

Variables	Initial	Extraction
COST	1.000	0.746
CORRUPTION	1.000	0.765
TIME	1.000	0.818
PROCEDURE	1.000	0.490
INTEREST	1.000	0.633
BUREAUCRACY	1.000	0.799
RECORDS	1.000	0.768
e-LAND	1.000	0.915
ORGANIZATION	1.000	0.792
DATABASE	1.000	0.819
NETWORK	1.000	0.788
EXPERTS	1.000	0.848
TRANSPARENT	1.000	0.847
CADASMAP	1.000	0.789
GIS	1.000	0.797
AERIAL	1.000	0.742
AUTOMATION	1.000	0.763
GRAPHICD	1.000	0.783
DELAY	1.000	0.842
MANPOWER	1.000	0.832
INFRASTRUCTURE	1.000	0.739

Extraction Method: Principal Component Analysis

5.2. Factor extraction

The 21 variables used in the study were subjected to factor extraction by principal component. The output of the analysis contained in Table 2 above with the initial component matrix subjected to rotation in order to fine tune the loading on each factor. The initial Eigen value, the extracted sum of squared loading and rotation sum of squared loading are presented in Table 3 as the total variance explained. In this Table 3, it could be observed that the first 6 components accounted for 77.23% of total variance explained while 22.77% of the variance of the variables is accounted for by extraneous factors which are unique to the variables and other variables outside the control of study. The values under the extraction sums of squared loadings is the same as the value under initial Eigen values except that only 6 factors with eigen-values greater than 1 were retained in the later. This is because these are the factors that their variances explained most of the factors accounted for. Others are then discarded. However, under the rotation sums of square loadings, the eigenvalues of the factors after rotation has the effect of optimizing the factor structure and the consequence for these data is that the relative importance of the 6 factors is equalized. Before rotation, factor 1 accounted for considerably more variance than the remaining five factors (i.e. 28.29%, 17.28%, 9.97%, 8.60%, 6.86% and 6.22%), however after extraction it accounted for only 17.39%, 14.03%, 13.35%, 11.62%, 10.80% and 10.05% of the variance of the six factors.

Table 3: Total variance explained

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	5.941	28.290	28.290	5.941	28.290	28.290	3.651	17.388	17.388
2	3.630	17.284	45.574	3.630	17.284	45.574	2.945	14.026	31.414
3	2.094	9.973	55.548	2.094	9.973	55.548	2.803	13.349	44.763
4	1.807	8.604	64.151	1.807	8.604	64.151	2.440	11.620	56.384
5	1.441	6.862	71.014	1.441	6.862	71.014	2.268	10.798	67.182
6	1.306	6.221	77.234	1.306	6.221	77.234	2.111	10.053	77.234
7	.958	4.563	81.798						
8	.675	3.212	85.010						
9	.592	2.818	87.828						
10	.528	2.513	90.341						
11	.489	2.329	92.670						
12	.354	1.684	94.354						
13	.259	1.234	95.588						
14	.191	.911	96.499						
15	.156	.741	97.239						
16	.134	.640	97.879						
17	.116	.553	98.432						
18	.107	.511	98.943						
19	.088	.421	99.364						
20	.077	.369	99.733						
21	.056	.267	100.000						

Extraction Method: Principal Component Analysis

There are two forms of rotation viz; orthogonal and oblique rotation. Orthogonal rotation assumes that the factors are uncorrelated. However, oblique rotation allows for some minor correlations among factors (Abdi, 2003). The rotation methods explored were varimax, promax, equamax and direct oblimin. Varimax, which is an orthogonal rotation method, was adopted based on the fact that it produced more meaningful loadings and also because the rotation converged after ten iterations, which happen to be the least. The result of the varimax rotation was used for interpretation. Furthermore, all factor loadings that were less than 0.4 were suppressed. The suppression of loading less than 0.4 also make interpretation considerably easier. The rotated component matrix is presented in Table 4.

Table 4: Rotated component matrix varimax

Variables Used in Factor Analysis	Component					
	1	2	3	4	5	6
DELAY	0.897					
TIME	0.873					
COST	0.803					
CORRUPTION	0.761					
PROCEDURE	0.610					
RECORDS		0.827				
AERIAL		0.751				
BUREAUCRACY		0.697				
ORGANIZATION		0.669			0.504	
GRAPHICD			0.870			
DATABASE			0.789			
INTEREST			0.634			
AUTOMATION			0.609			
INFRASTRUCTURE				0.844		
GIS				0.640		
CADASMAP				0.639		
MANPOWER				0.554		
NETWORK					0.833	
EXPERT						0.882
e-LAND						0.713
TRANSPARENT					0.564	0.623

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 10 iterations.

The numbers of factors to be retained were specified on the basis of a social science rule which states that only the variable with a loading equal to or greater than 0.4 in absolute term and percentage of variance greater than 1 should be considered meaningful and extracted for factor analysis (Tucker and MacCallum, 1993). The result presented in Table

4 was obtained based on this rule. A total of six (6) factors were extracted and the following six factor groupings were obtained and summarized below:

Factor 1: Procedural delay in land title registration	
(a) Prolong and delayed process	(0.897)
(b) Time taken too long	(0.873)
(c) High cost of processing	(0.803)
(d) Prone to official corruption	(0.761)
(e) Cumbersome procedures	(0.610)
Factor 2: Analogue record keeping method	
(a) Lack of proper record keeping	(0.827)
(b) Unreliable topo- maps and outdated aerial photographs	(0.751)
(c) Bureaucratic delay	(0.697)
(d) Defective organizational approach	(0.669)
Factor 3: Archaic land data procedures	
(a) Non provision of textual and graphic data on land	(0.870)
(b) Lack of establishment of geo-spatial data base	(0.789)
(c) Lost of interest by the owner	(0.634)
(e) Lack of automation of process	(0.609)
Factor 4: Absence of modern facilities	
(a) Inadequate physical infrastructure	(0.844)
(b) Non utilization of satellite imagery and GIS	(0.640)
(c) Inadequate cadastral coverage and outdated maps	(0.639)
(e) Shortage of training and manpower	(0.554)
Factor 5: Defective logistics and lack of transparency	
(a)Lack of networking and logistics	(0.833)
(b)Lack of transparency in working process	(0.567)
(c) Defective organizational approach	(0.504)
Factor 6: Inadequate Human capital	
(a) Insufficient technical expertise in ICT	(0.833)
(b) Lack of e-Land transaction process	(0.713)
(c) Lack of transparency in working process	(0.623)
(d) Shortage of training and manpower	(0.528)

5.3. Constraints associated with access to secured property rights registration

The study revealed that only 6 components accounted for 77.23% of the total variance explained while the remaining 22.77% was aaccounted for by extraneous factor. Varimax rotation was employed which converged in 10 iterations. A total of six (6) factor were extracted which were grouped and summarized under the following factor headings:

5.3.1 Factor 1: Procedural delay in land title registration

Five items loaded on factor 1. These items when closely examined pointed to procedural delay in property rights registration. These factors are ‘prolong and delayed process’, time taken too long’, high cost of processing’, prone to official corruption’ and cumbersome procedures. This is not unlikely because the processes involve are done within established ministry in government office. The stages and procedures involved are observed to be too many with attendant delay and unofficial facilitation money. This is in agreement with the

study conducted by Omirin (2003) and Bisiriyu (2008). They respectively observed too long procedures and corruption as reasons that inhibit the process of secured access to property rights registration

5.3.2 Factor 2: Analogue record keeping method

Four items loaded on factor 2. They include 'lack of proper record keeping', 'unreliable topo-maps and outdated aerial photographs', 'bureaucratic delay', and 'defective organizational approach'. There state of land information management is still at analogue state in majority of our land registries. There are issues with bureaucratic delay and defective organizational approach and these are not without impacts on security of property rights registration. Computerization efforts of government are observed to be frustrated by civil servants. The above noted factor is in accord with the finding of Arnot and Meadows (2006).

5.3.3 Factor 3: Archaic land data procedures

Four items loaded on factor 3 with a total cumulative variance of 44.76%. These factors include, 'Non provision of textual and graphic data on land', lack of establishment of geo-spatial data base'; 'loss of interest by the owner; 'and 'lack of automation of process'. The land registry that is saddle with title registration in the study area is still geo-spatial infrastructure and therefore find it difficult to handle textural and graphic data service to the public because of lack of automation process. This is in agreement with the findings carried out in Mabogunje (2006) and Enemark (2001).

5.3.4 Factor 4: Absence of modern facilities

Four items loaded on factor 4.These factors are as follows: 'Inadequate physical infrastructure'; 'Non utilization of satellite imagery and GIS'. 'Inadequate cadastral coverage and outdated maps'; and 'Shortage of training and manpower'. They were labeled 'Absence of modern facilities'. Neither satellite imager nor GIS are employed in operation of property rights registration. The property right registration still relied on inadequate cadastral maps that are many years behind reality on ground. Ukaejiofo, (2007) confirmed in the study carried out on land administration in Nigeria. The finding in this study is in agreement.

5.3.5 Factor 5: Defective logistics and lack of transparency

Factor 5 has three loadings namely: 'lack of networking and logistics; 'lack of transparency in working processes; and 'defective organizational approach. This is labeled 'Defective logistics and lack of transparency'. The existing organizational structure in the ministry cannot cope with modern ways of carrying out modern property rights registration. The process is devoid of transparency as supported by FIG, (2007) study.

5.3.6 Factor 6: Inadequate Human capital

Four items loaded on factor 6.The factors include insufficient technical expertise in ICT; lack of e-Land transaction process; lack of transparency in working process; and shortage of training and manpower. All these factors suggest inadequate human capital development for effective property rights registration. There are inadequate and qualified personal in government employment as registered estate surveyors, land surveyors, cartographers,

computer programmers, web site managers to mention few. There are low funding for continuing training and retraining of the existing workforce.

6. CONCLUSION AND RECOMMENDATIONS

This research has examined the factors that inhibits access to secure property rights registration in Akure, Nigeria. Twenty one (21) factors were highlighted from reviewed literatures were objectively used by respondents for assessment. The factor analysis result grouped variables into six (6) components factor namely: Procedural delay in land title registration; analogue record keeping method; archaic land data procedures; absence of modern facilities; defective logistics and lack of transparency; and inadequate human capital. The Akure land registry can be made more effective, efficient and respond to modern ways of doing business by addressing each of the identified factor component revealed by the study. Emphasis now should be on how to systematically improve on procedural delays experienced, computerization, improvement in human capital investment and more transparency in land data determination, recording and dissemination.

The following are the recommendations put forward for this study.

- Introduction of Land Information System (LIS) and Geographic Information System (GIS) into property right registration process to make it more secure and remove procedural delays.
- New skill and training that enhance human resources development must be pursued as well as the needed political will to enforce it. Highly trained technical personnel in database computerization management, computer networking, cartographers and LIS/GIS specialists must be employed.
- There is need for more transparency in land data determination, recording and dissemination.
- Corruption in land registration process must be brought to the barest minimum. Corruption is defined by UN/Habitat, 2014 as “the misuse of office for private gain”.

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EVALUATION OF FACTORS INFLUENCING PLANNING EFFORTS IN BUILDING PROJECTS IN UYO, NIGERIA

Oluseun O. Olubajo[1] and Shien S. Kuma[2]
[1]Department of Building, Federal University of Technology, Minna, Nigeria
[2]Department of Estate Management, Federal University of Technology, Minna, Nigeria

ABSTRACT

Purpose: This study investigates the factors influencing planning efforts in building projects in Uyo, Nigeria. The focus is specific on those factors that significantly affect the pre-contract planning stages of building projects.
Design/methodology/approach: A survey approach was adopted in the collection of data among key professional consultants involved in building project planning and execution. A sample selection of Architects (32), engineers (43) and Quantity Surveyors (38) was drawn from 56 project sites and 9 consulting firms in the study area adding up to a sample size of 113 professional consultants. Structured questionnaire were administered with 81.4% response rate.
Finding: The outcome from analysis of the square sum of ranks indicates factors such as client's demand, client's policy and planning procedures as the most significant factors influencing pre-contract building project planning efforts.
Research limitations/implications: The investigation of the factors was limited to those most applicable to the pre-contract planning stage of building projects.
Originality/value: The conclusion is that clients have significant influence on the amount of efforts invested in planning and performance of building construction projects.

Keywords: Building projects; consultants; factors; planning efforts; pre contract stage

1. INTRODUCTION

Planning efforts have become an issue of growing concern amongst professionals in the construction industry, it is the measure of how much resources are invested into planning activities at the pre-contract stage. Efforts invested in planning activities often impact on the successes or failure of construction projects (Zwikael & Sadeh, 2007). Planning activities include all actions involved in the preparation or production of contract documents used in carrying out construction. Every construction project is unique, though may essentially involve the same basic resources. Frank and McCaffer

[1]builderolubajo@gmail.com

(2001) also remarked that each project is peculiar and to ensure success, the procurement process must address the technicalities of the project features alongside the client and contractor's needs. Hence, investigations are required into whether the efforts invested into project planning activities differ and their influence on project success (Zwikael, 2009).

Project planning is applied in varying degrees of details when procuring a construction project; this is depending on the stage at which it is carried out in the process. The essence is to ensure that adequate provision is made for availability of resources at the right time and at each stage in the process. The resources being invested in the project planning and execution are described as renewable and non-renewable (consumables) resources (Patrick & Geffner, 2001). Renewable resources are needed during the execution of a project but are not consumed in the process e.g. machines, computers. Consumable resources, on the other hand, are consumed or used up in the process e.g. fuel and time. Hence to effectively plan and execute a project, an assessment is required of the availability of resources so as to provide a forecast into how the project can be managed, control and monitored.

Challenges are sometimes inevitable in spite of the level of preparation and progress made in any construction project. Some of these challenges are those of the projects itself on the measure of how much resources will be invested at pre-contract stage. Previous studies have shown that construction projects' failure to meet their objectives is as a result of poor or inadequate planning efforts. The advancement in information technology (IT) and its practical applicability to project planning and control has to a large extent, stem the growing concern over projects' inability to meeting their objectives. However, regardless of IT, concerns of overruns in project costs, delays, rework and poor quality of work in construction still persist. This possess a major task before the stakeholders and leaves the question as to what are the factors that weigh significantly on the level of efforts devoted in the planning of building construction projects especially at the pre-contract stage.

Zwikael (2009) stated that most construction projects' failures can be traced to inadequate and inaccurate planning as well as rigid adherence to originally formulated plans without modifications. This is in disregard to certain emerging interim changes within the project environment. While according to Mohamed (2010), the most successful construction project is characterised by a well-considered and thought of plan carefully developed by an understanding and committed project team. Not just by project managers, or some independent consultants.

Following the above background, the study aims at ascertaining the factors inhibiting effective project planning efforts among selected consultants in Uyo, Akwa Ibom State of Nigeria. The study objectives are to; identify the factors impelling planning efforts of a building project; assess the significant level of the identified factors among the consultants and determine the overall ranking of the factors based on their significant influence on the efforts devoted to the planning of building project in the study area. The expectation here is that the outcome and recommendation arising from this study will greatly benefit professionals and other stakeholders in the building construction industry.

2. PROJECT PLANNING

Project planning is defined as the establishment of a set of directions in sufficient detail for project teams to know exactly what must be done when it must be done and what resources are required in order to produce the deliverables of the project

successfully (Meredith & Mantel, 2006). It is also the process of defining project objectives, determining the framework, methods, strategies, tactics, targets and deadlines to achieve the objectives and the techniques of communicating them to project stakeholders (Idoro, 2010). Adequate planning equally involves the anticipation of possible problems and measures developed towards providing solutions whenever they arise as well as getting agreement among all concerned on clear targets and deadlines of work schedules.

There are 3 levels of project planning identified by Dvir, Raz and Shenhar (2003), these are; the end-user level where planning focuses mainly on the functional characteristics of the project end-product; the technical level which focuses on the technical specifications of the project deliverables that are needed to support the functional requirements. The third is project management level, which focuses on planning the activities and processes that need to be carried out to ensure that the technical work proceeds effectively. These three levels of planning can otherwise be regarded as project conception planning, project design planning and contract planning (Idoro, 2010).

Each project has a predetermined duration with a definite beginning (starting point) and identifiable end. According to Chitkara (2011), the starting point is the time when the idea is conceived by the client and the end marks the time all activities relating to the project comes to an end. The time span between the start and the completion of a construction project represents the project lifecycle. Although construction projects differ in many regards, their lifespan follows a similar pattern. After the project conception, there is a gradual build-up at the initiation and in the use of resources (construction), followed by a long duration of planning and design that increases the rate of resource consumption. It further peaked at the implementation phase with a higher rate of resource consumption and rapidly run-down till completion (closeout).

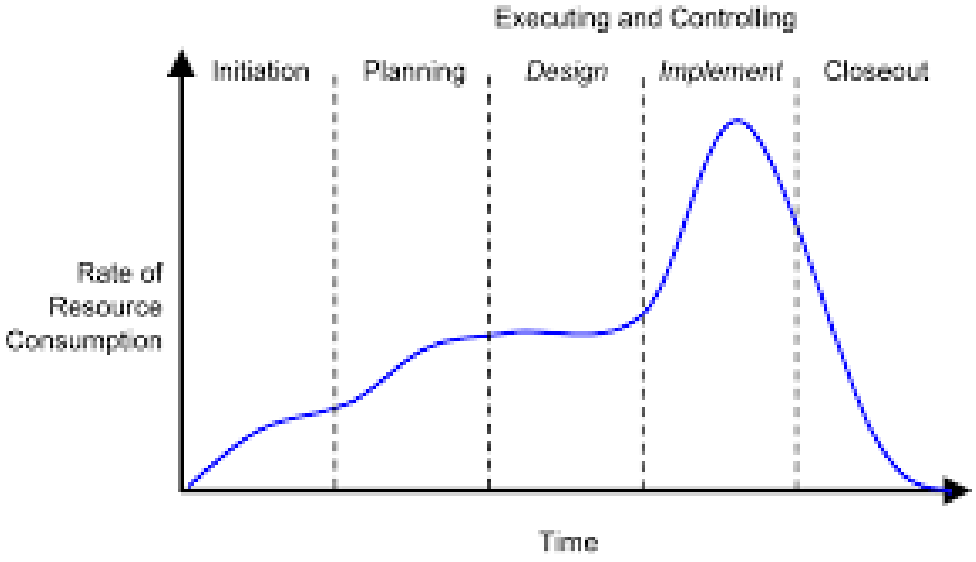

Figure 1: Diagram of a project lifecycle

The activities in a construction project are commonly categorised into five (5) main stages namely: opening or conception, design, tendering, construction and closing or handing-over based on the parties (Puthamont & Charoenngam, 2004). These stages constitute the project life cycle and are further categorised into two main phases,

namely: pre-contract and contract phases (Cooke & William, 2009). Pre-contract phase consists of the opening, design and tendering stages of project development while contract phase involves the construction and the closing of project development (Idoro, 2010).

2.1. Pre - contract stage

The conception stage is the first phase of the project lifecycle otherwise known as the inception stage or formulation stage. At this stage, clients' needs are very important in the planning decision. Though sometimes what clients perceive as their needs and what they actually need may differ. However, the success of any project will depend on how accurately these perceived and actual clients' need are articulated and harmonised (IFRC & RCS, 2000). Chitkara (2011) suggested that a feasibility study is required at this point to evaluate the project potentials of meeting its objectives and can be achieved by assessing its technical, economic viability and financial implications. Report from the feasibility study will enhance clients' decision on their needs and also outline the approach needed to tackle the project. The appointment of key personnel like the construction project manager to act as the client's representative, nomination of specialised associated agencies and professionals such as the architects, designer and consultants as per requirement will also be enhanced. The process of formulation of needs, collection of information, critical examination of concepts and re-examination of needs, may have to be repeated several times over before a project inception will finally take form.

The project design planning stage is the second phase in the project lifecycle otherwise known as the definition stage; this stage aims at processing the project preliminaries so as to facilitate the commencement of the construction stage. Chitkara (2011) mentioned that the composition of the design team at this stage depends on many factors such as the size and nature of the project, characteristics of the project and the time and cost objectives. The design team is led by a project manager and consists of participants such as architect, design and construction engineers, quantity surveyors, contract manager, and specialised consultants. After approval of the design development documents, the architects and the engineering team with the other specialised consultants, prepares the construction documents consisting of working drawings and technical specifications for the project components (Frederick & Ricketts, 2001).

2.2. Planning efforts at the pre-contract stage

Planning activities during the pre-contract stage of any building project are very pertinent. How much efforts should actually be invested in these activities and how they should be organised to achieve the expected performance, greatly determines the success levels of such projects. Some studies have attempted to examine or establish the relationship between planning efforts and success level of projects; Faniran, Love and Li (1999) and Zwikael (2009) belong to this streak of studies. They examined the probability of a link between these two variables and found that additional efforts a little above the optimal committed to a project increase the likelihood of a successful outcome of the project.

Further, project consultants are sometimes very itchy to open up and commence work on sites without much attention given to some details that could contribute to the critical

success factors. Zwikael and Sadeh (2007) look at the level of influence, the amount of planning could exert on the project success even under certain unforeseeable risks. This was in view of the fact that construction risks are sometimes inevitable and overcoming these risks, will require a carefully thought out alternative courses of action from the planning stage. Hence the study emphasised the need for a careful and detail planning among professionals where measures will be put in place in anticipation of any risk that may arise. In view of the importance of the requirement for additional efforts during the pre-contract planning, Idoro (2011) opined that there is a need for a careful project planning and the development of a quality documentation at the pre-contract stage. This will ultimately go a long way in providing a proper guide into the execution of a project. It is therefore very imperative for a careful and detail planning to be carried out that will take into cognisance those factors that could influence the amount of efforts that can be invested at this stage of the project.

3. RESEARCH METHODOLOGY

This study adopted a survey approach in data collection so as to achieve the research objective. Uyo the Akwa Ibom State capital was selected as the test bed for the research following the numerous building construction projects that are currently on-going. Also, it is one of the fastest growing state capitals in terms of infrastructure and development within the South-South region of Nigeria. The State is bounded by neighbouring states of Abia to the north, Cross River to the east, Rivers state to the west and the Atlantic Ocean to the south with a population of about 4 million according to 2006 Census.

Data for the study was obtained through the use of questionnaire distributed among the key professional consultants involved in building project planning and execution in the study area. The selection of the consultant was made through a random sampling by identification of building project sites and consulting firms in the study area. Architects, civil/structural engineers and Quantity Surveyors were the predominant professionals on sites and were adopted as the population for the study. A total of 56 project sites were identified which are made up of 87 professionals in all and 9 consulting firms with a total of 26 professionals. This brings a sum total of 113 professionals sampled and this was made up of 32 Architects, 43 Engineers (Civil/structural) and 38 Quantity Surveyors. See Table 1 below of questionnaire administered.

Table 1: Analysis of questionnaire distribution

Consultants	**No of Questionnaire distributed**	**No. of questionnaire retrieved**	**%**
Architects	32	28	87.5
Engineers	43	33	76.7
Quantity Surveyors	38	31	81.6
Total	113	92	81.4

The survey attained 81.4% success rate and data obtained for analysis includes those on academic and professional qualifications as well as levels of experience attained by the respondents. A total of 16 factors were generated from earlier literature and measured on a 3-point scale, with 1 = less significant, 2 = significant and 3 = highly significant. Analysis was made using descriptive statistics involving mean which was used in ranking the factors

to determine their level of significance. The Kendall test technique (Kendall Coefficient of Concordance W) was further used to ascertain the relationship of the responses among the professionals. It is obtained as follows;

$$\sum r = r_1 + r_2 \ldots\ldots\ldots\ldots r_n \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where $r_1 + r_2 \ldots\ldots\ldots r_n$ represent the ranking of the various professionals sampled

$$\sum r^2 = (r_1 + r_2 \ldots\ldots\ldots\ldots r_n)^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

The equation 2 above provides the squared sum of ranks where the final test is computed using the formula;

$$W = 12\sum r_t^2 - 3k^2\, n(n+1)^2] \div [k^2\, n(n^2-1)] \ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where, r_t^2 = the squares sum of ranks, n = no. of factors being ranked and k = no. of professionals from which the ranking of the factors was taken. The test coefficient ranges from 0 to 1 with values closer to 1 indicating strong relationship or agreement while those closer to 0 indicates a poor or weak relationship. The rank of pairs of professionals is also measured using the Average Rank Correlation (r_s) from the equation 4 below.

$$r_s = (kw - 1) \div (k - 1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

This further provides for the determination of the overall consensus in the significance of the factors as ranked by the different respondents (professionals) in the study area.

4. Results and Discussion

4.1. Qualifications and experience of respondents

Majority of the consultants involved in project planning holds first degrees representing 43.5% of the total professionals sampled and closely followed by those who acquired further qualification (MSc/MTech) with 30.4%. See Table 2 below.

The consultants are all registered with their respective professional institutions e.g. Nigeria Institute of Architects (NIA), Nigeria Society of Engineers (NSE) and Nigeria Institute of Quantity Surveyors (NIQS). Effective project planning and execution requires skills and professional experience acquired through academic and training. In Uyo the study area, most of the professional consultants meets this requirement which indicates their physical and mental competences to undertake project planning, control and execution. A high proportion of the consultants comprising 39.1% have put in between 11 and 15 years in their professional practice. While 22.8% have working experience of between 16 and 20 years thus, acquiring a substantial knowledge of the rudiments of project planning tasks in Uyo. This will afford them a good level of exposure to construction related problems and expertise solutions that embodies best practices. The results further show a wider disparity across gender which indicate that 80.4% are male whereas 19.6% female. One may be tempted to conclude here that, it may probably not be far from the age-old perception in

Nigeria that the construction industry is a male affair hence their dominance.

Table 2: Qualification and experience of the Respondents

Item	Description	Frequency	%
Sex	Male	74	80.4
	Female	18	19.6
	Total	92	
Educational Background	M.Sc./M.Tech.	28	30.4
	B.Sc./B.Tech.	40	43.5
	HND	24	26.1
	Total	92	
Professional qualification	MNIA	25	28.3
	MNSE	36	26.1
	MNIQS	31	25.0
	Total	92	
Working Experience	1 – 10	27	29.3
(in years)	11 - 15	36	39.1
	16 – 20	21	22.8
	21 & Above	8	8.7
	Total	92	

4.2. Factors influencing project planning efforts

In order to ascertain the significance of the factors affecting planning efforts of building projects, the means of all the 16 variables measured were computed and ranked in order of descending magnitude.

The outcome of the ranking of the factors as analysed and shown in Table 3 above indicates that, Architects considers client budget first as having a significant influence on planning efforts of building projects. This is followed by the experience of the planning team with a mean value of 3.94. However, they consider the level of use of IT as the least (3.06). Analysis of responses from the Engineers indicates that policy of the client (3.69) rank first, planning and approving authority (3.63) and client demand (3.60) are 2nd and 3rd most significant factors affecting project planning in Uyo. The Quantity Surveyors consider the Level of I.T. Use (3.94) as the 1st among the factors while client budget (3.71) and availability of construction materials (3.71) as 2nd and 3rd among the factors respectively.

4.2.1 Kendall Coefficient of Concordance (W)

Considering the outcome from analysis of the factors affecting planning efforts of building projects by Architects, Engineers and Quantity Surveyors, the Kendall test technique is used at this point to establish if there is an agreement among the professionals on the significant levels of the factors. Note that while the *W-coefficient* measures the overall relationship in the ranking of the factors among professionals (in this case 3), the r_s

–*coefficient* measures the possibility of a relationship or agreement between the ranking of one professional and the other.

Table 3: Mean and ranking of factors influencing project planning efforts

Factors	Architects		Engineer		Quantity Surveyors	
	Mean	Rank	Mean	Rank	Mean	Rank
Experience of the planning team	3.94	2	3.23	13	3.06	15
Client budget	3.96	1	3.53	7	3.72	2
Construction method	3.90	4	3.43	9	3.46	12
Planning and approving authority	3.91	3	3.63	2	3.34	13
Client demand	3.84	5	3.60	3	3.51	11
Type of project	3.77	6	3.33	11	3.34	13
Availability of local construction materials	3.71	7	3.54	6	3.71	3
Complexity of the project	3.68	8	3.47	8	3.58	6
Type of contract	3.61	9	3.53	7	3.68	4
Type of Client organization	3.47	11	3.55	5	3.66	5
Type of contractor	3.48	10	3.58	4	3.16	14
Policy of Client	3.42	12	3.69	1	3.52	10
Location of the project	3.39	13	3.39	10	3.57	7
Time invested in planning by the client	3.16	14	3.07	14	3.55	9
Awareness of project consultants	3.10	15	3.03	15	3.56	8
Level of I.T Use	3.06	16	3.30	12	3.94	1

The result of the test, $W = 0.083$ indicates a statistically poor relationship in the rankings of the significance of factors affecting planning efforts of building projects in Uyo among the professional consultants. This is further confirm by the result of the average rank correlation ($\boldsymbol{r_s}$) of the factors among the consultants. The coefficient of r_s = -0.375 indicates a substantial disagreement between all possible pairs of rankings among the professionals. This finding suggests that despite these professionals are all part of the project planning team; they differ in their opinion as to the significant level of influence of these factors.

4.3. Level of consensus among the professionals

To determine the level of consensus among the professionals in relation to the level of significance of the factors, the sum of the square sum of ranks ($\sum r^2$) is extracted from Table 4 above and ranked.

The outcome of the analysis so far has shown that clients demand, policy, planning and approval, client budget and type of client organisation are the top 5 most significant factors influencing building projects planning efforts in Uyo.

In project planning, the pre-contract stage is very important following that it is the basis for the determination of the level of execution of such project. Chitkara (2011) suggested for a feasibility study be conducted at this point to ascertain its technical and economic viability as well as financial implications. Hence, the building project design by Architects also embodies financial implications and the Quantity Surveyors, who are experts in bills and quantities as well as elemental costs, all maintained that client's budget is critical during

the planning stage. This is in recognition of the fact that, finance is the lifeline of any project. Away from the budget factor is the issue of planning and development approval.

Table 4: Results from Kendal coefficient of concordance

Factors	r_1	r_2	r_3	$\sum r$	$\sum r^2$	W	r_s
Experience of the planning team	2	13	15	30	900		
Client budget	1	7	11	10	100	0.083	-0.376
Construction method	4	9	12	25	625		
Planning and Approving authority	3	2	13	18	324		
Client demand	5	3	11	19	361		
Type of project	6	11	13	30	900		
Availability of Local Construction materials	7	6	3	16	265		
Complexity of the project	8	8	6	22	484		
Type of Contract	9	7	4	20	400		
Type of Client organization	11	5	5	21	441		
Type of contractor	10	4	14	28	784		
Policy of Client	12	1	10	23	529		
Location of the project	13	10	7	30	900		
Time invested in planning by the client	14	14	9	37	1369		
Awareness of project consultants	15	15	8	38	1444		
Level of I.T Use	16	12	1	29	841		

Note: r_1 = Architects, r_2 = Engineers, r_3 = Quantity Surveyors

Table 5: Overall agreement among the consultants in Uyo

Factors	$\sum r^2$	Ranking
Client demand	100	1
Policy of Client	256	2
Planning and Approving authority	324	3
Client budget	361	4
Type of Client organisation	400	5
Type of Contract	441	6
Complexity of the project	484	7
Availability of local construction materials	529	8
Construction method	625	9
Type of contractor	784	10
Level of I.T Use	841	11
Location of the project	900	12
Type of project	900	12
Experience of the planning team	900	12
Time invested in planning by the client	1369	13
Awareness of project consultants	1444	14

Every city or town has its planning and development approval requirements for different types of projects. When planning for a project, adequate attention could be given to its

acceptability and conformity to planning and development regulations, as delay in the approval means late commencement and behind schedule completion. Therefore, the Architects and Engineers in Uyo maintained that applying for and obtaining early approval from the planning authorities can prompt the timely commencement of other activities that are dependent on the planning approval. Although the Quantity Surveyors, differ slightly from the Architects and Engineers regarding their first 3 factors. They believe that involvement and use of information technology as is the current best practices and availability of construction materials are crucial factors that need to be harnessed properly so as not to affect negatively the planning efforts of any building project.

The overall consensus among the professionals in Uyo is that client demand, policy, planning and approval of projects, client budget and types of client organisation are the most significant factors affecting planning efforts of building projects. Project planning is an intricate task that involves a wider spectrum of considerations which the requirement for professional competences cannot be overemphasised. The client's demand forms the basis that brings in the concept of the project itself and as such, the demand must be clearly understood by the professionals before any planning will commence. A client could be an individual, corporate entity or the government and each has their respective policies relating to building projects. Organisations establish corporate images and strategies which their activities revolve around and which are often encompassed in their development and growth policy and same goes to the government. Whichever of their policy in relation to building projects, understanding these policies is also critical in the pre-contract planning stage of a project. Thus, the demand of clients, their policy, budget, project planning and approval requirements, as well as the type of client's organisation, are critical factors that needed to be considered among others in building project planning. This will also explain the level of efforts to be invested in the pre-contract planning that will ensure its successful execution.

5. CONCLUSION AND RECOMMENDATIONS

The study assesses the level of significance of factors influencing planning efforts of building projects in Uyo, Akwa Ibom State. Analysis and findings have led to the conclusion that, although the professional building project consultants differ slightly in their various expertise and experience in relation to the level of significance of the factors affecting planning efforts, they all agreed that clients' demand, client policy and planning and approval procedures, as well as budget, presents most significant challenges on projects planning efforts. By implication, clients have a greater influence on the efforts invested in project planning activities at the pre-contract stage. The study hereby recommends that;

Project consultants should establish effective and efficient ways of interacting with stakeholders and among themselves especially during the pre-contract planning stage. This will enable them to harmonise their knowledge and expertise towards an effective and holistic plan of action.

It was also found that clients have a significant amount of influence at this stage of project planning hence, the consultants should ensure a detailed brief is obtained from them (client) which will avail the consultants the necessary information that will determine the amount of efforts to put into planning.

Finally, information flow and frequent collaborations are encouraged among the consultants geared towards building stronger and viable partnerships. Continuous update

on current developments on relevant ICT will ensure effective communication as planning does not cease until the project is fully completed.

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ASSESSMENT OF EFFECTS OF ROAD CONNECTIVITY PATTERN ON THE PHYSICAL DEVELOPMENT IN AKWA IBOM STATE

Victor Umoren[1] and Usen Inyangmme[2]
[1&2]Department of Urban and Regional Planning, University of Uyo, Uyo, Nigeria

ABSTRACT

Purpose: Assessing the general circulation system in Akwa Ibom State cannot be overemphasized. This study aimed at assessing the effect of road connectivity pattern on the physical development in the study area.
Design/methodology/approach: To achieve this, two sets of data on road connectivity and physical development were collected. These involves data on the length of roads in each local government area were computed i.e. the independent variable (x) and data on the level of physical development in each local government area was collected. This centered on physical infrastructure available in these areas which was considered on 16 measurable variables i.e. dependent variables (y): data collected were analysed using descriptive statistics and Pearson Product Moment Correlation.
Findings: The result revealed that there is positive relationship between road connectivity and physical development. This means that as connectivity increases M = 1.0727, physical development also increases M = 35.267. It indicates that the relationship is statistically significant r = 0.898 $p < 0.05$, R^2 0.86 indicates about 86% of the variation in physical development is related to road connectivity.
Originality/value: It was conclude that road connectivity level has a positive relationship with physical development in Akwa Ibom State. It was also established that about 86% of the growth that occurs in the physical development in the study area is derived from the increase in the road connectivity level in the study area. It was observed that there were some lagging areas in road connectivity. The study recommended that there should be increased in road connectivity in the lagging areas to increase physical development in the area.

Keywords: Road; connectivity; physical development; effects

1. INTRODUCTION

Transportation is a vital element in the regional development of any country, state or city. It is an important part of societal development (Gauthier, 1973). The level of transportation facilities of any nation determines the potency of the socio-economic wellbeing of that nation. Man, nations, regions and the world would be severely limited

[1]vicmoor2000@yahoo.com

in physical development without transportation, which is a key factor for physical and economic growth (Oyesiku, 2002). Property and land values tend to increase in areas with expanding transportation networks, and increase less rapidly in areas without such improvements. Rapid and continued rise in housing and land prices are expected in cities with transportation improvements and rapid economic and population growth (Goldberg, 1970).

According to Bailey, Mokhtarian and Little (2008), transportation route is part of distinct development pattern or road network and mostly described by regular street patterns as an indispensable factor of human existence, physical development and civilization. The route network coupled with increased transport investment result in changed levels of accessibility reflected through Cost Benefit Analysis, savings in travel time, and other benefits. These benefits are noticeable in increased catchment areas for services and facilities like shops, schools, offices, banks, and leisure activities. Road networks are observed in terms of its components of accessibility, connectivity, traffic density, level of service, compactness, and density of a particular road. Level of service is a measure by which the quality of service on transportation devices or infrastructure is determined, and it is a holistic approach considering several factors regarded as measures of traffic density and congestion rather than overall speed of the journey (Mannering, Walter and Scott, 2004). The length of motorable roads in Nigeria was 3,200 kilometres in 1914. By 1962 the length of all categories of roads had risen to 71,870 km from 44,000 km in 1957 and later on to 114,768 km in 1980. By 1988 the total length of roads in Nigeria was estimated to be 193,200km, out of which the Federal Government controlled 34,123 km, approximately 18% of the road network was developed and controlled by the Federal Government, (Umoren, 2008).

In Akwa Ibom State, when assessing the level of regional growth and the development of roads, there is a clear indication that the level of physical development is dependent on the level of accessibility and also that over time, the existing roads will not be able to play its role as it would be over-utilised in some areas. This could be due to limitation in terms of capacity, functionality, connectivity and linkages. And as such many activities in the area would be hindered and limited to the level of road connectivity in the area. This explains why despite many research efforts on road development studies further research endeavours will still be needed to accommodate the differences in nodes and the relationship between connectivity and physical development. It is against this background that the study aim assessing the effect of road connectivity on physical development in the study area.

1.1. Objectives of the study

The objectives of the study were to:

i. To determine the level of road connectivity in the study area.
ii. To examine the relationship between road connectivity and physical development in the study area.

1.2. Research hypotheses

To achieve the objectives of the study one hypothesis was postulated which states that:

H_i: There is no significant relationship between road connectivity and physical development.

1.3. Area of the Study

Akwa Ibom State, is one of the states in the south-south geopolitical zone of the country, it is bounded on the north by Abia State, on the south by the Atlantic Ocean, Cross River State on the east and Rivers State on the west. It is located on the sandy coastal plain of the Gulf of Guinea. It is bordered on the south by the Atlantic Ocean which stretches from Ikot Abasi to Oron - a sprawling volume of water seemingly kissing the skyline from flank to flank (Binu, 2012). Akwa Ibom State lies between latitude 4°32' and 5°53' North, and Longitudes 7°25' and 8°25' East. In terms of structural make up, Akwa Ibom is triangular in shape and covers a total land area of 8,412 km^2, encompassing the Qua Iboe River Basin, the western part of the lower Cross River Basin and the Eastern part of the Imo River Basin. With an ocean front which spans a distance of 129 kilometres from Ikot Abasi in the west to Oron in the east (Bassey, 2005). It has a short dry season starting from mid-November to mid-March and a long wet season. The rainfall averages 2,500mm. The soil type is sandy loam – well-drained and only subtle difference in texture and colour make separation possible. The population of the state is put at 3,920,208 (NPC, 2006).

2. LITERATURE REVIEW

2.1. Road Connectivity

The term "road connectivity" suggests a system of streets with multiple routes and connections serving the same origins and destinations. Connectivity also refers to the density of connections in path or road network and the directness of links. A well-connected road or path network has many short links, numerous intersections, and minimal dead-ends (cul-de-sacs). As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations, creating a more accessible and resilient system (Hayens 1989). Connectivity is achieved by providing connections within individual developments, between developments and by having a well-planned collector road network to compliment the arterial highway network. Connectivity of an area can be measured using a connectivity index - commonly defined as the ratio of links to nodes. To achieve network connectivity, one guideline is to have arterials spaced approximately ½ kilometre apart and collectors every ¼ kilometre (Harrison, 2004). Providing a strong connected network of roads and pedestrian facilities can help distribute traffic, reduce travel distances and times, improve routing for transit and reduce walking distances. Good connectivity also provides better routing opportunities for emergency and delivery (solid waste, recycling, mail) vehicles. All of these effects can play a positive role in reducing congestion on the street network. Advocates of New Urbanist and neo-traditional planning concepts include street connectivity as a key component for good neighborhood design. Street networks that are more grid-like are preferred over networks that include many cul-de-sacs and long blocks, thus increasing distances between destinations (Rodrigue, 1998). Connectivity not only relates to the number of intersections along a segment of street, but how an entire area is connected by the transportation system (Harrison 2004).

2.2. Road Network Development in Akwa Ibom State

Akwa Ibom State under the former South Eastern State/ Cross River State had few roads and many foot paths .In 1987, the area was constituted into a state with ten Local

Government Areas. The number of Local Government Areas has increased to thirty-one in 2000. With these developments, new roads were constructed, old ones rehabilitated and some of the earth roads tarred. Today, all the Local Government headquarters are linked by tarred roads (Ekpeyong 2010).

In a nutshell, one can say that the political history of Akwa Ibom State is largely the story of the opening up of its vast areas by network of roads resulting in economic growth, which in turn stimulates the demand for transport. The networks of roads are single lane. The dual carriageways are found only within Uyo capital city. Most of the Local Government Councils in the State are not involved in road construction. This has serious implications on the accessibility of different parts of the state (Ekpeyong, 2010).

It is obvious from the foregoing that, our future challenge should be that of tarring more roads especially those linking rural communities and the dualisation of those linking major Local Government headquarters like Eket, Ikot Abasi and Okobo (Ekpeyong 2010)..

3. METHODOLOGY

In carrying out this study, two sets of data on road connectivity and physical development were collected from the study area. Data on the length of roads in each Local Government Areas were computed, these data was obtained from the Directorate of Civil Engineering, Akwa Ibom State Ministry of Works. The data was used as the independent variable (road connectivity) and was used to compare with the level of physical development in each of the Local Government Areas. These were the dependent variables (Y) while the data required for dependent variables (Y) which centred on physical infrastructures available considered 16 measureable variables as indicated in Table 1. In analysing the data the Pearson's Product Moment Correlation was adopted for this study using the SPSS software. This was done to investigate the relationship between road connectivity and physical development. (See Table 2).

Table 1: List of dependent variables (y) and units of measurement

S/N	Variables	Units of Measurement
1	Nursery/ Primary School	Number
2	Secondary Schools	Number
3	Postal Agencies	Number
4	Health Facilities	Number
5	Police Post	Number
6	Banks	Number
7	Hotels	Number
8	Recreational Facilities	Number
9	Filling Stations	Number
10	Bore Holes	Number
11	Churches	Number
12	Factories	Number
13	Motor Parks	Number
14	Shops	Number
15	Daily Markets	Number
16	Work Shops	Number

Note:

1. Nursery / Primary schools: The total count of nursery and primary schools (both public and private) in the area.
2. Secondary school: Total count of both public and private secondary schools.
3. Postal Agencies/Offices: Total counts of postal offices in the area
4. Health facilities: The total count of both public and private hospitals, clinics, health centres and medicine shops.
5. Police post: Total number of police stations, sub stations and police post
6. Banks: Total counts of commercial banks in the area
7. Hotel: The total number of hotels and guest house (private and public)
8. Recreation Centres: Total count of civic centres, playgrounds, sit outs, event centres, parks and organised open spaces (both public and private).
9. Filling Station: The total number of filling stations.
10. Public Borehole: Total number of boreholes.
11. Church: Total number of Christian worship centres.
12. Factories: This includes the presence of all forms of small scale industrial activities which include bakery, palm oil processing, cassava processing, rice processing, garri production, paint production etc.
13. Motor Park: The total number of motor parks available.
14. Shops: The total number of general provision and specialized shops, boutiques, restaurants supermarkets and other small commercial outfits.
15. Market: Total numbers of markets (daily and weekly).
16. Workshops: Total count of technical services and skill acquisition workshops such as carpentry, mechanic, tailoring, saloons and traditional craft workshop.

These data were computed and the mean value was obtained and used as a measure of physical development.

4. PRESENTATION AND DISCUSSION OF RESULTS

Data obtained from the field for the study as indicated in table 2 were collated on road lengths in the various local government area and also physical infrastructure available in the area as described in the methodology. The results of statistical analysis carried out are presented as follows:

4.1. Determining the Level of the Road Connectivity in the Area

Descriptive results of the level of variation in the road lengths in the thirty one (31) local government areas of the state as shown in table 2. The result in table 2 indicates that Uyo local government area has the highest length of road development of 308km, closely followed by Ikot Ekpene with 267.8km of road development and the least in terms of road development in the study area was Eastern Obolo with only 17.7km of road development. The variability level in road development in the study area is indicated in table 2, the road development level in the area is an indication of the real connectivity level.

Table 2: Road network and physical development

S/N	Local Government	Road network length in kilometres	Rank	Physical Development
1.	Abak	167.2	7	44
2.	Eastern Obolo	17.7	30	14.1
3.	Eket	190.1	4	50
4.	Esit Eket	77	18	27.2
5.	Essein Udim	174.8	6	46
6.	Etim Ekpo	137.8	9	40
7.	Etinan	74.4	20	27.5
8.	Ibeno	29.7	27	37
9.	Ibesikpo Asutan	31	26	28.6
10.	Ibiono Ibom	178.6	5	47.8
11.	Ika	66.7	25	18.5
12.	Ikono	83.6	16	22.3
13.	Ikot Abasi	71	22	34.2
14.	Ikot Ekpene	267.8	2	80
15.	Ini	29.6	28	25
16.	Itu	211.8	3	58.1
17.	Mbo	90.4	14	26.5
18.	Mkpat Enin	29	29	29
19.	Nsit Atai	89	15	25.7
20.	Nsit Ibom	76	19	26.7
21.	Nsit Ubium	97.8	13	27.7
22.	Obot Akara	70	23	20.6
23.	Okobo	72	21	21
24.	Onna	67	24	26.8
25.	Oron	112	10	47.8
26.	Oruk Anam	98	12	45
27.	Udung Uko	29.7	27	26
28.	Ukanafun	83	17	21.6
29.	Uruan	158	8	41.6
30.	Urue Offong Oruko	98.8	11	26
31.	Uyo	308	1	81

Source: Author's Data Analysis, (2017)

4.2. Determining the physical development and its relationship with road connectivity in the study area

The descriptive results of the physical development in the study area. Table 3 presents the different local government and the extent of the physical development in each of them. The physical development was measured in terms of the mean number of physical structures developed in each local government area. Sixteen (16) variables were selected and used in analyzing the physical development in the area as indicated in the table 3.

The primary objective of this study is to compute the number of the facilities and compare them with the extent of the road network development. It is to assess if the increase

in road network development has a corresponding increase in physical development of the areas.

The study revealed that areas with high road network tend to have a higher number of physical development as compared to areas with lower length or road development. This indicate that an increase in the area covered by road network also has a corresponding increase in the number of physical development.

Table 3: Weighted Data from the Field

S/N	Primary Nursery/ School	Secondary School	Health Facility	Postal Agency	Bank	Public Borehole	Police Post	Recreational Centre	Motor Park	Hotel	Workshop	Shops	Market	Church	Factory	Petrol Station	Total	Mean
Abak	39	27	25	1	18	71	1	36	1	47	18	177	25	116	68	27	697	44
Eastern Obolo	19	11	6	1	0	12	0	1	0	0	3	98	1	74	0	0	226	14.1
Eket	41	21	31	12	19	29	6	47	1	37	47	197	9	211	59	33	800	50
Esit Eket	37	18	6	0	3	36	1	17	1	17	33	89	11	121	43	3	436	27.2
Essein Udim	22	18	38	3	8	38	2	24	1	32	37	112	7	187	53	13	541	36
Etim Ekpo	41	27	16	0	0	66	4	47	2	0	6	187	28	178	29	10	641	40
Etinan	38	13	19	3	4	34	1	17	1	17	34	117	6	90	38	11	441	27.5
Ibeno	35	26	40	0	6	73	3	34	1	44	36	107	7	102	61	11	586	37
Ibesikpo Asutan	37	16	19	0	3	9	1	11	1	9	17	87	5	196	47	11	458	28.6
Ibiono Ibom	58	33	29	0	3	0	87	67	1	12	66	129	36	157	87	4	765	47.8
Ika	6	5	1	0	0	15	3	7	1	11	12	69	3	79	77	7	296	18.5
Ikono	23	16	27	1	0	11	3	22	1	5	19	86	7	88	48	8	357	22.3
Ikot Abasi	33	17	46	4	13	19	8	41	4	39	49	213	36	207	36	32	548	34.2
Ikot Ekpene	79	55	59	4	17	36	9	49	6	57	77	278	28	326	207	48	1285	80
Ini	17	11	8	0	0	37	1	54	1	3	8	55	33	79	87	4	398	25
Itu	47	32	39	2	12	48	4	27	3	39	110	117	19	288	122	22	931	58.1
Mbo	36	17	12	2	2	36	2	42	4	16	47	105	13	47	37	6	424	26.5
Mkpat Enin	46	21	34	17	6	37	6	56	2	31	21	144	19	79	32	9	430	29
Nsit Atai	18	13	22	0	0	29	2	26	3	17	33	103	6	97	39	11	411	25.7
Nsit Ibom	38	12	12	0	0	38	0	13	0	7	37	97	16	114	31	6	428	26.7
Nsit Ubium	37	21	21	1	5	29	8	27	1	26	13	114	17	88	29	7	444	27.7
Obot Akara	23	17	13	1	0	19	3	6	0	0	38	78	6	97	29	6	336	20.6
Okobo	22	17	13	0	0	39	1	17	0	6	18	78	17	93	13	12	339	21
Onna	28	17	22	0	3	18	2	29	1	16	56	99	12	76	47	14	430	26.8
Oron	47	36	36	7	11	46	7	46	3	46	62	197	14	187	87	17	796	47.8
Oruk Anam	44	32	37	3	4	77	3	34	7	35	31	117	21	211	66	6	728	45
Udung Uko	27	16	19	1	0	39	0	36	0	13	23	89	21	87	41	4	416	2.6
Ukanafun	31	21	17	0	0	18	1	17	0	12	27	77	6	79	31	9	346	21.6
Uruan	39	21	26	9	11	47	7	57	3	23	43	218	19	88	47	7	665	41.6
Urue Offong Oruko	22	16	14	0	0	47	2	33	2	11	37	89	6	114	17	3	413	26
Uyo	117	66	18	1	41	76	3	66	3	79	97	319	23	327	136	76	1296	81

Table 4: Summary of correlation analysis on the relationship between Road Connectivity and Physical Development

Variables	N	Mean	SD	r-value	r-critical	P.value	Remark
Road connectivity	31	1.0727	70.60	0.898	0.361	0.05	Significant
Physical development	31	35.267	16.18				

Correlation is significant at the 0.01 level (2-tailed)

The Table 4 above shows the results of the correlation analysis that was adopted to determine if there is any significant relationship between road connectivity and physical development. The Table revealed that there is a positive relationship between road connectivity and physical development. This means that as connectivity increases (M=1.0727), physical development also increases (M=35.267). It also showed that this relationship is statistically significant, $r = 0.898$, $P<0.05$, $R^2 = 0.86$, explaining that 86% of the variation in the physical development is attributed to road connectivity. The remaining 14% of the variation could be attributed to other factors e.g. compact nature of the area etc. The decision based on the result above, H_0 is rejected and H_1 is accepted. This indicated that the correlation coefficient (r) value did not occur by chance.

4.3. Implications of the Results

The study has revealed that the higher the road connectivity level of an area the higher the number of physical development and activities distributed along it. The implication of this is, as the areas are link with streets and multiple routes and connections its attract the development of physical infrastructure. As it is rightly said that road development is an engine of development because physical development develop along it. Statistically it has been established by this study that about 86% of the growth that occurs in the physical development in the study area is derived from the increase in the connectivity level of the area. On the other hand, the absence of adequate road connectivity in certain localities will invariably hinder growth and physical development in such areas. The study also revealed an uneven geographical spread in the provision and development of road and its implication on physical development in the study area.

5. CONCLUSION AND RECOMMENDATIONS

The study revealed that there is a strong relationship between road connectivity and physical development in Akwa Ibom State. The study indicated that areas with high road connectivity level has equally experience higher physical development in such areas. The study indicated that the entire study area has a connectivity level of 48.3% which is low. From the findings road connectivity has a great positive influence on the locations and especially physical development in the study area. It was also discovered that areas with low road connectivity level had low pace of physical development. The study recommend that efforts should be gear towards addressing the lagging areas in terms of road connectivity level to fast track physical development in such areas.

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TOWARDS SUSTAINABLE ARCHITECTURAL EDUCATION IN NIGERIA: CHALLENGES AND POTENTIALS - A REVIEW

Evelyn Lami A. Allu[1] and Fidelis A. Emuze[2]
[1]Department of Architecture, University of Jos, Jos, Nigeria
[1&2]Department of Built Environment, Central University of Technology, Bloemfontein, South Africa

ABSTRACT

Purpose: This study is a follow up from earlier research, which acknowledged the lack of sustainable curricula in some Nigerian universities and particularly for architectural education. The paradigm shift to sustainable built environment requires a prescriptive transformation of the architectural education in Nigeria. Architecture is a multifaceted discipline and so is the sustainability agenda. This study is an attempt to resound the importance of sustainable education particularly for development in the built environment. Given that, the architectural profession has a supervisory role in the construction industry and has the capacity to re-orient other professions within its sector.
Design/methodology/approach: This theoretical discourse presents; the challenges, potentials and the possible ways to advance sustainable architectural education in Nigeria. Additionally, this discourse contributes to a better understanding of integrating sustainability development into education and the treatise in itself would serve as a support document for policy formulation.
Findings: The main finding is that sustainable education is the most important medium required to transform, re-orientate and to build the capacity of future and current built environment practitioners.
Research limitations/implications: The study is limited to the Nigerian context underpinned by a theoretical discourse. Therefore, other methodologies are recommended for future studies.
Originality/value: The treatise recommends integrating sustainable education into architectural education in order to strengthen and advance the future of sustainable architectural practices amongst the future practitioners in Nigeria.

Keywords: Architecture; Nigeria; sustainable education; sustainable development

1. INTRODUCTION

Nigeria has a rapid population growth rate and the country is also the most populous black nation. It is the rapid population growth that has pushed upwards the demand for

[1]evelynallu28@yahoo.com

housing and other infrastructural development (Akunnaya and Adedapo, 2014; Cartalis et al., 2016). The country's construction sector has been noted to have a significant infrastructural and economic impact, and determines the direction of the built environment like with many developing countries (Wibowo, 2012). Yet the sustainable developmental activities of the Nigerian built environment practitioners are largely uncertain (Emuze, Mgudlwa, and Botha, 2013; Allu, 2015a). The role of designing buildings and the way any development of is processed has since shifted from the traditional to the globally accepted sustainable trend because of the environmental challenges. Furthermore, Kibert (2016) opined that the only way to promote environmental sustainability is to ensure that built environment practices are sustainably oriented and the architect's profession is central (Grierson and Moultrie, 2011). This therefore, makes the role of the architectural professional pivotal and relevant to reorient and direct the practices within the built environment sector towards sustainability. Hence, this background motivates the focus of this study.

The relationship between sustainable development and architecture became a global concern and the demand for sustainable design has increasingly been sought in order to ensure the sustainability of the built environment, particularly through education for sustainability. Thus, the role of education for sustainability has increasingly gained more attention (Altomonte, 2012; Allu, 2016). The current focus is, sustainable architectural education through the integration of sustainability into the curriculum of architectural education (Altomonte, 2012; Iulo, Gorby, Poerschke, Kalisperis, and Woollen, 2013; O'Rafferty, Curtis and O'Connor, 2014; Álvarez, Lee, Park, and Rieh, 2016). As such, the years 2005 to 2014 was declared the decade of education for sustainable development, by United Nations (Connell and Kozar, 2012). Furthermore, the post declaration Monitoring and Evaluation Report suggested that, laudable successes were recorded globally (UN Decade of Education for Sustainable Development (2005-2014) Final Report (2014). Yet there are still pockets of countries with non-compliance status and Nigerian has been noted to be one of such (Allu, 2015b, 2016).

This study's theoretical underpins has also, an observatory discourse in line with the obvious reality of what is truly obtainable and worrisome within the study's context. Consequently, this review aims at presenting highlights that point towards advancing sustainable architectural education in Nigeria. The study therefore, presents a live problem as a challenge, propels the way forward as its potentials and opportunity for the Nigerian and other similar context elsewhere. Furthermore, the expected outcomes and recommendations are enumerated. Thus, the paper presents its theoretical discourse in this sequence in order to harmonise the arguments therein.

2. THE DISCOURSE

This section reviews the theoretical underpins for sustainable architecture, the agenda for Education for Sustainable Development (ESD), the potentials and challenges for sustainable architectural education. In view of the focus of this theoretical discourse a robust literature review on historical background to these underpins are beyond the scope of this presentation. Rather the underpinning highlights are presented to support the arguments of the subject of this discourse.

2.1. Sustainable architecture

The premise, on which this discourse is hinged, is that sustainable architecture is a conscious attempt for an energy and ecological approaches that sustainably strategized to the design processes of the built environment and not just to reduce the use of natural resources. The paradigm shift towards a sustainable built environment begins with the transformation of the architectural profession (Barth and Timm, 2011) and the design process (Grierson and Moultrie, 2011). Sustainable architectural architecture has thus, becomes the means to sustainable architecture.

2.2 Education for sustainable development

Education for Sustainable Development (ESD) came as an offshoot of international efforts and commitment to ensure a sustainable future for all. In every sector of human activities many strategies have been identified and for the advancement of sustainability within the built environment; education has been widely recognised as the most important factor for achieving sustainable development (Krizek et al, 2011; UN 2016) with "ESD as the key action" (Alvarez et al., 2016). However, it is equally important that the educators are also knowledgeable and understand fully the role educator have towards ensuring ESD (León-Fernández Domínguez-Vilches, 2015).

According to Cebrian, Marcus and Humphris (2014), Sustainability in Higher Education (HE) is very important and has had an increasing global support. It is apparent that the Nigerian HE should not be seen to be unconcern, but to join the quest for a global sustainable concern.

The introduction of ESD is not to be seen as a temporary measure but as a cultural and structural change to what has been the practice (Tilbury, 2012). This change must introduce approaches that improves the curriculum, the campus day to day operations and to strategize its research output and actions to have a positive impact on the surrounding community (Barth and Timm, 2011; Müller-Christa et al., 2014). In furtherance to these, the development of a sustainable vision for any University requires clearly defined; mission, objectives, strategies for the implementation of a sustainable curriculum and research (Cebrian, Marcus and Humphris, (2014). Also to the strategy need to reach out to all stakeholders who are relevant, the University itself and to the student during and in their future practices (Velazquez, Munguia, Platt, and Taddei, 2006).

2.3 The potentials of ESD in advancing sustainable architecture

It is clear from the preceding sections that ESD is increasingly being acknowledged as the means to sustainability and with significant potentials as opportunities for advancing sustainable architecture.

Education is the main channel for disseminating information, having the power to influence and re-orientate the mind-set of its recipients (Allu, 2016). The curricula of a university system or Higher Education (HE) can be controlled to suit a purpose that would have an impact on; present and future practices and serve as an agent to the society (Cockrell, 2010; Thomas and Day, 2014). Also, the premise for the decade or sustainable education was aimed at achieving global sustainability through education as the most effective means. This assertion was informed from the UNESCO Report quoted below;

> *...seeks to integrate the principles, values, and practices of sustainable development into all aspects of education and learning, in order to address the*

> *social, economic, cultural and environmental problems we face in the 21st century.* (UNESCO, 2010 p.4)

Suffice to note that environmental challenges have become a common reoccurring event in Nigeria like many other part of the world (Ojuibo, 2010; Allu, 2014) and anthropogenic activities mostly from the built environment have been identified as a major cause of these challenges and problems (Dixon, 2010). Therefore, the need for practices within the built environment to act sustainably is important (UNESCO, 2010; Capuzocca and Sarni, 2012), and this can be guided through sustainable education (Zuo, Leonard and Beach, 2010; Leslie, 2012). While other researchers have argued that sustainable education for the built environment professionals are most effective at the university level (Lukeman and Glavic, 2017; Leal and Manolas 2012, Allu, 2016). Thus, the necessity to pursue sustainable education and training for these professionals.

Consequently, in line with the aforementioned argument western universities have shown their commitment by ensuring that all environment related courses have sustainable education integrated into their curricula (Barth and Timon 2011; Lazano, Lukman, Lozano, Huisingh, and Lambrechts, 2011). Furthermore, architectural education in particular has been given much commitment in this regard (Zuo et al., 2010; Leslie, 2012). Following this commitment, it has been observed that, practices of the beneficiaries have greatly improved over those without sustainable education training. This is because the latter has value added training, increased capacity to apply acquired skills and better innovative applications to their practices (Capuzocca and Sarni, 2012; Kamal and Asmus 2013).

In another similar study, Demirkan and Afacan (2012) noted that sustainable education bridges that gap between taught courses and design studio courses. The UN Final Report (2014) on the scorecard on the Declaration of the Decade of sustainable education revealed that architectural education curriculum has been adapted successfully by many western universities. Yet, the story is not the same for Nigeria.

Sustainable development provides the ability for proactive productive solutions to environmental complexes in its application and practices. The application of sustainability offers HE as a catalytic systematic change for development is a necessity. Adomssent, Godemann, and Michelsen (2007) also viewed sustainable development education as an education that provide specific and flexible solutions seeking agendas for environmental protection through the education. Other advantages of sustainable education are:

Firstly, universities are to guide, to transform, disseminate and apply the principles for sustainability within its practices and to influence its surrounding communities (Sterling, 2004; Kehm, 2004; Kamal and Asmus 2013). Secondly, integrating Sustainable Development Education encourages diversity, links and interactions of various dimensions for progressive learning processes for the future professionals. Accordingly, the evaluation study conducted in Schools of Architecture in Turkey, students who were guided to reorient and focus on sustainable solutions were observed to ready to transfer their knowledge to their studio design course, tagged ‘applied studio’ and are well able to perform with the environmental challenges and their professional expectations in the labour market (Ertas and Tas, 2015). Otherwise, the students would have a traditional architectural education, a dis-jointed studio course from other taught course and are likely to perform as expected with their pairs from other Schools of Architecture where sustainable ESD was part of their training.

Thirdly, “Rethinking Universities" is a slogan used for commitment of such Universities to the sustainability agenda. In Africa, Central University of Technology (CUT) which is considered a small University is also a member of this commitment amongst other

universities. This suggest that, it is not just a Western ideology and that it is possible in Africa.

Fourthly, sustainable education at the universities help to address the contradictory environmental demands and thus, sustainably taking is considered a productive integration that addresses conflicting demands and purposes (Krucken, 2011).

Finally, the universities are seen as a change agent (Finlay and Massey, 2012) and a catalyst for sustainable actions rather than those that block positive change (Brennan et al., (2004).

Gomera (2011) gave a sound reminder that people within the university community would require the knowledge and understanding of sustainability and the consequences of unsustainable actions, before they are able to change their attitude and influence others positively. As a follow-up to this assertion by Gomera (2011), a qualitative study on sustainability and architectural education carried out by Allu (2014a) has established that there is limited knowledge of sustainability and its application amongst the interviewees who participated in the study although, they were architectural educators. This revelation has led this discourse to further uncover what other challenges are likely to slow down the advancement of sustainable architectural education in Nigeria.

2.4 Challenges for ESD in advancing sustainable architecture

It has long been established that, Architecture is a multidisciplinary profession. The challenges of the environment are also complex and as such, the strategies of surmounting these complexities are not without challenges. Musselin (2007), Adomsent, Godemann, and Michelsen (2007) and Walls and Carovan (2016) assert that any university whose curriculum does not integrate sustainable education is bound to suffer from marginalization and greater competition from compliant universities, unequal international developmental platforms, backwardness, poorly defined solution processes, least diversified norms and values and difficulty in grassy new technologies (Adomssent and Michelson 2006). These negative outcomes should be of great concern to the Nigerian Universities affected by this lack of commitment in the training of its built environment professionals.

Education for sustainability has increasingly influenced all forms of disciplines; this sustainable agenda caters for the future and therefore, an all-inclusive strategy for sustainable actions. This as was rightly defined by the WCED (1987) as a strategy to promote sustainable solutions for the present and with a consciousness for the needs of the future generations.

The challenges of sustainability in general is that of a seemly non-clarity in the definition of what sustainability is and what its concepts are for applications (Altomonte, 2012). This study concluded that the inherent lack of conceptual clarity, within the realm of education exposes its lapses and thus, suggesting a danger that whatever emerges is essentially reliant on a superficial consensus predicated upon the potentially prescriptive aims of education for sustainability.

Several scholars' perceptions on sustainability education in the architectural education also suggest that a clear understanding and articulation of sustainability is foremost and the premise for design solutions must be prescriptive, ethical, value adding, motivational and to have a sustainable approach (Graham et al., 2007; Graham, 2008; Timmer and Mercalte, 2009; Altomonte, 2012).

In a mixed concurrent research, which was conducted by Allu (2014), amongst the private, public and built environment professionals in the academics Nigeria, revealed that about 51% did not even understand the workings of sustainability. Thus, agreeing with the

earlier researchers and validating Altomonte (2012) whose conclusion points to the fact that sustainable education training may suffer a setback when even the educator/trainers are not well knowledgeable themselves on what sustainability entails.

Additionally, the challenge of motivating the Lecturers and students to readily adopt the shift for sustainable approaches to architectural design may be difficult (Altomento, 2012), for change does not always come easy. Yet, the sustainable agenda is not a matter of option in the face of the environmental challenges being experienced globally. Nigeria is not an exception to the many environmental catastrophes that may be mitigated and adapted sustainably (IPCC, 2007; Ojuibo 2010; Ebohon et al., 2013; Allu, 2014).

A major challenge for education in developing countries has been observed to be in the arena of political incorrectness and financial limitations (Adomssent, Godemann, and Michelsen 2007). Thus, posing a major challenge particularly for the architecture students, their educator and the professionals already practicing.

Although the environmental challenges are global, the need to develop specific curricula for contextual peculiarities is eminent. Case studies were carried out on developing countries in Asia and India were Kishani and Ng (2011) in their study on educating the Architect suggested that the integration of sustainable taught courses and the design studio approaches and processes technique is relevant for harmonising knowledge and its application for the architectural training.

The challenge therefore, for the Universities in Nigeria is to agree firstly, to take up the commitment for sustainable training and education. Secondly, to agree on a definite process that encompasses a pedagogical approach that adds value to architectural education and build the capacity of architectural educators. These value-adding processes are achievable by adopting relevant case studies and agreed consensus on a specific contextual Nigerian sustainable architectural education curriculum formulation.

3. CONCLUSION AND RECOMMENDATIONS

This study supports the ESD agenda because it leads to sustainability of the built environment by advancing sustainable architecture. Advancing sustainable architecture requires the appropriate training, tools, techniques and the reorientation of the trainees and practitioners to consciously adapt and apply processes that are sustainable to their design. This makes it a necessity for sustainable compliant curricula for the Nigerian architectural education. Thus, the paradigm shift for a sustainable prescribed design solution requires a proactive transformation of the Nigerian architectural education curriculum. The treatise discourse also revealed that the commitment to ensure sustainable actions, which are taken through sustainable education, is not to be taken lightly to ensure that the advancement of sustainable architecture is not an option.

As much as the onus of ensuring sustainable architectural education is on the educators and educational system, the government, legislation and the financial commitment are also necessary. However, role of the architectural educator is to equip and prepare the students with the right (sustainable) training, thinking and tools for sustainable holistic practice.

This study recommends that the architectural educators take the challenge to support the advancement of sustainable architecture through supporting the integration of ESD into the curricula of architectural education. Where it is obtainable, it is important to re-evaluate and upgrade where necessary and to encourage continuous professional development in this regard. This discourse also intends to spur researchers to contribute to the arguments therein for possible legislation and adoption by the Nigerian Institute of Architects (NIA) for possible regulation by the Architects' Registration Council of Nigeria (ARCON).

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INFLUENCE OF PROPERTY CHARACTERISTICS ON EVENT CENTRES' RETURNS IN AKURE, NIGERIA

***Nnaemeka B. Ezeokoli*[1]**
Department of Estate Management, Federal University of Technology, Akure, Nigeria

ABSTRACT

Purpose: The importance of event centres to the functionality of a city has given birth to the study of the physical and functional qualities of event spaces, and their suitability for the proposed functions that are supposed to take place in them. This study thus aims at examining the effect of property characteristics on the returns from event centres in Akure, Ondo State.
Design/methodology/approach: To achieve this aim, 18 event centres in Akure were examined, noting their physical attributes through well-structured questionnaires. The data collected were analyzed using multiple regression analysis in order to measure the effect of the explanatory variables on the dependent variable, i.e. event centers' income returns.
Findings: The finding revealed that out of the selected property characteristics, the number of convenience i.e. toilet facilities in an event centre and distance of event centres to a major road significantly affect the returns from event centres at 0.007 and 0.030 levels of significance respectively.
Originality/value: It is recommended that the investors in event centres should ensure proper placement and positioning of event centres and their physical attribute during development, because these can have long term effect on the patronage of event centre, and hence, the returns from such centres.

Keywords: Event centre; income returns; influence; investors; property characteristics

1. INTRODUCTION

Event centres are properties that generally have physical and functional conditions that influence social interaction, comfort, security, and attract people to the settings (Lang, 2005). The physical and functional qualities of event spaces are related to physical amenities, the activities, accessibility conditions, and the surrounding land-use that support the activities there. Accordingly, Yusrafarah (2009) is of the opinion that great public spaces are the living room of the city i.e. people come together to enjoy the city and each other's company. Furthermore, the combination of beautiful architecture with great public space creates the most beautiful place to live. It expresses a life of richness and tradition, and act as a setting for life to happen. The relationship between the public spaces to significant building is symbolic as well as functional.

[1]nbezeokoli@futa.edu.ng

According to Kofoed-Pihl (2009), event centres as a new commercial real estate asset class is becoming a playground for numerous investors, corporations and managers that are looking for long term investments due to its unique and heterogenic character. However, the asset also has wide-ranging qualities e.g. it is a good source of diversification, and a generator of attractive risk-adjusted returns through its low risk and high Sharpe Ratio (i.e. an average return earned in excess of the risk free rate per unit of total risk). It offers opportunities for hedging against unexpected inflation and finally, it is regarded a strong cash flow generator through the income component of the return.

Event centre investment has become a good investment most especially in the urban areas due to large population of high income earners residing in the urban areas, but the income generating ability of this investment can also be influenced by several factors such as location, accessibility, feature and facilities available in the event centre, the investment environment among others. Accordingly, the ability of event centres to generate returns that varies as a result of varied level of patronages gives it an edge over other forms of real estate investment depending on the ability of the investor to harness the appropriate factors (microeconomic) that will attract such patronage (Ezeokoli, 2015).

Accordingly, reception venues come in varying degree of sizes and glamour depending on the usage. The characteristic of a particular event centre depends on the use to which the owners want to put it. It can be used as a conference venue, seminar and training centres, reception venues for ceremonies and social gathering as well as a banquet centre. Nevertheless, whatever use to which the centre is put, there are some features that make it distinct from other commercial properties. Braun (2011) observed that it is essential for a contemporary hotel lobby, which serves as a gathering place for social interactions, to adapt to the customers' needs and develop innovations and products to enhance the quality of the service environment. The returns are mostly influence by location and available facilities factor, the sociability of the people, decoration and goodwill (Ezeokoli, 2015).

Therefore, this study is aimed at analyzing the effect of property characteristics on the returns from event centres Akure. The research objectives are to examine the characteristic of event centres in Akure, analyze the trend in rate of returns from the event centres, and investigate the effect of the property characteristics on the rate of returns of event centres in Akure.

2. LITERATURE REVIEW

The evolution of event centre developments dates back to the United Kingdom in the early centuries. According to Roger (2003), its origin of the UK conference lie in political and religious congresses, while that of America was the trade and professional association conventions. Toulmin (1995) observed that the purpose of fairs has changed in Britain as the year advances by selecting suitable elements of the traditional festivals, which attracted much people, and adapting them to what is mainly operated for enjoyment, with rides, sideshows and stalls. However, things took new shapes as there were developments of meeting places, which started with public halls, churches, market towns and guide halls. Then more recently assembly rooms, town halls and the likes developed. These were all developments by the community (Bowdin, Allen, O'Toole, Harris and McDonnell, 2006).

Many researches focused on event tourism, industry and event managements (Davidson and Cope, 2003; Tambe, 2004; Bowdin et al., 2006). Only few focussed on the event centres. And the factors that affect their performances. For instance, Project for Public Spaces (2009) evaluated thousands of public spaces around the world in order to know the factors that make some successful and others fail. It was found that a successful public place is accessible, people engage in activities there, the space is comfortable with good image, and finally, it is a place that encourages social interaction among people. Accessibility of a place can be judged by its connections to its surroundings, both visual and physical. A successful public space is easy to get to and through; it is visible both from a distance and up close. Apart from the aforementioned characteristics, conference venues are especially built to meet the requirements of the corporate events. They are meant for providing world class facilities under a single roof. Thus, a perfect conference venue, which is crucial for a successful event, should possess certain characteristics, which has to be in complete agreement with customers' requirements.

The return on any real estate investment is a function of the combination of many factors that begin from the environment in which the investment is located, to economic factors, and nature of market, available facilities as well as accessibility of such property (Ataguba, Olukolajo, and Falana (2013). Baum (1991) identified three major factors that determine the return on any rental property as economic factors, location factors and property factors. These three factors arise out of the basic nature of properties. Hardin and Wolverton (2000) examined the micro-market determinants of neighbourhood centre rental rates in Atlanta. The study employed regression model to measure how market, draw (attraction), lease and location affect the rental rate of centres. The finding suggests that the primary trade area purchasing power is of essence in predicting centre's rental rate. Also, Swarbrooke and Homer (2001) opined that a successful conference centre must be designed in such a way to meet the needs of the clients or customers, while Kruger (2006) examined key success factors in managing a conference centre in South Africa, and concluded that a conference centre cannot be managed successfully without the necessary human resources. These resources will attend to the operational details of the centre such as the design aspect of the conference centre, catering services, technical facilities and support activities.

Roubi and Littlejohn (2004) developed a hedonic valuation model for hotel properties in the UK, and concluded that hotel property return is a function of the local economic condition, location (prosperity of the area, general access to tourism business/commerce and travel infrastructure) and location (immediate proximity to facilities and positioning in the local environment, the facilities available in the hotel and meeting room standard. Thus, physical and economic attributes of any centre ought to be such that will satisfy the users. While Olayiwola et al. (2006) noted that accessibility is one of the factors that determine the return on property, the parametric portfolio approach of Brandt, Santa-Clara, and Valkanov's (2009) hedonic model was used by Plazzi, Torous and Volkanov (2011) in trying to exploit property characteristics in commercial real estate portfolio allocation. By relying on a data set from NCREIF of commercial property from 1984 to 2009, the study considered variables such as property location and types, income, cap rates, values, vacancy rates, which are property specific factors, as well as some macroeconomic factors. The study found that optimal portfolios are influenced more by high capitalization rate, highly leveraged and low vacancy rate of properties, and away from properties with high values. Though, these vary with property types and also with the prevailing economic conditions.

However, Abidin (2010) concluded that the major factor that contribute to any event space is how accessible it is in terms of time and mobility. The finding is in conformity with that of Olayiwola et al. (2006) on accessibility as a return factor. Other factors could

be socio-cultural factors such as the population of the city, occupational or level of education of the people in such environment where the property is located. Furtherance to this, Kim et al. (2012) found out that the location factors that influence rental properties include five main variables, viz: accessibility, visibility of the property, traffics, the location of the property within an urban area, and the presence of other complementary properties. Accessibility is the general convenience of local transportation environment to the premise, while visibility is the ability of potential customer to enjoy unobstructed view of the property or sign from a number of vantage points.

The physical attributes and the type of activities carried out in an event centre has to a large extent defined such a centre. Babatola and Ojatula (2014) analyzed the growth trends and service characteristics of event centres in Lagos in order to determine the strength of correlation between selected attributes of the event centres and their inter-centre competitiveness. The result shows that there is a high level of competitiveness in Ikorodu market, which is a rural area compared to Ikeja that is already built up. Due to this competitiveness, the prices charged are relatively lower than where there are lesser competitions. Also, the event centres are not as sophisticated as those found in Ikeja and Eti-Osa. Considering the activities carried out in event centres, Ezeokoli (2015), while examining the prospect of investing in event centre in Akure, concluded that most of the centres in Akure are used for conferences, seminars, wedding ceremonies, church activities and political meetings. Furthermore, the researcher noted that people are willing to make use of centres for social activities especially when they are well located and the charges are not too high, and these have great implication on the total return from event centres. Excellent interior setting, good accessibility to event centres, location in serene environment with low population density, which is essential to save the guests from any discomfort related to traffic jams, and a good parking space for cars; are all essential factors for successful event centre.

Sakip, Norizanand and Siti (2014), while considering the factors that determine the success of any public park in Malaysia suggests that the key determinants are general accessibility and linkage (GAL), sociality (SOC), Degree of comfort and image (DCI) and user and social activities. Tabassum and Sharmin (2013) noted that public parks with proper accessibility and well connected with its surrounding area can improve the value of park environment and can enhance community development and social bondage. It means that with good design layout, clear signage for direction and good facilities provided, social activities will be enhanced. The study of Ezeokoli (2015) on the prospects of investing in event halls in Akure employed a descriptive approach (Weighted Mean Average) by seeking the opinion of the managers of thirteen (13) event halls on the factors that influence the performance of the halls. The study found some germane factors that are mostly property characteristics of the centres. However, an empirical study backed by an inferential statistics is required to substantiate the validity of those factors. Therefore, this research work will look in that direction by employing a more appropriate approach in measuring the effect of property specific characteristics on event centre's return in Akure.

3. METHODOLOGY

This study focuses on the effect of property characteristics on event centre's rate of returns in Akure. The study is based on primary data gotten from the managers of event centres in Akure. A reconnaissance survey of the study area shows that there are twenty four (24) event centres in Akure with different designs and capacities, and scattered around

the town. In the course of data collection, twenty four (24) structured questionnaires were administered on all the managers of these centres, while only eighteen (18), which represents 75% of the total population were retrieved and fit for analysis. The physical characteristics of the centres were examined and measured against the average annual returns from the centres. Both descriptive and inferential statistics were used to identify and analyze the effect of the selected property characteristics on the event centre's returns.

Regression analysis is the general process of predicting one variable based on another variable. It may also be said to be a technique that will find a formula or mathematical model which best describes data collected (Mason and Perreault Jr., 1991; Mason, 2012). Therefore, the relationship existing between the dependent and independent variables was defined as:

$$Y = \alpha + \beta 1Nuconv + \beta 2Typsec + \beta 3Madvert + \beta 4Mecharg + \beta 5Distmaj + \beta 6Adjprop + \mu$$

α = Constant

β = Beta coefficient of variable i measuring the amount of change in Y associated with a unit change in the independent variables

μ = the error term that is assumed to be associated with the Variables.

The assessment of the formulated models was done with the view to establishing how appropriate they are for use and for further studies. Results of the models will be evaluated based on: the correlation coefficient (R); the coefficient of determination (R2); the significance of the regression equation (F-ratio); and the Residual Analysis.

Table 1: Operationalization of variables

Variable code	Description of variable	Measurement
NUMCON	Number of conveniences in the centre	"5" if above 6 conveniences "4" if between 5-6conveniences "3" if between 3-4conveniences "2" if between 1-2conveniences "1" if no convenience
TYSEC	Type of security hired by the centre	"4" if armed policemen "3" if corporate outfit "2" if hired men "1" if no security
ADVERT	Means of advertising the centre	"4" if through media '3" if through billboard "2" if through flyers "1" if no advertisement
MECH	Method of charging for an event	"3" if per proposed attendance "2" if per event space "1" if per event
DISTANCE	Distance of centre to a major road	"4" if above 60 meters "3" if between 40-60 meters "2" if between 20-40meters "1" if between 0-20meters
ADJPPTY	Type of adjoining property	"3" if industrial property "2" if commercial property "1" if residential property
INCOME	Annual income	Actual in Naira

4. RESULTS AND DISCUSSION

The background information of the respondent in this regard is basically the academic qualification of the respondent, and this is done so as to determine the validity of the data provided for this research.

Table 2: Academic qualification of respondent

Academic Qualification	Frequency	Percentage
SSCE	2	1.1%
OND/HND	7	50%
Bsc/BTech	9	38.9%
Total	**18**	**100%**

Table 2 shows that majority of owner/manager of event centre in the study area are graduates of universities, this is the reason for the improvement in the relationship between the managers and the customer. Also, it helps during the course of this research as most of the respondent willingly provided the data that are needed.

Table 3: Distribution of event centres according to capacity, year built and year operation commenced

Name of event centre	Capacity of centre	Year Completed	Year operation commenced
Ade-super Centre	500	1995	1996
A&T Centre	1500	2006	2007
Castle Crown	1000	2009	2010
B-Kay Event Centre	2000	2009	2010
BTO Centre	2000	2005	2006
Elephant Centre	700	2011	2012
EssbeeCentre	1500	2009	2010
Fafun Event Centre	3000	2014	2014
Font Centre	2000	2007	2008
Helena Centre	500	2009	2010
Governor Centre	2000	2008	2009
JosemillaCentre	1750	2004	2005
NULGE Centre	500	1998	2000
Ruby's Court	850	2012	2013
St Thomas Event Centre	2500	2013	2014
Swan Centre	1500	2003	2004
Zion Gate Centre	200	2007	2008

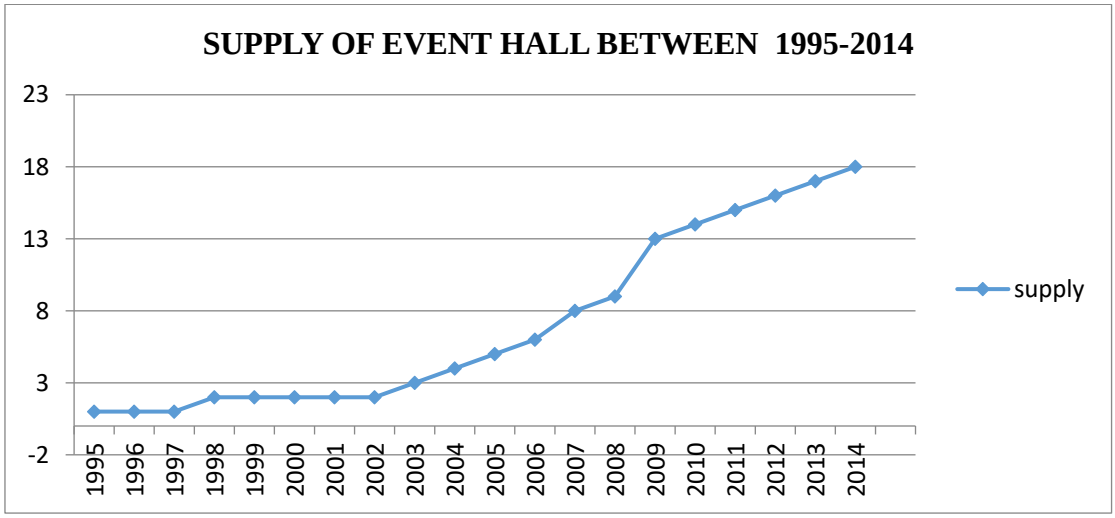

Figure 1: Trend in the supply of event centre between 1995 -2014

From Figure 1 above, event centre supply in Akure has just started experiencing growth in recent years. For instance from 1995-2003, only 2 event centres were supplied, but the supply experienced growth in 2009 where 4 event centres were supplied. However considering the population of the city of about 453,731 people as at 2014 (Emmanuel & Fasakin, 2017), the socio-cultural characteristic of the city as well as the socio-economic features of the dwellers with a total number of 24 event centres available for leasing, it could be concluded that event centre is a good investment, as the number of available centres is low compared to the features of the city aforementioned.

Table 4: Type of event held at the event centres in Akure

Type Of Event	Very Often	Often	Seldom	Never	Mean	Rank
Wedding	14(77.8)	3(16.7)	1(5.6)	-	3.7222	1st
Conference	9(50)	6(33.3)	2(11.1)	1(5.6)	3.2778	2nd
political meeting	9(50)	6(33.3)	2(11.1)	1(5.6)	3.2778	3rd
Seminar	8(44.4)	5(27.8)	4(22.2)	1(5.6)	3.1111	4th
Others event	7(58.9)	7(38.9)	3(16.7)	1(5.6)	3.1111	5th
religious event	3(16.7)	3(16.7)	11(61.1)	1(5.6)	2.4444	6th

Table 4 shows the ranking of event mostly held in event centres in the study area. The result shows that wedding is the event mostly held as it was ranked 1st with the mean score of 3.7222. It could be said that social gathering is a major purpose of using the centre. This could be attributable to socio-cultural characteristic of the city as the city is renowned for its social stand (Afe, 2012). Conference and political meetings were ranked 2nd and 3rd with the same means score of 3.2778. The reason could be as a result of the city being an administrative centres and government seat where all political events take place.

Furthermore, seminar and other events were subsequently ranked 4th and 5th respectively. The other event in this regard which as detailed in the questionnaire are birthday and burial ceremony, while the least rank of the event is religious event with a mean score of 2.444 and this is because religious activities in the study area are mostly held in churches, and in case of large religious gathering, open space are preferred.

The characteristic of event centres in the study area analyzed by considering same from type of event mostly held in the centres, numbers of time events are held in the centres in a

month, number of available conveniences in the centres, type of security mostly used in the centres, means of advertisement and if media is an advertisement means, then the frequency, method of charging for an event as well as charge per event, distance of centre to a major road, types of adjoining property, other services rendered by the centre and finally the rate of demand. These are presented in the tables 5 and 6 below.

Table 5: Property characteristic of event centres in Akure

Characteristics		**Frequency**	**Percent (%)**
Number of conveniences at the centres	1-2 Conveniences	2	11.1
	3-4 Conveniences	4	22.2
	5-6 Conveniences	6	33.3
	Above 6convenience	6	33.3
	Total	**18**	**100**
Type of security hired at the centre	None	2	11.1
	Hired Men	5	27.8
	Corporate Outfit	11	61.1
	Total	**18**	**100**
Distance of Centre to major road	0-20 Meters	14	77.8
	20-40meters	2	11.1
	40-60meters	2	11.1
	Total	**18**	**100**
Type of adjoining properties	Residential Property	6	33.3
	Commercial Property	8	44.4
	Recreational Property	2	11.1
	Industrial Property	2	11.1
	Total	**18**	**100**
Rate of demand for the Event Centre	High	2	11.1
	Average	9	50
	Low	7	38.9
	Total	**18**	**100**

From the information gathered regarding the features of the centres in table 5 above, it was revealed that most of the centre hired the service of a corporate outfit security with a percentage of 61.1%, who do not use fire arm as Akure is relatively peaceful and does not need armed policemen at event centres who might scare guest away.

In the case of distance of event centres in the study area to a major road, 77.8% of the centres are within 0 – 20 meters of a major road. The reason for this being that location and accessibility are the major factors in building an event centre in a particular location as most of the investors believe that building an event centre in a location where it can be easily seen is better than advertising the centre, the rest are within 20-40 meters and 40-60 meters of a major road.

It was also revealed that 44% of the centres were surrounded by commercial properties and 33.3% of residential property. Furthermore, 55.6% of the centres rendered other service aside centre leasing, which include restaurant, accommodation, interior decoration and hotel accommodation. Finally the rate of demand for the centre shown on the average by 50% of the respondents, 38.9% low and 11.1% high, which mean half of event centre owners in the study felt that the rate of demand for event centre in the study area is on the

average. This could be attributed to current economic stand and the socio-economic characteristic of the study area.

Table 6: Management characteristic of event centres in Akure

Characteristics		**Frequency**	**Percent (%)**
Means of advertising the centre	None	8	44.4
	Flyer	2	11.1
	Billboard	5	27.8
	Advertisement Media	3	16.7
	Total	**18**	**100**
Numbers of times events hold in a month	1-2times	11	61.1
	3-4times	6	33.3
	5-6times	1	5.6
	Total	**18**	**100**
Method of charging for an event	Per Event	14	77.8
	Per Space	2	11.1
	Per proposed attendance	2	11.1
	Total	**18**	**100**
Charge Per Event	N20,000 - N50,000	1	5.6
	N51,000 - N80,000	4	22.2
	N81,000 - N120,000	4	22.2
	N121,000 - N160,000	4	22.2
	N161,000 - N200,000	1	5.6
	Above N200,000	4	22.2
	Total	**18**	**100**

Table 6 reveal that most of the centres in the study area host events 1-2 times in a month and this has a percentage of 61.1%, while the number of convenience in most of the centre are either 5 or above. This is to ensure that the customers' or guests could easily use the convenience as often as desired Furthermore, 44.4% of the centres sampled do not employ any advertisement means, billboard and flyer as an advertisement means were only employed by 27.8% and 11.1% while the use of media was employed by 16.7% of the accumulated 55.6% of the owners/managers of event centres that advertise their centre. Evidence from the respondent also established that 78.8% of the event centres charge per event while per space and per proposed attendance are only employed by 11.11% respectively. Based on the finding, evidence suggested that the rental value per event in majority of event centres in Akure falls between N51, 000 – N160, 000 as 66.67% of the centres fall within this category while 22.2% of the centre charge above N200,000. The last categories are within N20, 000 - N50, 000 and N151, 000 – N200, 000 respectively.

4.1 Factors that determine the returns of event centres

Respondents' opinions were sought on the factors that determine the return of event centres and hereby discussed in the table below.

From Table 7, the basic factors that determine the rate of return of event centres are shown; the various responses have been assessed, presented and ranked for better meaning and interpretation to the research. From the table the most ranked of the factors are good location of centre and easy accessibility from major road with both having a mean score of 3.6111. This conforms with the finding of Olayiwola et al. (2006) and Ezeokoli (2015) that accessibility of a venue is very crucial to the success of a centre. It needs to be accessible by car or bus. The roads toward the venue should be clear, as this is essential to save the guest from any discomfort related to the traffic jams if the guests travel by car. The location

factor could be an attribute of being located in secured environment or/and a location where it can be seen by everybody most especially those travelling by car. Also accessibility plays an important role in determining the return as every user will want an event centre that can be both easily accessible by guests that come with car, so as to reduce the difficulty of getting to the centre and the ones without car so as to enhance the ease of getting a taxi or cab.

Table 7: Factors that influence event centres' returns in Akure

Factors	Mean	Rank
Good location of the centre	3.6111	1st
Easy Access from major road	3.6111	1st
Availability of modern facilities	3.5556	3rd
Good and spacious Parking space	3.5000	4th
Good design of the centre	3.4444	5th
Availability of Convenience	3.3889	6th
Size of centre	3.3889	6th
Interior Decoration and settings of Centre	3.2222	8th
Discount on Charges	3.1667	9th
Friendly attitude of the manager and workers	3.1667	9th
Charges per event	3.1111	11th
Goodwill of the event centre owner	2.8333	11th
Availability of adequate Security of life and property of user	2.8333	13th
Good Event planner	2.7222	14th
Adjoining Property	2.2222	15th
Advertisement of the Centre	2.1111	16th

Where HS=Highly Significant, S=Significant, LS=Less Significant and NS=Not Significant.

Availability of facilities such as air conditioner, electricity etc. and good parking space were also regarded as determining factors and were ranked 3rd and 4th with mean scores of 3.556 and 3.50 respectively. This is consistent with the finding of Ezeokoli (2015) that guests would not want to stay in centres where the available facilities are antiquated or have suffered functional obsolescence but an event centre that meet the current standard.

The two least ranked factors with the rank of 14th and 15th are types of adjoining property and advertisement of centre with the mean score of 2.2222 and 2.1111 respectively. This means that advertisement and adjoining property has less influence in determining the return of event centre in the study area and this is due to socio-economic status of the resident of the study area in terms of education status or the percentage of the people in the study area without formal education.

4.2 Effect of property characteristics on event centres' annual returns

Having considered the various characteristic of event centres in the study area, it is thus expedient to investigate the relationships that exist between the annual income of the event centres and their major characteristic. On this note, regression analysis was carried out to determine the relationship that exists between the total features and the annual returns of the event centre. Using the returns of 2014 as the dependent variable, the type of adjoining property, means of advertising the centre, method of charging for an event, distance of centre to a major road, type of security hired by the centre, number of convenience at the

centre were selected as the independent variables in order to measure their influence on the annual return.

Table 8: Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.882[a]	.777	.656	2.0175410

From the Table 8 above, it can be deduced from the correlation coefficient (**R**) that there is a strong relationship of 88.2% between the characteristic of event centre and it annual income while it was also established that the major characteristic account for 77.7% of every change in the annual income of each event centre with R-Square equal 0.777.

The analysis of variance carried out in this analysis is to determine the significance of this model in predicting the relationship.

Table 9: Analysis of variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	156.099	6	28.017	6.392	.004[b]
Residual	44.775	11	4.070		
Total	200.874	17			

Table 9 above, show that the model is a good predictor of the relationship between the characteristic of event centre and the income level, this is gotten when F-calculated of 6.884 is higher than the F-tabulated of 6.392; hence, the null hypothesis is thus rejected for this model.

The model coefficient table shows the significant level of each dependent variable which are number of convenience, type of security employed by centres, means of advertisement, method of charging for an event, distance to a major road and type of adjoining property to the overall change in the income level as well as the contributing effect of each variable when other variable are held constant, and this could either be positive or negative.

Table 10: Model coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	12.875	2.634		-1.091	.298
NUCONV	1.886	.572	.649	3.299	.007*
TYPSEC	.029	.751	.007	.039	.970
MADVERT	1.154	.561	.382	2.058	.064
MECHARG	.634	.870	.127	.728	.482
DISTMAJ	-1.946	.780	-.388	-2.496	.030*
ADJPROP	1.122	.777	.218	1.445	.176

The Unstandardized coefficient column (B) in table above shows that while holding all variable constant, increase in the number convenience, change in means of advertisement and change type of adjoining property has a positive effect on the change in income level. And this given by the formula:

$$Y=12.872+1.886Nuconv+0.029Typsec+1.154Madvert +0.634Mecharg -1.946Distmaj + 1.122Adjprop +e$$

For instance holding all other variable constant, one (1) unit change in number of convenience will increase the income level by 1.89%, while a unit change in the means of advertisement and type of adjoining property will also cause a change of 1.154 and 1.122 respectively in the income level. Finally, an increase of 1unit change in the distance of the property from the major road will have a negative effect of 1.946 in the income, which is still congruous with the ranking of the factors determining the return of event centre as provided by the respondent. It can thus be concluded that accessibility of event centre via a good transport route is a major factor in determining a change in the income level of event centre as established by the model. It was also establish that the number of convenience and the distance to major road are highly significant in determining the change in the income of the event centre as both of the characteristic are having a p-value less than 0.05. However, means of advertisement is slightly insignificant at a p-value of 0.064.

5. CONCLUSION AND RECOMMENDATIONS

This study has examined the characteristics of event centres in Akure town, and the implications on the rental returns from the investment. Most of the event centres have been discovered to have more than four (4) conveniences which can serve the users, and are between 0 – 20 metres of the major transport route for easy accessibility. However, the demand rate has been for these centres have been on the average. This study further highlighted some of the factors that influence the rental returns of the event centres as good location of the centres, accessibility from the major road, availability of modern facilities, good and spacious packing spaces available for users, good design, adequate toilet facilities (conveniences) as well as the size of the centres (capacity). However, The regression of event centre's returns against the property characteristics revealed that number of conveniences (i.e. toilet facilities) provided in the centres and distance from the major transport routes have statistically significant effect at 0.05 levels on the event centre's returns in the study area. It therefore means that development of event centres without due consideration for the nearness to the major road and other physical characteristics of the property type could lead to poor performance of the investment.

Thus, in order to maximize returns from event centres (which is the aim of every prudent investor), the investors are advised to develop adequate event centres having good designs, enough conveniences, packing spaces, in good location, and with adequate facilities that will draw the attention of the end users. The proper placement and positioning of event centres and their physical attributes will increase the rate of demand or patronage, thereby increasing the level of returns from the event centres.

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ACTION RESEARCH AS A PROACTIVE APPROACH FOR WASTE REDUCTION IN STRUCTURAL DESIGN PHASE OF CONSTRUCTION PROCESS

A. Aka [1], F.A. Emuze[2], E.T. Kaase[3] and M. Marafa[3]

[1]Department of Building, Federal University of Technology, Minna, Nigeria
[2]Department of Built Environment, Central University of Technology, Bloemfontein, South Africa
[3]Department of Building, Waziri Umaru Federal Polytechnic, Birnin Kebbi, Nigeria

ABSTRACT

Purpose: Research in construction engineering and management requires practical research approaches. However, the literature indicates that limited attention is focused on this issue and the methods used by most researchers are mainly quantitative surveys or case studies. In order to bridge this gap, this paper investigates how a proactive approach such as action research (AR) can be effectively adopted as waste identification and reduction in the structural design phase of the construction process. In other words, the paper explores the application procedures of AR as a data collection approach in South African consulting engineering firms.

Design/methodology/approach: This was achieved by conducting action research in five selected consulting engineering firms located in Bloemfontein, South Africa, in 2016. The firms that were selected were those that have engineers with extensive experience in the structural design process (SDP), and are affiliated with Consulting Engineers South Africa. In the AR study, waste that is significant with the structural design process (SDP) in South African construction were investigated. The causes of the waste, their frequency of occurrence in different projects and the strategies that can be adopted to overcome the waste were also investigated.

Findings: The findings in the exploratory study indicate that AR is a reliable, structured, and rigorous research approach that can be adapted to identify and reduce waste such as waiting time, design error, over-processing, excessive vigilance, overproduction, and correction/rework in the structural design phase of the construction process.

Practical Implications: The study shows that AR is a suitable approach that can effectively improve collaboration between researchers and industry practitioners for efficient projects delivery.

Originality/value: This paper satisfies all the tenets of originality as it has not been previously published and all the information obtained from other studies have been dully referenced.

Keywords: Approach; construction; design; proactive; process; waste

[1]aka.femi@futminna.edu.ng, akafemi@yahoo.com

1. INTRODUCTION

Construction engineering and management (CEM), by epistemology and axiology, is a "proactive" field as each construction project is an intervention into what exists and thus creates new reality (Azhar et al., 2010). Hence, CEM in its present form, does not prioritize abstraction and extraction of conceptual knowledge, and can be problematic to adequately understand through quantitative survey and case study methods (Benbasat and Zmud, 1999; Kelemen and Bansal, 2002). An approach that is clearly needed in CEM is a research method that can contribute to solution of practical problems and creation of new theoretical knowledge. A method that can be best described as action research (AR) (Azhar et al., 2010).

Action research (AR) is any practical research undertaken by those involved in the practice area (Buchy and Ahmed, 2007; Hughes, 2008). It is a process of enquiry by a researcher into the effectiveness of a particular organisation (Buchy and Ahmed, 2007; Hughes, 2008).

According to Lewin (1948), the idea of AR started when practitioner researchers came across problems that needed immediate attention in their work. Lewin (1948) proposed the first AR methodological framework that was adopted by the practitioners to overcome the problems in their practice. Thus, Lewin (1948) explains AR as a cyclical process of four iterative stages of reflecting, planning, acting, and observing.

Lewin (1948) methodological framework is unique as it produces highly reliable research results, which is grounded in practical action that aimed at solving a realistic problem situation (Elliot, 1994). The method also enables a researcher to effectively conduct a study without interfering with the phenomenon that is being investigated (Naoum, 2001).

Several researchers among which are Elliot (1994), Stringer and Genat (2004), Kemmis and McTaggart (2007), Buchy and Ahmed (2007), Mill (2011), McNiff and Whitehead (2011) have adopted Lewin (1948) AR methodological framework to identify and reduce problems in diverse researches. However, findings in literature show that AR is mainly on areas such as information systems, management, health care development and education studies (Cushman 2001; Hauck and Chen, 1998; Barker et al. 2004; Rezgui, 2007; Azharet al., 2010). The application of AR in engineering sector of construction is scarce in literature. Hence, this paper systematically examine how AR can be adopted to identify and reduce the problems (waste) confronted by structural engineers during SDP.

2. METHODOLOGY

The applicability of AR as a research approach in Bloemfontein consulting engineering firms was demonstrated through the adoption of the framework shown in Figure 1.

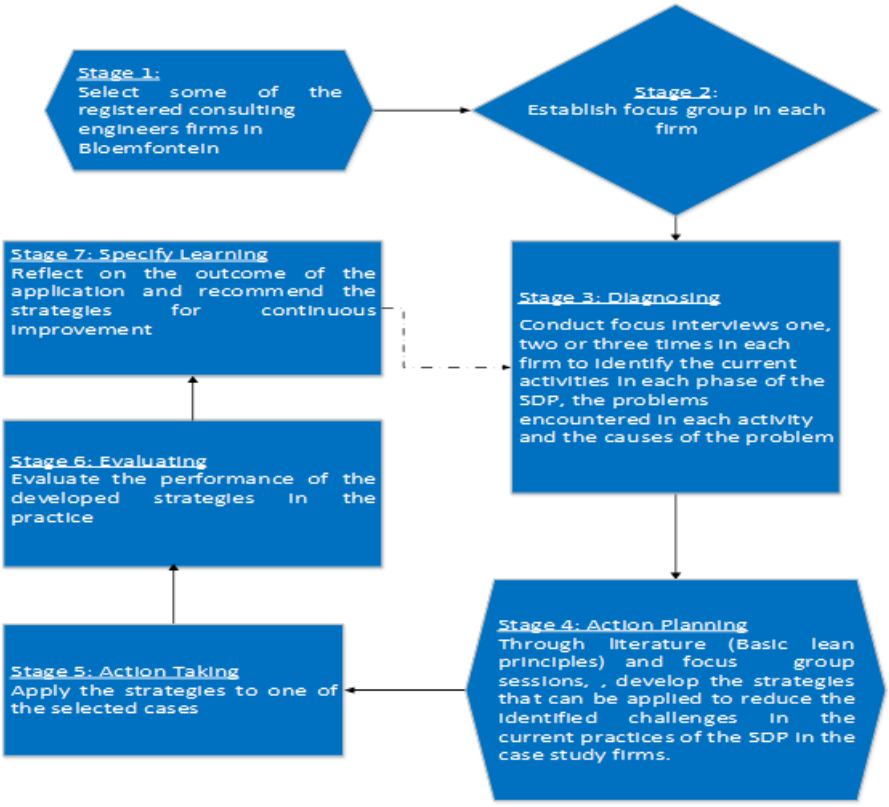

Figure 1: A methodological framework for conducting action research in Bloemfontein based consulting engineering firms (Adapted from Lewin, 1948; Mill, 2011; McNiff and Whitehead, 2011; Stringer, 2014)

As shown in Figure 1, after the establishment of focus groups, focus interviews were first conducted in all the firms so as to understand the current flow of activities in the inception design phase (IDP), the pre-design phase (PDP), and the detailed design phase (DDP) of the SDP (diagnosing phase). Thereafter, another round of interviews was conducted in each firm so as to enable the researchers and the participants in all the groups to propose for different strategies that can be adopted to eliminate the identified waste (action planning phase). For consistency, the focus interviews in each step of the study (diagnosing and action planning) were conducted thrice in each firm. Each focus interview in all the firms was between 60 to 80 minutes in duration. All the focus interviews discussions in each firm were recorded and transcribed. After transcription, the resultant information was analysed using content analysis method (Krippendorff, 2012). The resulting information from the interpreted data (themes) were validated using follow-up interviews, which were conducted by the researchers with the head (the chief engineer) of each group of respondents in all the studied firms.

The next phase of the study as indicates in the proposed methodological framework is the implementation stage. Here, the researchers, and the participants created a change in the activities of the firms by implementing the suggested strategies to the organisation practices. This was achieved by selecting one of the case study firms that had an ongoing project at hand as at the time of this study. The project is located in the region of Johannesburg, South Africa. Hence, the suggested strategies by the participants of the study and the researchers were implemented in the project right from the IDP to the structural design aspect of the construction phase (CP). As a collaborative effort, the

structural engineers in other firms were also involved in the activities specifically at the design stage of the project.

After the implementation stage (stage 5), the researchers and the group members in the firm selected evaluated the changes that were created on the performance of the firm (stage 6), which was based on the executed project. In the evaluation phase, the researchers and the group members in the case firm determined whether the theoretical effects of the adopted strategies were realized or not and whether these effects reduced or completely eliminated the non-value adding activities (NVAA) in the SDP. These were achieved by summoning the group members together at the end of the main activities (structural design related activities) in the executed project, and find out from the group if the quality of the structural activities in the design and the construction phases in the newly executed project has been substantially improved through minimal mistakes or errors. The researchers also found out from the group members if the lead time (LT) formerly experienced during SDP by the team has been significantly reduced, and if the requests for information (RFIs) from the contracting party was also reduced during the structural design related activities in the CP of the new project.

3. RESULTS AND DISCUSSION

3.1. Waste in the inception design phase of the structural design process

From the AR conducted in this study, Table 1 provides the summary of the various forms of waste and their causes in the inception design phase (IDP) of SDP. In the diagnosing phase of the AR exercise, all the respondents in all the firms agreed that the general categories of waste indicated in the table occur virtually in every construction project, with the exception of the waste categories of "ineffective site workflow" and "waiting for the site report", which occur only occasionally. Some of the respondents did not agree that excessive soil test in the IDP is one of the design problems that needs to be addressed, or that requires action by management. The respondents argued that it is mandatory for designers to know the exact bearing capacity of soil in the proposed site, and, as such, they asserted that the professional tasked with this responsibility is obligated to take as many samples as possible during site visits, so as to arrive at a standard or acceptable result that is not compromised.

Table 1: Waste in the inception phase of the structural design process

Waste	Cause
Waiting for fund release from the clients before the start of work	Waiting for fund release before the start of structural work often results in wasted time in most of the studied firms, due to slow decision-making by the client.
Waiting for the start of structural work	This occurs due to late release of project funds by the client.
Ineffective site workflow	Ineffective site workflow or difficulties in accessing the site freely by the various construction actors during the site topographical survey, due to gaps in the topographical survey. Difficulties such as sloping, rocky, valley or high-hill surfaces result in ineffective workflow during this activity.
Several soil tests/site visits	The site soil test may have to be repeated two or three times before a satisfactory result is obtained, particularly when the proposed site has unstable soil. In the ideal situation, the soil test is carried out

	once, in an environment where there are existing structures that are similar to the proposed one.
Waiting to establish the scope of the work	These are caused by poor architectural briefing and too many changes made to the architectural drawings.
Waiting to implement contract agreement between the client and the designers	These occur mainly due to delays in understanding the scope of the work, due to changes made by the client to the architectural drawings.
Poor site report	This occurs when the information supplied by the geotechnical engineer conflicts with the existing knowledge of the structural design team (SDT).
Waiting for the site report	Site report writing wastes time, as the study shows that to write a good site report after site visitations takes approximately seven to eight weeks in some of the studied firms, due to laxness on the part of the geotechnical engineer (a poor site report). Waiting for the site report also occurs when the proposed site is in a remote location, where the necessary facilities for conducting the soil tests cannot be easily accessed.
Waiting for the compilation of inception design documents	These occur mainly due to lateness in completion of inception work, as a result of problems encountered in the process by the SDT.

3.2. Waste in the pre design phase

The pre design phase (PDP) is the second stage in the SDP, and its main objectives, according to the responses from the AR conducted, are to finalise the project concept, and to clearly lay out the procedures needed by the designers in order to complete the next phase of work. This implies that in the PDP, the SDT thoroughly studies the architectural plan and draws attention to the general layout and the preliminary sizing and stability of the proposed structural elements. Table 2 provides a summary of the types of waste in the PDP of a project. It is worth noting that all the respondents agreed that ambiguities in the architectural drawings are the main challenges at this stage of the work, as they are responsible for most of the problems encountered by the SDT. One of these ambiguities is specification for a large floor size.

Table 2: Waste in the pre design phase of the structural design process

Waste	Cause
Ambiguities in the architectural drawings	Ambiguities, such as wrong specifications of materials, slab thicknesses/sizes, and column sizes, due to a lack of communication between the architect and the SDT during the architectural process.
Disagreements between the architect and the SDT	Disagreements arise between the SDT and the architect in attempts to clarify information on aspects such as the number and the size of columns required for the proposed structure. Disagreements occur due to inadequate structural knowledge by the architect.
Excessive meetings between the client, the architect, and the SDT	Excessive meetings occur before the architect and the SDT reach consensus on issues regarding the architectural work.

Unnecessary waiting time due to design modifications	Unnecessary waiting time occurs during structural work, where the architect needs to effect changes to the architectural drawings, due to comments made by the SDT, or changes in client requirements
Several, lengthy, and repeated structural computations	This is due to lack of suitability of the existing technology; every structural work is unique in nature. Computations used for structural elements on previous projects cannot be used for structural elements on a new project
Wrong computations	These occur due to mistakes (human error) made by the SDT during the computation of structural elements. A typical example is the computation of sizes and permissible bending moments for each structural element. The procedures involved in performing these computations are routine in nature, and are sometimes boring, and can thus lead to human error, that is, mistakes. Wrong computations may also occur when the SDT misinterprets the building codes, or does not adhere to them strictly
Several printings of paperwork	This occurs due to human errors/mistakes made by the SDT during the structural work. It also occurs due to complexity in the architectural drawings
Excessive supervision of work by the chief engineer	This is caused by the stipulation of procedures in the consulting firms; the senior engineer is expected to cross-check every aspect of work carried out by the junior engineer/designer before moving on to the next phase of work
Waiting to establish preliminary design documents	This occurs mainly due to lateness in completion of the pre design work, as a result of problems experienced in the process by the SDT

3.3. Waste in the detailed design phase

With regard to the detailed design phase (DDP), it was discovered that this phase involves detailed consideration, determination and selection of the most suitable alternative solution in terms of the proportions, dimensions, and connections of structural elements defined in the pre design phase, in order to create the complete, perfect, and final structural drawings/specifications for the proposed project. Table 3 provides a summary of the different types of waste in the DDP of projects. Inability to complete tasks as earlier scheduled constitute the main problems in this phase of construction process.

Table 3: Waste in the detailed design phase of the structural design process

Waste/problem	Cause
Design corrections	Design corrections occur due to mistakes made by the SDT in critical areas during production of the structural drawings
Redesign	Redesign occurs when a structural element that is wrongly computed in the predesign phase is detected in the detailed design phase of the work
Unnecessary printings of draft work	Draft drawings at every stage of work are submitted to the chief engineer for necessary corrections and contributions before proceeding to the next stage

Inability to complete work as earlier scheduled	This is an inability of the SDT to complete work in accordance with the prepared work programme. The SDT has "no work timetable" due to the many contributions, corrections, and adjustments in the course of the work
Waiting for the approval of final drawings	Design work is being carried out by the junior engineer in the consulting firm, which will be submitted to the senior engineer, and thereafter to the project director of the firm or the chief engineer for corrections. This wastes time, as the chief engineer/project director has to thoroughly cross-check every section of the work before final approval
Waiting to establish detailed design documents	This is due to all the problems experienced in this phase of the work by the SDT
Several copies of final work	Several copies of the final work are made, as recommended by the studied firms. All the construction actors must be given copies of the final work for documentation purposes.

3.4. Waste in the construction phase of projects

Table 4 provides a summary of the various types of waste in the construction phase of a project. According to some of the respondents in the AR study, excessive RFIs constitute the main problem in this phase, and RFIs may occur as many times as possible, particularly in a large project, such as the construction of a commercial or non-residential (multi-storey) building or an industrial building.

Table 4: Waste in the construction phase of construction projects

Waste/problem	Cause
Excessive RFIs	The construction contractors excessively request the presence of a member of the SDT on site for clarifications of information in the design drawings. This is due to lack of involvement by the construction contractor at the design stage of the structural work
Excessive waiting time during structural reinforcement	Excessive waiting time occurs during structural reinforcement. This is due to the complexity of the structural drawings. The construction contractors find it difficult to interpret some aspects of the structural drawings on site. A typical example is the top reinforcement of the foundation and stairs
Variation/changed orders	Changes in client requirements and changed orders occur on site due to sudden changes made by the client regarding the proposed structure, or unforeseen problems, such as foundation problems.
Redesign	Redesign becomes necessary on site when the materials specified are not available
Wrong fabrication of formwork, rebar cages, and reinforcing steel	This is due to improper or inadequate supervision of work by the construction contractors, or misinterpretation of the structural drawings. It may also be due to the complexity of the structural drawings
Excessive writing of site instructions	This occurs when there are several mistakes on site, particularly with regard to formwork, rebar cages, and reinforcing steel fabrications

Ineffective communication flow between the SDT and the construction contractor	This is due to lack of involvement of the construction contractor at the design stage of structural work. Human error is also a factor, that is, failure to understand the problem
Inadequate spacing of structural reinforcing materials	This occurs on site due to poor or inappropriate supervision of work by the construction contractor. It can also occur due to misinterpretation of the structural drawings
Excessive supervision of work	This is due to the need for the construction contractor to comply with the necessary regulatory authorities, that is, there must be supervision in every phase of a new task
Excessive cutting/fabrication of structural reinforcing materials	This is due to misinterpretation of the structural drawings by the construction contractor, or poor supervision of work.

3.5. Average frequency of occurrence of SDP waste in projects

Based on the opinions of the respondents in the QMAR conducted, Figure 2 concise the frequency of occurrence of SDP waste in different projects. In the figure, project 1 represents construction of a simple residential building, while projects 2 and 3 represent construction of non-residential (commercial) and industrial buildings.

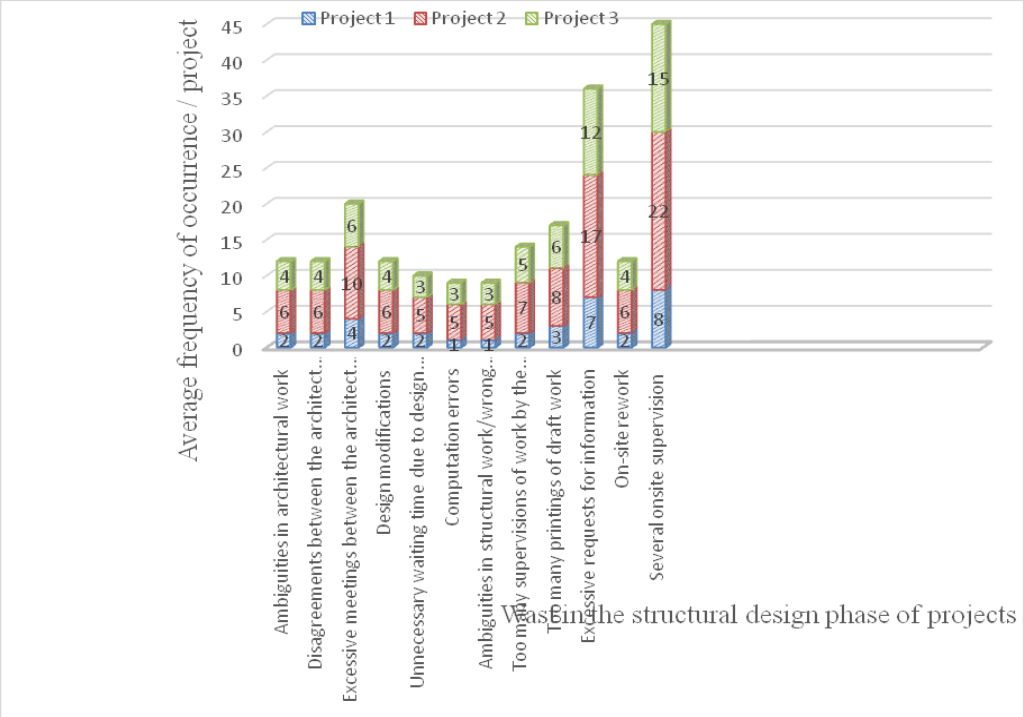

Figure 2: Frequency of occurrence of waste in three different construction projects

3.6. The categories of waste in the structural design process

Based on literature, the identified types of waste in SDP during the AR study can be grouped into nine categories, namely waiting time, over-processing, motion, excessive vigilance, overproduction, rework/correction, clarification, design error and work interruption as shown in Tables 5,6, 7 and 8.

Table 5: The categories of waste in the inception design phase

Categories	Waste
Waiting time	Waiting for fund release from the clients; waiting for the start of structural work; waiting for the site report; waiting to establish the scope of the work; waiting to execute contract agreement between the clients and the designers, and waiting for the compilation of inception design documents
Over-processing	Several soil tests, and several site visits
Motion	Ineffective site workflow

Table 6: The categories of waste in the pre design phase

Categories	Waste
Design error	Ambiguities in architectural work, and wrong computation
Overproduction	Several printings of paperwork
Over-processing	Excessive meetings between the client, the architect and the SDT
Motion	Several, lengthy, and repeated structural computations
Excessive vigilance	Several supervision of work by the chief engineer
Waiting time	Unnecessary waiting time due to design modifications, and waiting to establish preliminary design documents
Clarification	Disagreements between the architect and the SDT

Table 7: The categories of waste in the detailed design phase

Categories	Waste
Overproduction	Unnecessary printing of draft work, and several copies of final work
Corrections/rework	Design corrections, and redesign
Waiting time	Waiting for the approval of final work, and waiting to establish detailed design documents
Work interruption	Inability to complete work as earlier scheduled

Table 8: The categories of waste in the construction phase

Categories	Waste
Corrections/rework	Variation/changed orders; wrong fabrication of formwork; rebar cages/reinforcing steel; redesign, and inadequate spacing of structural reinforcing materials
Over-processing	Excessive requests for information, and excessive cutting/fabrication of structural reinforcing materials
Waiting time	Excessive waiting time during structural reinforcement, and ineffective communication flow between the SDT/the construction contractor
Excessive vigilance	Several on-site supervision

3.7. Strategies that can be adopted to reduce the identified waste

Several strategies that can be adopted to reduce the identified waste in the SDP were proposed by the participants in the AR study. These are concise in Tables 9, 10, 11 and 12.

Table 9: Strategies for waste reduction in the inception design phase of the structural design process

Waste	Strategies
Several meetings especially in the project initiation phase	Adoption of phone calls and internet enabled communication (IC) during the SDP
Lateness in the start of the structural design activities due to delay in the release of project fund from the client	Appropriate communication and regular meetings with the client
	Long-time loan from the various available funding agencies
	Commencement of every structural project from high level discussion before the involvement of the SDT
	All clients need to be realistic right from on-set
Gaps in the topographical survey of the proposed site	Timely conduction of the site topographical survey through the service of experienced land surveyors
Several soil tests	Assumptions of certain design variables based on the geotechnical information of the existing buildings in the proposed site
Waiting for/poor site reports	Early investigation of the various soil tests and land topographical survey by the various professionals
	Minimize assumptions during the geotechnical investigation of the proposed site
	The use of an experienced designer that understand the information required by the geotechnical engineers for the necessary soil test.

Table 10: Strategies for waste reduction in the pre design phase of the structural design process

Waste	Strategies
Ambiguities in the architectural designs	Adoption of quality assurance (QA) strategy in every architectural design firm
	Involvement of the structural designers in architectural process
	Adequate and continuous communication between the SDT and the architects during the architectural process
Excessive meetings and disagreements between the architect and the SDT	Involvement of the SDT in the architectural process
	Adoption of meeting agenda and schedule of work or roster in every project

Modifications of architectural drawings and unnecessary waiting time due to the design modifications	Involvement of the SDT in the architectural process
Several repeated structural computations	The use of programmed excel spread sheet, adoption of some developed generic assumptions or a design software such as REVIT structure for structural computation
Computations errors/wrong computations	Carefulness in the adoption of certain design assumptions and some structural software
	Proper adoption of QA procedures
	Complete engagement of a long time and experienced senior engineer in the necessary structural computations
Several printings of paperwork	Adoption of EC by the various project actors
	Avoidance of all form of complexities in the architectural and the structural drawings
Excessive supervisions of work by the chief engineer	More engagement of a senior designer in the calculation aspect of the structural work

Table 11: Strategies for waste reduction in the detailed design phase of the structural design process

Waste	Strategies
Design corrections	Adequate involvement of experienced designers such as senior engineers in every aspect of the SDP
Redesign	Implementation of DVSP or GP in the SDP
	Penalizing DVSP defaulters
	Avoidance of vague assumptions and design variations in the SDP
	Adequate involvement of the client in every phase of the SDP or proper communication between the client and the SDT in every phase of the SDP
	Adequate engagement of an experienced designer such as senior engineer in the computation aspect of the structural design
Delay in selection of the suitable structural elements computed in PDP, delay to incorporate the comments made in the PDP into work and inability to complete work as earlier scheduled	Proper planning and communication between the senior and the junior engineers and the client Total commitment among the various design actors and the client
	Appropriate communication for additional resources such as man powers when the need arises
Waiting for approval of the final drawings	Proper planning as well as adequate flow of communication among the various actors

	Adoption of a register or time record book among the designers for proper commitment to work
	The junior designers should not be left with the primary aspects of the design.

Table 12: Strategies for waste reduction in the construction phase of projects

Wastes	Strategies
Excessive RFIs, Construction reworks, excessive writing of site instructions and excessive waiting time during the structural reinforcement	Production of drawings that is free of mistakes/errors and unambiguous to understand and interpret on the site
	Involvement of construction contractors in the design process
	Full time engagement of a structural engineer at the construction phase of projects
	Engagement of a structural engineer for reasonable hours for clarification of the technical aspect of construction drawings before the start of site activities
Variations/change orders and redesign	All forms of project variability are to be avoided during site activities
	Project actors are to defer the execution of the technical aspects of work that are liable to changes during construction activities until final decision has been taken by all project actors
Wrong fabrication of formwork, rebar cage and reinforcing steel and excessive cutting or fabrication of structural reinforcing materials.	Engagement of the services of experienced contractors and subcontractors
	Full time engagement of a structural engineer at the construction phase of projects
Ineffective communication flow between the SDT and the construction contractor	Production of more sections or details of some technical aspects of construction drawings for simplicity of every design information
	Engagement of the service of an experienced contractor

4. STUDY IMPLICATIONS

The study offers guiding information on how a method such as AR can be adopted to identify and reduce waste in the SDP. Hence, the proposed methodological framework allows structural engineers to identify gaps in their implementation efforts, focus attention on areas for improvements, and assess the benefits of AR in the design and the construction phases of projects. In words, the study provides structural designers in South African consulting engineering firms a method that can be adopted to identify and reduce waste such as overproduction, over-processing, motion, waiting time, excessive vigilance, correction/rework, and design error during SDP.

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5. CONCLUSION AND RECOMMENDATIONS

The main goal of this paper was to provide guidelines for conducting AR in consulting engineering firms. The methodological framework presented in Figure 2 was followed in the various case study firms described in this paper. Hence, AR can be conducted in consulting engineering firms to effectively improve collaboration between researchers, and industry practitioners for efficient projects delivery. AR is not without its problems for researchers. The literature reveals that the cyclical process in AR study needs to be repeated several times for continuous improvement. This implies that the proposed methodological framework (Figure 2) needed to be repeated perhaps two or three times in different projects before being drawn to a conclusion. However, it should be noted that construction process is a project that may take 10 to 14 months in duration (from the inception stage to completion).This made the researchers reach the conclusion of the AR study after the first cycle. With the single cycle conducted, the purpose of this study was observed to be met as the researchers ensured that the action-planning and action-taking phases in the AR plan were repeated until the saturation states were reached (three times).With these saturation states, it can be contended that if the AR process is repeated the second time, there might be no additional information or new knowledge or findings. Therefore, for effective AR study in the engineering aspect of construction, attention should be focused mainly on action-planning and action-taking phases.

Further, based on the findings of QMAR conducted, it can be concluded that waste occurs in every phase of the SDP, although the frequency of their occurrence differ from one project to another. Typical examples of these types of waste are waiting time, design error, over-processing, excessive vigilance, overproduction, and correction/rework. This paper also concludes that the discovered waste in the SDP can be reduced through the application of the strategies suggested in the action planning phase of the QMAR conducted (Table 9, 10,11 and 12 of this paper). Among these strategies is adequate involvement of the structural design team (SDT) in the architectural process (AP). This is in agreement with the views of Forbes and Ahmed (2011), Eastman et al. (2008) regarding the application of information and communication technology platforms for waste identification and reduction in the design and the construction phases of projects. Another notable strategy is to limit/discourage all forms of variability by the various actors the moment a project get to the DDP and the CP of projects. This discovery is also consistent with the findings of Mossman (2009) and Nagapan et al. (2012) regarding some of the waste elimination strategies in projects.

This study recommends the methodological framework presented in Figure 2 of this paper as a suitable outline for prospective researchers that intend to conduct AR in consulting engineering firms. Further studies should be conducted on the applicability of AR as waste identification and reduction in other aspects of construction process such as electrical/mechanical design process.

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COMPRESSIVE STRENGTH PERFORMANCE OF CEMENT STABILISED EARTH MADE BRICKS FOR LOW COST HOUSING

ThankGod Ehiabhi Omongbale [1] and Ifiok Edem Ekop[2]
[1]Department of Building, Ambrose Alli University, Ekpoma, Nigeria
[2]Department of Building, University of Uyo, Uyo, Nigeria

ABSTRACT

Purpose: The quest for the government to provide more affordable housing for the masses has necessitated more researchers to continue to investigate alternative means of low cost Building materials. Earth made bricks have been recognized as one of the oldest building material. It is not enough to provide these low cost houses but more efforts should be geared towards durability and other mechanical properties. This research examines performance characteristic of earth made brick to determine the compressive strength and water absorption rate of earth made bricks.

Design/methodology/approach: Samples of earth made bricks were produced using cement as a binder at various percentages of 0%, 5%, 10%, and 15%, using 0% as the control. The produced earth made bricks were cured for a maximum of 28 days and the strength was determined at 7 days, 14 days, 21 days and 28 days respectively including its rate of water absorption.

Findings: The result of the dry density test indicates that the higher the cement contents and age of curing, the lower the density. The compressive strength increased as the percentage of binder increased. The result shows that the control mix (NSB) has a maximum compressive strength of 0.01N/mm^2 at 7 days of curing with steady increase to 0.50N/mm^2 at 28 days of curing. At 5% cement stabilisation (SB_1), the maximum compressive strength recorded between 0.02N/mm^2 and 0.79N/mm^2 at 7 days and 28 days of curing respectively. Similarly, 10% cement stabilisation reveals a maximum compressive strength of 1.10N/mm^2 to 1.73N/mm^2 at 7 days and 28 days of curing. While at 15% cement stabilisation, the maximum compressive strength recorded between 1.45N/mm^2 to 2.01N/mm^2 both at 7 days and 28 days of curing. However, the result shows that the compressive strength of SB_{II} increased by 54% while SB_{III} increased by 14%, indicating that the higher the cement content and curing age, the higher the strength and the lower the density. And also the maximum water absorption of 12% recommendation was not exceeded.

Originality/value: The study therefore concluded that 10% and above is recommended for cement stabilization for the production of earth made bricks in the study area and the various tests carried out showed an acceptable performance standard of the earth made bricks.

Keywords: Earth made brick; compressive strength; stabilisation; performance standard; absorption rate

[1]anointedz2k@yahoo.com

1. INTRODUCTION

The dream of the poor masses to own their own houses will remain a mirage if urgent steps are not taken by the government including private sector to participate in affordable housing delivery. This can only be possible if alternative building materials are constantly been developed and utilized. Earth made bricks has been recognized as one of the oldest building material. It is not enough to provide these low cost houses but more efforts should be geared towards durability, strength and other mechanical properties that could make its usage worthwhile.

The abundance of earth materials also known as lateritic soil deposits in Nigeria can be harnessed for brick production, unfortunately, this potential is not adequately maximized. The production of bricks using earth materials is believed to be a lot more economical, especially when compared to sandcrete blocks/bricks. This may not be unconnected with savings in the cost of cement used for mortar in plastering and elimination of cost of transporting the products as production takes place right on site. Akinrolabu in Igbokwe (2006) posited that over the years, cement-based materials and most of other imported building components have continued to add to the cost of housing. This is consequent upon the inflationary trends and scarcity of foreign exchange for the purchase of these items. Another dimension of the problem stems from over reliance on cement which happens to be the main ingredient for the provision of public infrastructure especially housing where it constitute 40% of building materials (Suleiman, 2011).

The major characteristics of low-cost housing is that, it should be affordable, durable, comfortable and at least have some measures of considerable improvement over existing condition. Although, there is no fixed standard for low-cost housing as it varies with technology, culture and economy of a particular country concerned. The construction of walls with cement stabilized laterite bricks could be load or non-load bearing. But in any case, it also protects the interior from exterior elements and provides attractive finishes. Using cement as binder to stabilize earth bricks in buildings have the advantages of fire resistance, thermal insulation, bulletproof and do not require plastering and painting if desired, due to its high aesthetic looks. These qualities suggest cement stabilized laterite bricks, to be a better product in terms of cost and functional performance requirement. A lot of researches have been carried out in the past to arrive at the best possible way laterite can be harnessed and utilized in different ways. A study by Ahon (2008) shows that 10% by volume of cement usage increased the strength of the laterite block by 73%. In another study by Raheem, et al (2010), the use of cement and lime in stabilizing laterite interlocking blocks was investigated. The study shows that 5% volume of cement could not meet the required compressive strength specified by the code but at 10% and above the requirement was met. According to Agbede and Manasseh (2008), a study of Cement-Sand Admixture in Laterite Brick Production shows that laterite cannot be stabilized effectively for brick production within the economic cement content of 5% as the 28-day unconfined compressive strength of 1.1N/mm2 did not meet the value recommended by NBRRI. An addition of 45% sand content by dry weight enhanced its suitability for use in the production of bricks within the optimum cement content of 5% giving a 28-day UCS of 1.8 N/mm2. Since NBRRI did not specify any particle distribution curve for soil to be used in brick production, addition of 45% sand was used as a guide for the production of bricks in Makurdi metropolis (Agbede and Manasseh, 2008). Past studies shows that inclusion of fibre can help improve the performance standard of earth made bricks. Aguwa (2013), reported

on the use of coconut coir as fibre in stabilizing laterite blocks. In his study it was discovered that, Coir has the potential to increase the compressive strength of laterite blocks by ten percent (10%) at 28 days curing duration and reduction in mass by two percent (2%). Oluremi, Adedokun and Osuolale (2012), investigated the effects of coconut husk ash on stabilizing poor lateritic soil. The result indicates that coconut husk ash is suitable for improving the California bearing ratio because this parameter increases with addition of coconut husk ash. In all these studies, the performance standard of stabilizing earth made brick with 5% cement was below the required percentage. Looking at the current economic price of cement in the market, this research tends to investigate the use of cement as a stabilizing agent for the production of earth made bricks and also to improve its performance characteristics.

2. MATERIALS AND METHODS

The earth sample which was gotten from Bariga, Yaba, Lagos State was extracted from a pit of not less than 4 meters below the top soil and was air–dried for seven days in a cool, dry place. This was necessary in order to enhance grinding and sieving. After drying, grinding was carried out using hammer to break the lumps present in the soil with adequate care being taken not to reduce the sizes of the individual particles, after which sieving was done to remove over size materials from the earth sample using a wire mesh screen with aperture of about 6mm in diameter as recommended by Oshodi (2004). Fine materials passing through the sieve was collected for use while those retained were discarded.

Ordinary Portland Cement (grade 32.5) with the trade mark "Dangote Cement" which comply with BS EN 197-1 and fully certified by Standard Organisation of Nigeria (SON) was used as the binder. Clean tap water, free from particles and good for drinking as specified in BS EN 1008 was used for the mixing. To be sure of the right sample of laterite used, the following laboratory tests were carried out indicating the various observations.

Table 1: Laterite sample tests

S/No	Types of Test	Observation/Result	Percentage Content (%)	
			Sand	Clay
1	Touch Test	A slight fluffy feel	-	-
2	Wash Test	Easy washing off of sand with slight deposits of clay particles	-	-
3	Cigar Test	Average laterite cigar length of 6.7cm	75.5	23.5
4	Bottle/Sedimentation Test	Sand dimension of 3.8cm out of 5cm	76	24
5	Colour	Reddish colouration observed		

2.1. Production of earth made brick

The earth made bricks were produced using a prefabricated steel mould measuring 290mm x 140mm x 100mm base. In each sample, twelve (12) no. bricks were produced giving a total of 48 brick samples. The production process consists of batching, mixing, casting and compaction of the earth bricks. For the 5% cement stabilization, the mix ratio was 0.5:10 while 1:10 and 1.5:10 was for 10% and 15% cement stabilization respectively. The materials that were used for the production of the earth made bricks were measured by

weight of dry soil in accordance with the predetermined percentages of stabilization (0%, 5%, 10% and 15%) with 11kg (in weight) of water content determined.

The main approach adopted was to compare the properties and performance standard of two categories of earth made bricks, namely: Non Stabilised Bricks (NSB) and Stabilised Bricks (SB). While the later was made in a conventional way using Ordinary Portland Cement (OPC) as the stabiliser, the former was used as a control against the SB. A four litre container was used as the gauge box. One four litre container of laterite measured 6kg, making ten number of four litre container to be 60kg which is equivalent to 2.5 headpans. Table 3 shows the mass of each material used for the varying percentages of stabilisation considered.

The mixing was performed on an impermeable surface made free (by sweeping and brushing/ scraping) from all harmful materials that could alter the properties of the mix. The measured laterite sample was spread using a shovel to a reasonably large surface area. Cement was then spread evenly on the laterite and mixed thoroughly with the shovel. The dry mixture was spread again to receive water, which was added gradually while mixing until the optimum moisture content of the mixture was attained. The optimum moisture content (OMC) of the mixture was determined by progressively wetting the soil, collecting handfuls of the soil, compressing it firmly in the first, then allowing it to drop on a hard and flat surface from a height of approximately 1.10 m. When the soil breaks into four or five parts, the water content is considered adequate (National Building Code, 2006). After the steel mould was rid of all impurities, it was coupled together and oiled to enhance the demoulding of the blocks. The wet mixture was filled into the mould in 3 layers, with each layer being compacted with 35 blows of 4.5 kg rammer on a level and rigid platform. The excess mixture was scraped off, and the mould was leveled using a straight edge. The mould and its contents were left for two hours before the removal of the mould. Identification marks were inscribed on the bricks to allow easy referencing. The bricks were first allowed to air dry for 24 hours under a shade constructed from a polythene sheet. Thereafter, water was sprinkled on the bricks in the morning and evening, and the bricks were covered with a polythene sheet for one week to continue the curing process and prevent rapid drying of the bricks, which could lead to shrinkage cracking. The earth made bricks were later stacked in rows and columns with a maximum of four bricks in a column until they were ready for strength and durability tests

Table 2: Sample classification

Sample Type	Composition
NSB	0% Cement Stabilisation
SB_1	5% Cement Stabilisation
SB_{II}	10% of Cement Stabilisation
SB_{III}	15% of Cement Stabilisation

Table 3: Sample batching by weight

Percentage of Cement Stabilisation	Laterite (Kg)	Cement (Kg)	Water (Kg)
0	60	0	13
5	60	3	11
10	60	6	11
15	60	9	11

2.2. Testing of earth made bricks

2.2.1 Water absorption test

This test was performed on the earth made bricks after 28 days of curing. Two bricks were randomly selected from each group of the specified age and were weighed on a balance. These bricks were then immersed completely in water for 24 hours, after which they were removed, excess moisture was mopped from the surface of the brick and then weighed again. The percentages of water absorbed by the bricks were estimated using the following formulae:

$$W_a = \frac{W_s - W_d}{W_d} X\ 100$$

Where:
Wa = percentage moisture absorption
Ws = weight of soaked brick
W_d = weight of dry brick

2.2.2 Strength Test

Compressive strength tests were performed to determine the load-bearing capacities of the earth made bricks. In this test, the bricks aged 7, 14, 21 and 28 days were transported from the curing or stacking area to the laboratory two hours prior to the test to normalise the temperature and to ensure that the bricks was relatively dry. The weight of each brick was measured before it was placed onto the compression testing machine such that the top and bottom, as moulded, lied horizontally on a flat metal plate; the recesses were filled with a metal plate of the exact size to prevent sheaving of the brick during testing. The brick was then crushed, and the corresponding failure load was recorded. The crushing force was divided by the sectional area of the brick to arrive at the compressive strength.

3. RESULTS AND DISCUSSION

3.1. Water absorption test

The results of the water absorption tests is presented in Table 4. In general, the results indicate that water absorption decreases with increased percentages of cement stabilisation. This result was expected because the cement binds the laterite particles together and thereby reduces the sizes of the pores through which water could flow into the bricks. No measurement was obtained for the control (0% stabilisation) because the control bricks dissolved in the surrounding water. The maximum water absorption of 12% recommended in the Nigerian Industrial Standard (NIS, 2004) was satisfied by the bricks produced.

Table 4: Water absorption at 28 day of curing

Sample Types	Composition (Mix)	Water Absorption (%) After 28 Days
NSB	0% Cement Stabilisation	-
SB_1	5% Cement Stabilisation	10.4
SB_{II}	10% Cement Stabilisation	10.2
SB_{III}	15% Cement Stabilisation	8.4

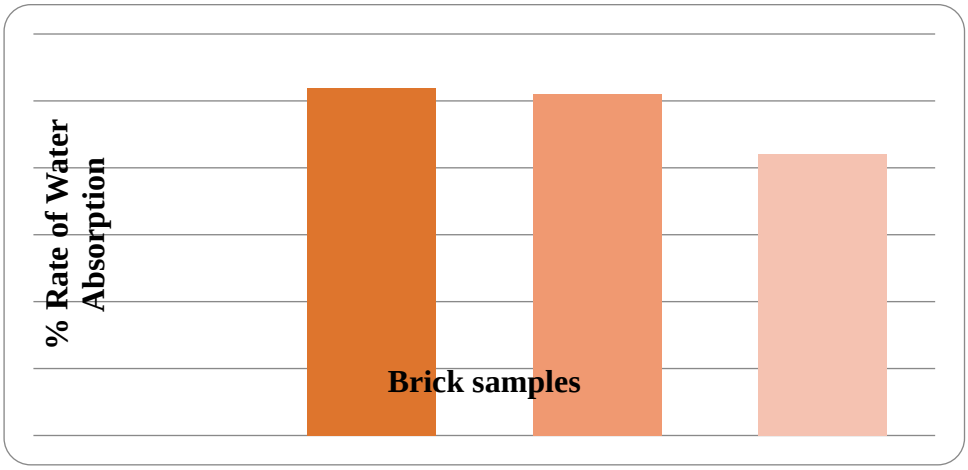

Figure 2: Water absorption of the earth made bricks

3.2. Compressive strength test

The results of the compressive strength tests performed on the various cement stabilized earth made bricks samples were tabulated in table 5. The compressive strength at 0% cement stabilisation (NSB) increases progressively as the age of curing increases from 0.01 N/mm^2 at 7 days to 0.50N/mm^2 at 28 days. At 5% stabilization (SB_1), it recorded 0.02N/mm^2 to 0.79N/mm^2. While at 10% stabilization (SB_{II}), the earth made bricks recorded 1.10N/mm^2 to 1.73N/mm^2 and lastly, at 15% cement stabilization (SB_{III}) the brick samples recorded between 1.45N/mm^2 to 2.01N/mm^2. It was observed that the compressive strength of the earth made bricks at 10% stabilization (SB_{II}) increased by 54% and at 15% (SB_{III}), the compressive strength increased by 14%.

The results indicate that the higher the cement content, the higher the compressive strength, as the results corresponds with that of Raheem, et al (2010). The twenty-one-day compressive strength recorded by 10% cement stabilization was able to meet the minimum requirement of 1.60N/mm^2 by the National Building Code (2006), whereas at fourteen-days of curing, 15% cement stabilisation met the same requirement.

Table 5: Compressive strength at various curing age with the densities

Sample Type	Composition (Mix)	Compressive Strength (N/mm^2)			
		7 DAYS	14 DAYS	21 DAYS	28 DAYS
NSB	0% Cement Stabilisation	**0.01**	**0.1**	**0.33**	**0.5**
SB_1	5% Cement Stabilisation	**0.02**	**0.40**	**0.60**	**0.79**
SB_{II}	10% Cement Stabilisation	**1.10**	**1.43**	**1.60**	**1.73**
SB_{III}	15% Cement Stabilisation	**1.45**	**1.67**	**1.80**	**2.01**

It can be seen that from the four different samples produced, only two samples (SB_{II} and SB_{III}) satisfy the 28 days minimum of 1.0 N/mm^2 compressive strength recommendation by Nigerian Building Road Research Institute (NBRRI) but failed to satisfy the 1.60N/mm^2 at 7 days compressive strength requirement of the National Building Code.

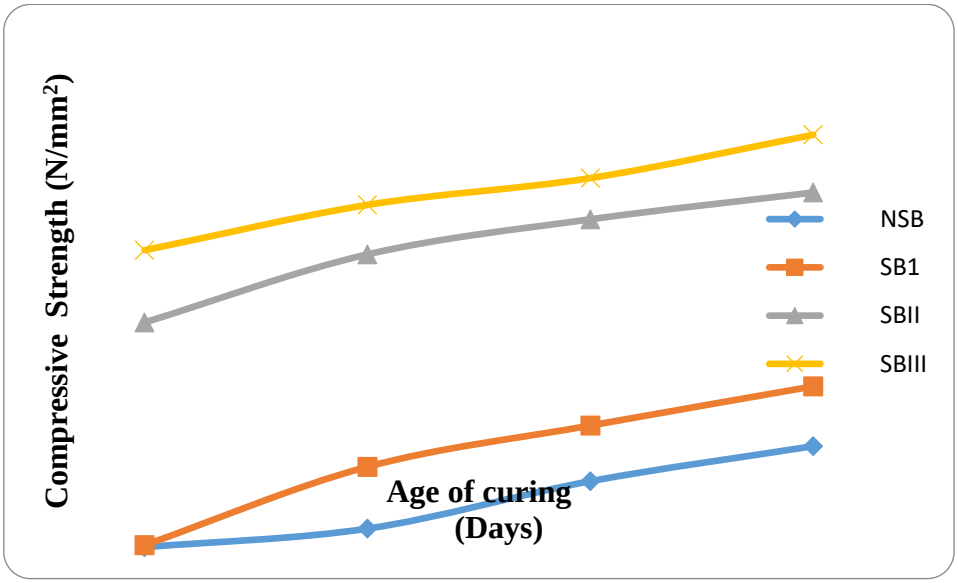

Figure 3: Compressive strength of the earth made bricks

3.3. Density of bricks

The results of the dry density of the bricks produced are shown in table 5 above. The density of the bricks from each of the mix ratios after 7 and 28 days of curing were estimated from the weight and volume of each of the bricks samples and recorded. It shows that the unsterilized bricks varied from 1810kg/m^3 to 1710 kg/m^3 at the end of seven and twenty-eight days of curing respectively, whereas that of the stabilised bricks ranges between 1950kg/m^3 to 1750kg/m^3, which clearly indicates that the higher the cement contents and age of curing, the lower the density. These values are similar to those obtained by Madedor (1992). Furthermore, the results indicate that the stabilised bricks are denser than the unstabilised bricks.

Table 6: Dry densities of the earth made bricks produced

Sample Type	Composition (Mix)	Density (kg/m^3)	
		7 Days	28 Days
NSB	0% Cement Stabilisation	1810	1710
SB_1	5% Cement Stabilisation	1950	1870
SB_{II}	10% Cement Stabilisation	1920	1820
SB_{III}	15% Cement Stabilisation	1830	1750

4. CONCLUSION AND RECOMMENDATIONS

To provide housing for the greater majority of Nigeria, the use of laterite bricks should be encouraged as it is cheaper, more readily available and the production process is environmentally friendly. This study was able to prove beyond reasonable doubt that cement stabilized laterite bricks has greater compressive strength compared to unstabilised laterite bricks thus, enhancing its durability. Only two samples SBII and SBIII were able to meet the minimum requirements by the various codes. Therefore, 10% and above is recommended for cement stabilisation in producing earth made bricks from the study area. The earth made bricks should be cured for a minimum of 14 days before being used in buildings. Also, the strength and performance evaluation through various tests carried out proved an acceptable performance standard of the earth made bricks. It therefore shows that, it can be used without rendering thereby saving cost. However, it is not advisable to use these bricks for the base of the wall (the first two to three courses on top of the foundation slab).

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