



**NIGERIAN INSTITUTE OF QUANTITY SURVEYORS:
5TH RESEARCH CONFERENCE– NIQS RECON5
9TH – 10TH NOVEMBER 2020**

THEME:
**Confluence of Research, Theory and Practice in the
Built Environment**

EDITORS:

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Proceedings of the 5th Research Conference of the Nigerian Institute of Quantity Surveyors

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FOREWORD

The development of a country's economy depends on the activities of its construction industry, as construction plays a significant role in providing the infrastructure required to sustain any country's growth. This by implication means that no country can witness any growth without an efficient and effective construction industry. However, the construction industries of most developing countries continue to be a serious concern to all the stakeholders not only because of poor performance but due to lack of enabling environment to engender cutting edge research that will reposition the industry and infrastructure development at large. Against this background, the Nigerian Institute of Quantity Surveyors (NIQS) conceived the idea of research conference to bring people together; both the academics and practitioners to engage in fruitful discussions that will provide the foundation for research that will enhance the growth of Nigeria's Construction Industry and lead to the emergence of new research focus in Quantity Surveying and Built Environment in general. The conference holding in Minna, Niger State Nigeria has as its theme Confluence of Research, Theory and Practice in Quantity Surveying Profession for a Sustainable Built Environment.

Over the years, Nigerian Construction Industry (NCI) practitioners have given teaching experience to their numerous organizations and institutions. There is, however, a paradigm shift in the way Quantity Surveying and therefore all professions in the Built Environment are practiced. Conventional functions and obligations are being developed beyond the previous standard. There are evolving roles which need to be addressed, and one way to do so is to conduct research into the potential application of those concepts and theories that govern these roles.

The conference welcomes paper submissions from all over Nigeria, the host nation. This represents the interest of the stakeholders in the NIQS research conference. The research papers consist of 56 papers on all sub-themes. Research papers have undergone a two-stage paper review process. The first stage included the screening of the abstracts and, if necessary, the review of each abstract by the members of the International Scientific Committee of the Conference. The second stage included the review of the original full article of each accepted abstract by at least two members of the Scientific Committee. The two-stage review process has helped to raise the quality and standard of the papers accepted for the conference.

The LOC hopes that the delegates will gain substantial benefits from the research papers presented at the conference, both in terms of research and professional practice. This will help to achieve the key aim of the Nigerian Institute of Quantity Surveyors Research Conference, which is to serve as a bridge between academics and construction industry practitioners. On this note, I would like to warmly congratulate the Institute's Professional Development and Library Committee, the Chairman and the Members of the Conference Organizing Committee and all those who have contributed to the success of the conference.

QS Mohammed Abba Tor FNIQS, FSCI Arb, FNIMN, MBA
President
The Nigerian Institute of Quantity Surveyors
November, 2020

PREFACE

It is with great delight and profound pleasure that I gladly welcome all of you, esteemed attendees, to this first virtual edition of the Fifth Research Conference of the Nigerian Institute of Quantity Surveyors (RECON5), organized by the Association of Quantity Surveyors / Educators. NIQS RECON is a bi - annual conference, and RECON5 is the fifth of the series.

The 5th Research Conference (RECON5) of the Nigerian Institute of Quantity Surveyors (NIQS) is a follow-up to previous four editions, which was hosted last by Enugu State University of Science & Technology, Enugu. The goal of the Research Conference is to provide a forum for researchers and practitioners in the Built Environment to address key issues and broaden knowledge domains in such a way as to include new thematic areas in order to promote greater participation and to eliminate barriers in areas of research interest that are fast becoming global best practice. It was expected that the theme — the Confluence of Research, Theory and Practice in the Built Environment — would increase the required knowledge and understanding of the topical issues of collaboration between scholars and/or professionals. The level of participation in the subject matter of the conference has been sustained since the previous event, when hundreds of related abstracts were submitted for presentation at the conference. They were subjected to a double-blind peer review process prior to the publication of the final papers for the conference.

It is expected that presentations at the conference will be able to inform policy formulations across Nigeria and the Built Environment in particular. The broad sub themes covered by the conference include:

Construction

Building Information Modelling (BIM)
Cost and value Management
Construction Procurement and Contract administration
Change management
Financing of Infrastructure projects
Construction education and training
Disaster management
Concept of sustainability in construction
ICT in construction
Knowledge management and construction organisations
The construction industry and national economy
Project management
Public private partnership
Health and safety

Real Estate and Land

Housing policy and property
Planning challenges in Urban development and management
Asset, property and Facilities management

Ethics and Legal Issues in Construction

Alternative Dispute resolution
Building Regulation Control
Construction Contract Laws
Law of property
Legal educations in Construction and property
Professional Issues and Ethics in the Built Environment
Taxation

Warm appreciation is expressed to researchers who have successfully undergone a two-tier peer review procedure in order to have their papers accepted and published in this proceeding. The review process would have not been possible without the kind support of the members of the Scientific and Technical Committee. The LOC is grateful for this voluntary service, which is central to the quality of accepted papers

I would like to take this opportunity to appreciate the President of The Nigerian Institute of Quantity Surveyors, Abba Tor, FNIQS, the past and the current National Executive Council (NEC) for their commitment and support. I also wish to thank the local organising committee led by Dr Yakubu Mohammed for their commitment to the success of the conference.

QS Dr Ganiyu Amuda-Yusuf FNIQS
Secretary, Professional Development & Library
The Nigerian Institute of Quantity Surveyors
November, 2020

ACKNOWLEDGEMENTS

The Organizing Committee of the NIQS Research Conference (RECON 5) would like to express its gratitude to the President, the Nigerian Institute of Quantity Surveyors, QS Abba Tor, FNIQS and to the entire past and present Executive Council of the Institute for the Support of the Association of Quantity Surveying Lecturers / Educators (AQSLE) and to individuals for their support of the conference. The organisers are appreciative of the efforts of Dr Ganiyu Amuda-Yusuf, Secretary of Professional Development and Library towards the success of RECON 5.

We thank Prof. Ahmed Doko Ibrahim, Chairman of the Quantity Surveyors Lecturers/Educators' Forum, for the vision of the Research Conference as a platform for developing strong research work in the industry. We are also grateful to the Chairman of the Organization Committee, Dr. Yakubu Danasabe Mohammed, for his contributions and unflinching support. The Niger State Chapter of the NIQS is commended for their efforts to carry out this enormous mission.

The efforts and unique support of the Scientific and Technical Committee, which has worked hard and long to prepare refereed and edited articles and written conference proceedings, are truly appreciated. The contributions of Dr Luqman Oyekunle Oyewobi, Prof A. D. Ibrahim, Dr Kasimu Alhaji Mohammed, Dr Abdulganiyu Adebayo Oke, Dr AbdulwasIU Adeniran Ola-awo and Mr Ibrahim Inyass Adamu (Conference Editorial Assistant) are warmly welcomed. We are truly thankful to the authors, participants, conference organizing committee and all academic colleagues especially Dr A. A. Shittu, for their immense contribution to the success of this conference.

Finally, we are thankful to Prof R. A. Jimoh of Building Department, Federal University of Technology Minna, for his support in the review process. Any mistake contained in this work is accidental and very greatly regretted.

Dr Y. D. Mohammed
Chairman, Local Organising Committee

DECLARATION

All the papers in this conference proceedings undergone double-blind review process at both abstract and full paper stage by members of the Scientific Committee. This process involves detailed screening of the abstracts and papers by at least two referees, reporting of comments to authors, modification of papers by authors whose papers were accepted by the reviewers, and re-evaluation of revised papers to ensure quality of content.

THE PEER REVIEW PROCESS

In order to maintain and ensure a high-quality conference process, the organizers of this conference adapted a comprehensive two-stage peer review process to the papers submitted by at least two recognized experts in the field of the paper.

At the first stage of the reviews, each abstract received was reviewed in order to ensure: its appropriateness to the theme of the conference, originality of the paper, the intellectual rigour and the intended contributions to the knowledge after which it was sent to at least two reviewers. At this point, a total of 111 abstracts were received and sent to the reviewers. Subsequently, the authors of approved abstracts received comments from the reviewers and were recommended to proceed to complete paper submission, including all suggested changes in the revised abstracts.

A total of 61 full papers were obtained and submitted for peer reviews. The comments and suggestions arising therefrom were then forwarded to the authors of the accepted papers requiring that they address all of the issues raised by the reviewers. Follow-up revisions made by reviewers to the original authors' papers were also provided to the authors to aid in the revision of their papers. Authors whose papers were rejected were also provided with comments from the reviewers so that they could understand the flaws identified by the reviewers. It was assured that, during the peer review process, members of the paper review committee, editors and conference organizers were not involved in the review of any paper they wrote or co-authored.

A total of 56 papers in which the authors showed clear evidence that all the suggestions of the reviewers had been addressed were accepted in the conference proceedings.

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PERCEIVED EDUCATION COURSES THAT INCULCATE SUSTAINABILITY AWARENESS IN STUDENTS OF HIGHER INSTITUTION OF LEARNING IN NIGERIA.

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ABSTRACT

The Global demand for efficient use of natural resources in the production of the products of built environment sector prompted a serious concern to the industry practitioners and the academia. Thus, inclusion of courses that would enhance the expertise of trainees in the built environment related programmes in tertiary institutions of learning must be accorded utmost importance. Literature review has revealed that sustainability education and promoting awareness of it to students is crucial, hence focus on inclusion of sustainability principles and concept in curriculum of built environment programmes of institution of higher learning are crucial. The research aims to examine education courses that can be infused in the built environment programmes curriculum to help students understand the concepts of sustainability. The targeted groups of respondents are 500 level and HND II students of built environment in university and polytechnics. The survey design was adopted to gather data from 199 respondents representing 500 level and HND II students of built environment in Niger State, Nigeria. The data collected were subjected to descriptive statistics and Mann-Whitney test statistics on SPSS to examine the distribution for single variables and assess education coursework with highest score values and p-values. The survey analysis revealed that there are significant differences in agreement among students by level of education ($p > .05$) and found to be significantly higher for 500 level. It is concluded from the result that the most effective education courses to inculcate sustainability idea in students are environmental impact assessment, and design and sustainable development.

Keywords: Education courses, curriculum, sustainability, sustainable development.

INTRODUCTION

Sustainability education has been recognized as a key instrument to achieve the sustainable development, and has been emphasized as an important tool in increasing public awareness and understanding of sustainable development (United Nation, 2018). Institutions of higher education are essential stakeholders in fostering understanding and forging a way forward in achieving a sustainable future (Abubakar *et al.*, 2016; Ferrer-Balas, 2008). Universities all over the world are dedicated to achieving sustainability in terms of their operations, research, and curriculum (Hugé, 2018). Awareness among students for sustainability is generally associated with the environment, especially related to pollution (Malik *et al.* 2017). Having an awareness of sustainability among students can eventually contribute not only to understanding sustainability but also to contributing towards sustainable development. Providing sustainability awareness to students requires institution of higher learning to adapt sustainability principles in their teaching, and in particular their curriculum (Stough *et al.* 2018). As the sustainability concept is expanding in industry (Perez-Foguet *et al.*, 2018), the sustainable mindset of young graduates must be nurtured through sustainability education courses. Although efforts have been directed towards highlighting sustainability education's importance (Tejedor *et al.*, 2018), little attention has been given to investigating the inclusion of sustainability in technology education curriculum for students' competence development (Stough *et al.*, 2018). Addressing such key sustainable competencies among students is imperative to the construction industry. Therefore, there is a need to examine sustainability education courses for inclusion in the curriculum of universities and polytechnics construction related programs. This research aims to examine the education courses to be included in curriculum for promoting sustainability awareness and understanding

of stakeholders in construction industry. Against this backdrop that the paper seeks to; ascertain the courses to be included in the built environment programmes curriculum, and to establish the extent of agreement among students of built environment on courses to be included.

LITERATURE REVIEW

Education courses for promoting sustainability awareness and understanding of stakeholders in construction industry.

Sustainability concept and its practices in the technology development field are necessary for addressing the industry's current and future needs (Akins *et al.*, 2019). It is also specified that to address the concern of the industry an appropriate education curriculum should provide sustainability education to students of related field (Calafell *et al.*, 2019). Sustainability practices can be incorporated into the formal higher education institutions curricula by offering students the opportunity to become leaders for change through curriculum and operational innovation (Chalmers *et al.*, 2016). The promotion of Education for Sustainable Development (ESD) is taking place due to critical transition factors beginning with the acceptance of environmental principles, sustainable development perspectives through individual initiatives that policy-makers are aware of, new trans-disciplinary programs, networking, and whole-institution approaches that include practical green campus initiatives. Trans-disciplinary initiatives, changes in teaching and learning processes, and innovation in the content of university curricula may then occur (Dlouhá *et al.*, 2017). Working to build a whole-of-university educational programme that links the principles of sustainability being taught in the classroom with the principles of sustainability being implemented on the campus is one of the most tangible ways to help students see the connections between theory and practice and the relationship of their studies to the campus itself and to the broader world (Jennifer and Rob, 2009).

The university needs to develop quick and shorter procedures for curriculum development (Aderonmu, 2012). From these perspectives, the author suggest attention be drawn to sustainable art and crafts, ecology, energy conservation, Heat and Ventilation, Air conditioning, green architecture, energy efficient buildings, entrepreneurship, and affordable housing, water resources management, city architecture, renewable energy and eco-sanitation. Biedenwegk *et al.* (2013) explain education for sustainability in higher institutions as the education that prepares future professionals to be responsible citizens in a more sustainable society; however, little attention is given to instilling a deeper understanding of the ethical principles that provide the base for sustainability. Rather, sustainability education tends to involve students in practical activities such as campus greening initiatives, field visits to learn about sustainable practices and support to environmental studies courses or workshops. There are several studies in relation to sustainability in construction industry in Nigeria as established from the above body of literature; however, our study seeks to investigate the knowledge of students on education courses that can be integrated into the curriculum to help promote sustainability awareness for students of higher learning in Nigeria which many studies have overlooked.

METHODOLOGY

A survey of courses that promote sustainability awareness in students of higher institution of learning

Survey Design

The systematic random sampling technique was used to take representative sample from the heterogeneous population and proportional stratified sampling method was utilized to allocate

the total sample size to various fields of study. In order to address the research question: “What sustainability coursework be included in the built environment curriculum?” a questionnaire survey was undertaken. A total of 250 students from various fields were surveyed. The aim of the survey was to understand coursework to be included in education curriculum of built environment in universities and polytechnics and extent of agreement of students with regards to coursework to be integrated in curriculum. The survey aimed to portray the opinions and realities at different institutions with regard to their beliefs. The survey instrument was composed of 15 closed questions and structured in a way that it could gather information on the coursework. Table 1 and 2 presents the background information of students and courses covered in the questionnaire.

Table 1. Student demographics

General	Characteristics	Respondents	
Gender	Male	178	89.4
	Female	21	10.6
Age	15 – 20	10	5.0
	21 – 25	181	91.0
	26 – 30	6	3.0
	above 30	2	1.0
Level of education	500 level	99	49.7
	HND II	100	50.3
Course of Study	Architecture	60	30.2
	Quantity surveying	80	40.2
	Building Technology	56	29.6

Table 2 Coursework (Measurement Items)

	Questionnaire Items	Scale	Reliability
Please rate the extents to which you belief the following coursework in teaching be included in curriculum by putting a tick mark ("✓") under: (Strongly Agree =5, Agree =4, Undecided =3, Disagree =2, Strongly Disagree=1.	Sustainable development economic, social and political structures		
	Measuring sustainability		
	Design and sustainable development		
	Technology for sustainable development	Strongly Agree =5	
	Sustainable materials and products	Agree =4	
	Sustainable materials and products	Undecided =3	
	Fundamentals of sustainable construction and development	Disagree =2	
	The rationale for green buildings	Strongly Disagree=1	
	Energy efficiency in sustainable construction, building and design		
	Sustainable job site operation		
	Construction waste management and site protection		
	Environment and social impact assessment		

Data Analysis

A total of 199 students from various fields responded to the survey. The numerical data received from 199 students were analysed using SPSS 20 in order to perform descriptive statistics and inferential statistics. The descriptive statistic was carried out to examine the distribution for single variables. The Mann Whitney T-Statistics was conducted to determine the significance difference of students' opinion across educational levels. Mann Whitney Ranking Statistics was conducted to establish the direction of significance difference.

Descriptive statistics, Mann Whitney T-Statistics and Whitney Ranking Statistics were performed using the statistical package for social sciences (SPSS Version 20.0)

RESULTS AND DISCUSSION OF FINDINGS

What sustainability coursework should be included in the built environment curriculum?

Descriptive statistics was conducted to examine the distribution for single sustainability coursework's to be included in education curriculum. Table 3 reveals a general view of the students by educational level. From the analysis the most effective courses are: environment impact assessment ranked first (mean score value = 4.327), design and sustainable development was ranked second (mean value = 4.146), while fundamentals of sustainable development ranked third (mean score value = 3.950) construction waste management ranked fourth (mean score value = 3.789). While technology for sustainable ranked fifth (mean score value = 3.774), sustainable materials and products ranked sixth (mean score value = 3.704), sustainable job site operation ranked seventh (mean score value = 3.508), measuring sustainability ranked eighth (mean score value = 3.186), sustainable development ranked ninth (mean score value = 3.146) and rationale for green buildings ranked tenth (mean score value = 3.080). It is evident that mean score of courses to inculcate the idea of sustainability is within the range of 3.1-4.4. This implies that respondent strongly agreed the inclusion of nine education courses into curriculum as important technique for promoting student's awareness and understanding of sustainability principles. Similarly, energy efficiency course had mean score below 3.0, which signify that the respondents disagreed on the possibility of including it into curriculum. Finally, nine of the courses (variables) out of twelve had approximately 1.0 standard deviation; this implies inconsistency in agreement among respondents on rating the variables. But environment impact assessment and design and sustainable development are below 1.0 standard deviation; this implies consistency in agreement among respondents as coursework be included in the built environment curriculum.

Table 3: Descriptive statistics on Courses to be included in Built environment Curriculum

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environment impact assessment	199	1.00	5.00	4.327	0.846	1
Design and sustainable development	199	1.00	5.00	4.146	0.855	2
Fundamentals of sustainable development	199	1.00	5.00	3.950	1.053	3
Construction waste management	199	1.00	5.00	3.789	1.437	4
Technology for sustainable development	199	1.00	5.00	3.774	1.458	5
Sustainable materials and products	199	1.00	5.00	3.704	1.282	6

Sustainable job site operation	199	1.00	5.00	3.508	1.381	7
Measuring sustainability	199	1.00	5.00	3.186	1.341	8
Sustainable development	199	1.00	5.00	3.146	1.249	9
The rationale for green buildings	199	1.00	5.00	3.080	1.335	10
Energy efficiency	199	1.00	5.00	2.834	1.262	11

What is the extent of agreement among students of built environment on inclusion of sustainability courses in the curriculum?

To establish the degree of inconsistency in agreement among respondents on the scoring of variables. The Mann Whitney T-Statistics was conducted in order to determine significance difference of students' opinion across educational levels. It was evidence from analysis in Table 4 that there is statistically significant difference by level of education ($p > .05$) on Sustainable development ($p = .156$), Design and sustainable development ($p = .558$) Energy efficiency as ($p = .442$), Sustainable job site operation ($p = .512$), Construction waste management ($p = .338$) courses.

Table 4: Educational Program Courses Mann-Whitney Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2- tailed)
Sustainable development	4394.500	9344.500	-1.417	.156
Measuring sustainability	1598.000	6548.000	-8.455	.000
Design and sustainable development	4732.000	9682.000	-.586	.558
Technology for sustainable development	3409.500	8459.500	-4.016	.000
Sustainable materials and products	3217.000	8267.000	-4.434	.000
Fundamentals of sustainable development	3623.500	8673.500	-3.478	.001
The rationale for green buildings	3506.000	8556.000	-3.633	.000
Energy efficiency	4634.500	9684.500	-.803	.422
Sustainable job site operation	4692.000	9742.000	-.656	.512
Construction waste management	4584.000	9634.000	-.958	.338
Environment impact assessment	4220.000	9170.000	-1.984	.047

In addition to describe the direction of the significant differences by level of education (which group is higher) Mann Whitney Ranking Statistics was conducted as seen in Table 5. The results as rated by 500 level and HND II show that 500 level students surveyed strongly agree on technology for sustainable development (Mean Rank =115.56), sustainable materials and products (Mean Rank =117.51), fundamentals of sustainable development (Mean Rank =113.40),

the rationale for green buildings (Mean Rank =114.59), Energy efficiency (Mean Rank =103.19), Sustainable job site operation (Mean Rank =102.61), Construction waste management (Mean Rank 103.70), while HND II students surveyed strongly agree on Sustainable development (Mean Rank =105.56) ,measuring sustainability (Mean Rank 133.52), design and sustainable development (Mean Rank =102.18) and environment impact assessment (Mean Rank =107.30).

Table 5: Educational Program Courses Mann-Whitney Ranking Statistics

Level of education		N	Mean Rank	Sum of Ranks
Sustainable development	500 Level	99	94.39	9344.50
	HND II	100	105.56	10555.50
Measuring sustainability	500 Level	99	66.14	6548.00
	HND II	100	133.52	13352.00
Design and sustainable development	500 Level	99	97.80	9682.00
	HND II	100	102.18	10218.00
Technology for sustainable development	500 Level	99	115.56	11440.50
	HND II	100	84.60	8459.50
Sustainable materials and products	500 Level	99	117.51	11633.00
	HND II	100	82.67	8267.00
Fundamentals of sustainable development	500 Level	99	113.40	11226.50
	HND II	100	86.74	8673.50
The rationale for green buildings	500 Level	99	114.59	11344.00
	HND II	100	85.56	8556.00
Energy efficiency	500 Level	99	103.19	10215.50
	HND II	100	96.85	9684.50
Sustainable job site operation	500 Level	99	102.61	10158.00
	HND II	100	97.42	9742.00
Construction waste management	500 Level	99	103.70	10266.00
	HND II	100	96.34	9634.00
Environment impact assessment	500 Level	99	92.63	9170.00
	HND II	100	107.30	10730.00

Discussion of findings

Sustainability concepts if comprehensively covered in the offered curriculum of higher institutions of learning could help students to build capabilities to act as change agents to actively incorporate sustainability principles directly or indirectly in construction projects. Therefore, if sustainability is not adequately addressing in the curriculum and among students, it may contribute to failure of construction industry. To address the concern of the industry, it is opined that an appropriate sustainability education coursework be included in curriculum to provide students sustainability education related to their disciplines (Calafell, et al., 2019). It is observed that the current curriculum need be revisit in order to incorporate sustainability to enhance student's knowledge. The survey results firstly, identified coursework that incorporate sustainability to be included in curriculum as environment impact assessment, design and sustainable development, fundamentals of sustainable development, construction waste management, technology for sustainable, sustainable materials and products, sustainable job site operation, measuring sustainability, sustainable development and rationale for green buildings. Secondly, this study proved that there is statistically significant difference by level of education ($p > .05$) on sustainable design and sustainable development, energy efficiency, Sustainable job site operation, and construction waste management courses. Thirdly, 500 level students agreed

on technology for sustainable development, sustainable materials and products, fundamentals of sustainable development, the rationale for green buildings, Energy efficiency, Sustainable job site operation, Construction waste management, while HND II students agreed on Sustainable development, measuring sustainability, design and sustainable development, and environment impact assessment.

Conclusions

The research aims to identify courses on sustainability to be included in the study curriculum of institution of higher learning. A survey was used to identify the courses on sustainability to be included in education curriculum.

It was found that the most effective education courses to inculcate sustainability idea in students are environment impact assessment, and design and sustainable development. The survey analysis revealed that there are significant differences in education courses to inculcate sustainability idea in students by level of education ($p > .05$). Upon detailed analysis of result of Mann Whitney test statistics, it was found that agreement of students on education courses is significantly higher for 500 level. The survey analysis revealed general inconsistency in agreement among respondents on rating the variables. There is a need to include in education curriculum of built environment courses that promote sustainability awareness in students. The analysis of list of courses on sustainability was based on the available materials which limits the generalization of the findings to the whole students in higher institution of learning. This study comprehensively focused only final year students; however, the sample size was a limitation, which can be improved in future research. A similar study should be conducted to replicate these results in engineering and increase sample size. Future research should investigate extent of agreement on sustainability courses to be included in the education curriculum among students of engineering.

The outcomes of the present research have implications for quantity surveying practice. Firstly, the sustainable mindset of young graduates nurtured through sustainability education courses help to undertake sustainable project analysis during the Planning and design stage of a project.

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WOMEN QUANTITY SURVEYORS' PARTICIPATION IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

Women possess skills and competencies that makes them relevant and gives them the capacity to fill in the skills shortage gap experienced in the construction industry. However, their participation in the industry is low especially in professional roles as they face difficulties affecting their recruitment and retention. Moreover, studies on women as professionals within the industry is scant. The participation of women Quantity Surveyors within the construction industry was explored. The study adopted a quantitative approach with structured questionnaire used to gather information from registered women Quantity Surveyors in the country. The data collected was analysed using the percentage and mean methods of descriptive statistics. The findings revealed that a high percentage of the women Quantity Surveyors studied are practising Quantity Surveyors who have worked on construction sites. However, women Quantity Surveyors still experience gender discrimination during recruitment. In order to overcome the myriads of difficulties faced, women take up jobs in firms with flexible work schedule rather than jobs in firms with rigid/hectic schedule. The study recommends that the government and Quantity Surveying bodies promulgate and enforce laws to mitigate gender discrimination during recruitment in both private and public organisations. The findings of this study provide insight into the participation of professional women; and will assist the professional bodies and researchers in the construction industry in exploring measures and policies that encourage women participation in the industry.

Keywords: Construction industry, gender discrimination, professional, skills shortage, women quantity surveyors.

INTRODUCTION

The construction industry provides economic growth and employment opportunities globally (Powell *et al.*, 2007; Ratnasabapathy and Rameezdeen, 2007; Wibowo, 2009; Haupt and Harinarain, 2016); and embraces diverse activities, skills and products (Gurjao, 2006), while providing infrastructure and physical structures for other industries (Wibowo, 2009). It accounts for 7-10% of GDP in developed countries and 3-6% in developing countries (Lowe, 2003 cited in Wibowo, 2009). Globally, the industry employs 7% of the total world employment and 28% of industrial employment (Patel and Pitroda, 2016). In Nigeria, the industry employs 4-6% of the nation's workforce (Andawei, 2018; Jimoh *et al.*, 2018), with more than three million people working as professionals, administrative staff, operatives and labourers (Adeyemi *et al.*, 2006).

The industry is faced with a shortage of skills due to recruitment and retention difficulties (Powell *et al.*, 2004; Sang *et al.*, 2004; Ginige *et al.*, 2007), blamed on the negative image of the industry as it is associated with poor, too physical and difficult working conditions (English *et al.*, 2006; Ginige *et al.*, 2007), brute strength, good tolerance for outdoor activities, inclement weather and bad language (Agapiou, 2002; Ksiazek and Nowak, 2017). To address the skills shortage and the gender imbalance already existing in the industry, Ginige *et al.* (2007) and Ksiazek and Nowak (2017) suggested that women should be recruited to fill the existing skill gap. Furthermore,

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English *et al.* (2006) posit that increasing the participation of women will exponentially improve the image of the industry. While Powell *et al.* (2004) and Powell *et al.* (2005) advocates that various governments should encourage women to pursue careers in construction as they have potentials yet untapped. Women are important as they bring the diversity lacking in the industry (Gurjao, 2006), they also possess skills and competencies (better listener, creative, attention to details and are more organized) not quite expressed in men (Sang and Powell, 2012; Ksiazek and Nowak, 2017), and can function as administrators, professionals, labourers (Patel and Pitroda, 2016). Women in the industry can function in three major capacities: in professional/technical positions (Architects, Engineers, Quantity Surveyors); administrators (managers in finance and human resources); and as construction labourers (Patel and Pitroda, 2016).

Globally, studies on general women participation within the construction industry (see English *et al.*, 2006; and Patel and Pitroda, 2016) have increased over the years. However, few have explored professional women's participation. Challenges to the effects of participation of women as professionals need to be investigated as their productivity is reportedly not different from that of their male counterparts in brain tasking job descriptions such as design, preparation of working drawings, estimating and tendering, and cost management (Adeyemi *et al.*, 2006). For instance, studies on the participation of women Quantity Surveyors (WQS) in the construction industry is scant; when considering the important role of financial management (including costing, planning and financial administration) of all construction activities Quantity Surveyors (QSs) undertake in the industry (Okeke *et al.*, 2018). QSs work encompasses both on-site and off-site functions (Haldankar, 2017).

The focus on WQS' experience in the industry was based on the meagre percentage of women's involvement in the industry as reported in extant studies (such as Madikizela and Haupt, 2010; Andi and Alifen, 2007; Haupt and Smallwood, 2006); where most take up administrative (secretarial/clerical) and site labour roles with few engaged as professionals and very few on construction sites. Furthermore, most extant studies on women in the construction industry focus on issues such as under-representation, recruitment and retention, gender inequality, career advancement, and career choice; with limited studies on professional women's participation in the industry. Therefore, this study examines the effective participation of WQS in the construction industry towards addressing the skills gap in the industry. The objectives of the study are to: [1] investigate women Quantity Surveyors' participation in the construction industry, [2] identify the difficulties they face, and [3] explore measures adopted to overcome the difficulties faced.

Overview of the participation of Women Quantity Surveyors in the Construction Industry

Despite their important roles in the industry, women constitute a small percentage in the industry. Globally, women make up less than 20% of the construction workforce (Haupt and Smallwood, 2006; Ksiazek and Nowak, 2017; Akinlolu and Haupt, 2018), While women make up 9% of the workforce in the UK (Amaratunga *et al.*, 2006; Gurjao, 2006), 9.1% in the US (Connley, 2019) and 16.3% in Nigeria (Adeyemi *et al.*, 2006). Even with the skills and competencies possessed by women, only two-thirds work in the industry mostly in secretarial/clerical, administrative and labourer roles; while less than 2% work as professionals in consultancy firms and very few works on construction sites (Patel and Pitroda, 2016; Ksiazek and Nowak, 2017; Regis *et al.*, 2019).

Foley (2020) noted that women have successfully infiltrated all levels of the construction industry; while Natukunda (2020) and Naidoo (2020) opine that the industry is gradually becoming all-inclusive, unlike its historic male-domination. In the surveying profession, there is a global rise in female surveyors from 6% to 14%; in Africa, 15% of the Royal Institution of

Chartered Surveyors (RICS) professionals are females (Natukunda, 2020). In Nigeria, 456 (or 11%) of the 4126 membership of the Nigerian Institute of Quantity Surveyors (NIQS) are registered WQS (NIQS, 2019); although the number may be higher, as not all WQS are registered with the NIQS. Natukunda (2020) further asserts that even though construction is not an obvious choice for most women, several of them are building successful and fulfilling careers; with female RICS professionals holding senior positions with cost consultants, contractors and developers. WQS possess six core competencies - procurement and tendering, quantification and costing of construction works, project financial control or reporting, contract practice, design economics and cost planning, construction technology and environmental services that make them relevant in the industry (Jaafar *et al.*, 2016).

Challenges to the effective participation of Women Quantity Surveyors in the Construction Industry

According to Foley (2020), challenges faced by women in the construction industry are more subtle compared to 30 years ago, but they do exist. Women are also confronted with numerous obstacles working against their participation within the industry (Dainty *et al.*, 2000; Amaratunga *et al.*, 2006). These obstacles have been extensively reported in extant studies; the key obstacles being male domination and lack of diversity (Powell *et al.*, 2008; Kamardeen and Sunindijo, 2017) and under-representation in recruitment and retention (Thurairajah *et al.*, 2007; Powell *et al.*, 2010). The numerous problems that women face within the industry are summarised in Table 1.

The peculiar challenges that WQS working in the industry face are not highlighted in extant literature as studies in this area are scant. Foley (2020) who is a practising WQS in an interview highlighted some of the challenges WQS face as variance in the standard for men and women within the industry, pay disparity, exclusion from leadership events, and negative words to describe positive skills exhibited by women. Furthermore, Natukunda (2020) another RICS member also in an interview strongly asserted that women still face a myriad of challenges in construction that men are exempted from such as variance in pay in comparison to their male colleagues of the same grade, a stereotypical bias that women have diminished physical strength, and prejudice and trust in women's capability. She further stressed that there were instances where women were excluded from certain projects as it is believed they cannot handle being on site.

Table 1 Challenges Women Face in the Construction Industry

S/N	CHALLENGES	AUTHORS
1	Male domination	Kamardeen and Sunindijo, 2017; Ksaizek and Nowak, 2017; Akinlolu and Haupt, 2019
2	Excessive work stress and environment	Fielden <i>et al.</i> , 2000; Ling and Leow, 2008; Kamardeen and Sunindijo (2017)
3	Sexual harassment and discrimination	Bagilhole <i>et al.</i> , 2002; Babatunde <i>et al.</i> , 2012; Regis <i>et al.</i> , 2019
4	Limited networking opportunities	Sang and Powell, 2012; Ksaizek and Nowak, 2017
5	Long and inflexible working hours	Ling and Leow, 2008; Worrall <i>et al.</i> , 2010; Ahuja and Kumari, 2012; Ksaizek and Nowak, 2017
6	Harsh work environment and culture	Amaratunga <i>et al.</i> , 2006; Madikizela and Haupt, 2010; Patel and Pitroda, 2016
7	Insufficient career knowledge about the construction industry	Madikizela and Haupt, 2010; Patel and Pitroda, 2016; Ksaizek and Nowak, 2017

8	Shortage of successful women role models	Madikizela and Haupt, 2010; Patel and Pitroda, 2016; Ksaizek and Nowak, 2017
9	Gender-biased recruitment	Fielden et al., 2000; Ksaizek and Nowak, 2017; Regis et al., 2019
10	Work safety	Regis et al., 2019
11	Lack of professional promotions	Regis et al., 2019
12	Lack of support for devotion to family responsibilities	Ahuja and Kumari, 2012
13	Heavy workload	Ling and Leow, 2008
14	Inadequate welfare facilities for women	English et al., 2006
15	Marital status and family commitment	Kehinde and Okoli (2004); Amaratunga et al., 2006

Overcoming the challenges women Quantity Surveyors face

In order to recruit and retain women in the construction industry, Amaratunga et al. (2006) opine that the barriers that women face first need to be reduced or eliminated. Some of the measures put forth in extant studies to overcome the challenges women face within the industry are summarised in Table 2. Interviews granted by women members of RICS to mark the international women day celebration gave an insight into how women Surveyors can overcome the challenges they face in the industry. For instance, Natukunda (2020) strongly asserts that the industry needs first to change the prejudice it has as a male-dominated industry. Natukunda (2020) and Lai (2020) both agreed that women need to look out for role models in order to enhance their career progression in the area of technical skills, career advice and crisis management. While Naidoo (2020) stressed that women need to be bold enough, refuse to be intimidated and persevere in stamping their relevance within the industry. Lai (2020), a female QS further asserts that women should keep learning and updating their skills with the latest industry and innovative technologies, build an external network, and also join professional networking organizations to meet people with diverse industry experiences and learn from them. However, factors such as professionalism, competency and experience were absent from this assertion.

Table 2 Measures to overcome the challenges WQS Face in the Construction Industry

S/N	MEASURES	AUTHORS
1	Create a conducive work environment and culture	Powell <i>et al.</i> , 2004; Kamardeen and Sunindijo, 2017
2	Advancement of specific continuous professional development (CPD) for women	Worrall et al., 2010; Adogbo et al., 2015
3	Legislation and government policies to provide enabling platforms for women	Adeyemi <i>et al.</i> , 2006; Kolade and Kehinde, 2013; English and Hay, 2015
4	Company (firm)'s effort	English and Hay, 2015
5	Having role models and mentoring programmes	Adogbo <i>et al.</i> , 2015; English and Hay, 2015
6	Introduce flexible work schedule	Babatunde et al., 2012; Kolade and Kehinde, 2013
7	Allow women to work from home	Ling and Leow, 2008
8	Adopt equal opportunities policies	Ling and Leow, 2008; Jimoh <i>et al.</i> , 2018
9	On-site and other training for women	Bagilhole <i>et al.</i> , 2002; English <i>et al.</i> , 2006
10	Equitable workplace environment	Dainty <i>et al.</i> , 2001
11	Favourable selection and recruitment criteria	Jimoh <i>et al.</i> , 2018
12	Improve environmental factors (such as reduce workload, make works less tedious and stressful)	Kolade and Kehinde, 2013; Jimoh <i>et al.</i> , 2018

13	Eradication of foul languages and harassment	Jimoh <i>et al.</i> , 2018
14	Continuous support to balance work and family responsibilities	Jimoh <i>et al.</i> , 2018
15	Improve working conditions on construction sites	Regis <i>et al.</i> , 2019
16	Provision of adequate career guidance	Kolade and Kehinde, 2013

RESEARCH METHODS

In assessing WQS participation in the construction industry, this study took the positivist view, which informed the adoption of quantitative approach using a structured questionnaire as the data collection instrument. The questionnaire covers a broad range of participants within a short time at their convenience and possesses objective and quantifiable characteristics needed in social science researches (Statistics Canada, 2010; Tan, 2011; Sekaran and Bougie, 2016). The questionnaire consisted of four sections. The first section assessed the background of respondents in order to evaluate their response in other sections. The second section explored the participation of WQS; while the third section assessed the challenges WQS faced. The last section of the questionnaire sought answers to the measures adopted by WQS to overcome the challenges faced. The study population was practising WQS registered with the NIQS practising in Kaduna State, Nigeria. The choice of Kaduna State as the study area was based on the important position it holds in the northern part of Nigeria both economically and politically.

According to the data retrieved from NIQS (2019), there are 56 WQS in Kaduna State registered with the NIQS. The study respondents were identified using the Convenience Sampling Technique to reach accessible and available respondents (Taherdoost, 2016; Ross, 2005). The researchers reached out to 49 women Quantity Surveyors (WQS) in Kaduna State registered with NIQS who were readily available to respond to the questionnaire. Thirty-two questionnaires representing a response rate of 65% were retrieved, as shown in Table 3. Data retrieved were analysed using descriptive statistics methods using frequency, tabulation and percentages, relative importance index (RII) and mean item score (MIS).

Table 3 Questionnaire Response Rate

RESPONDENTS	QUESTIONNAIRE ISSUED	RESPONSES	%
Women Quantity Surveyors	49	32	65%

Study Findings

The analysis of the data retrieved on the background of the respondents revealed that the average age of respondents was 38 years. Majority of the respondents representing 75% were married while 25% were not married. In terms of employment, 31.25% work in academia, 31.25% work in government establishments, 31.25% work for consultancy firms while 6.25% work for contracting firms. Furthermore, in terms of years of experience, only 25% of respondents below five years of experience, while the remaining 75% have above five years of experience in the construction industry. On the average, respondents possess 8.25 years working experience. For NIQS membership, 87.5% of respondents possess membership status while 12.5%, probationer's status. On account of the results gathered, diverse organisations where QSs work are represented in the survey. The respondents in this study are well experienced as they are registered members of the profession and have been working for quite some years. Hence, the response gathered can be relied upon as they were based on vast experience in the industry.

Women Quantity Surveyors' participation in the Construction Industry

In exploring reasons for joining the profession, 31.25% respondents (10) revealed that it was based on a suggestion by friends/relatives, while 25% respondents (8) came across the profession by chance where they had no other option. Furthermore, 18.75% respondents (6) had prior knowledge about the profession, another 18.75% respondents (6) joined as they already had parents in the profession, while 6.25% respondents (2) joined out of curiosity about the profession. On the work experience of WQS in the construction industry, the analysis of respondents' background revealed that all respondents work in the construction. However, 68.75% respondents (22) participate actively in the industry as they are practising WQS while 31.25% (10) work in the industry but in academia as researchers/lecturers as shown in Table 4. All respondents revealed that they have participated in projects on construction sites at one point as most respondents (93.75%) reported they had pleasant and cordial work experience, while 6.25% reported they did not have a good site work experience.

Table 4 Women Quantity Surveyors participation in the Construction Industry

	FREQUENCY	PERCENTAGE (%)
Reason for joining the QS profession		
Suggestion by friends/relatives	10	31.25%
Came across the profession by chance, wherewith no other option	8	25%
Prior knowledge about the profession	6	18.75%
Had parents in the profession	6	18.75%
Curiosity about the profession	2	6.25%
Total	32	100%
Women Quantity Surveyors work experience		
Practising	22	68.75%
Non-practising (Academia)	10	31.25%
Total	32	100%
Participated in projects on construction sites		
Yes	32	100%
No	0	0%
Total	32	100%
Experience in the projects handled		
Pleasant and cordial work experience	30	93.75%
Not so good experience	2	6.25%
Total	32	100%

Further exploring the perception of the respondents about the participation of WQS in the construction industry, respondents all agreed that an increasing number of women are taking up quantity surveying roles in the industry as shown in table in Table 5.

Table 5 Perception of WQS participation in the Construction Industry

PERCEPTION	WEIGHTED TOTAL	RII	ITEM MEAN	RANK
Increasing number of women are taking up roles in the industry	116	0.73	3.63	1st
Construction work is masculine and not suitable for women	102	0.64	3.19	2nd
Women Quantity Surveyors prefer other roles such as lecturing than working in the industry	102	0.64	3.19	2nd

Women in the industry are not as productive as those in other sectors such as academia	90	0.56	2.81	3rd

Difficulties Women Quantity Surveyors face in the Construction Industry

In assessing the difficulties WQS face in the industry, five difficulties were selected from the difficulties identified from extant literature based on their frequency in extant studies to identify those experienced in the course of practicing their profession. Moreover, respondents were given the option of stating difficulties not included in the survey. The result presented in Table 6 revealed that WQS experienced gender discrimination during recruitment the most, while respondents reported that they experienced no sexual harassment.

Table 6 Difficulties experienced by WQS in the Construction Industry

Difficulties	Frequency	Percentage	Rank
Gender discrimination during recruitment	14	43.75%	1st
Masculine domination culture and practice	8	25%	2nd
Difficulty in work and family commitments	6	18.75%	3rd
Hostile and inconvenient working environment/conditions	4	12.5%	4th
Sexual harassment	0	0%	5th
Total	32	100%	

Measures adopted by Women Quantity Surveyors to overcome difficulties faced

In exploring measures adopted by WQS to overcome the difficulties they face in the construction industry; three measures were selected based on their frequency in extant literature to examine the most adopted measures among WQS. Moreover, respondents were given the option of adding other measures adopted that were not included in the study. The result on Table 7 revealed that the most adopted measure by WQS was working with firms with a flexible work schedule (such as consultancy firms) rather than with firms with a rigid and hectic work schedule (such as contracting firms).

Table 7 Measures adopted by WQS to overcome difficulties face

Measures	Frequency	Percentage	Rank
Working with firms with a flexible work schedule	16	50%	1st
Good time management and avoiding work-family conflicts	10	31.25%	2nd
Competency and efficiency in work delivery	6	18.75%	3rd
Total	32		

Discussion

From the analysis of the result gathered, it is evident that there is a growth in the number of WQS in the construction industry. This is because a high percentage of the WQS in the study are currently practising their profession. This finding aligns with the submissions of Dainty et al. (1999, 2000) and Fielden et al. (2000) that the number of women in the industry is on the increase even though the percentage of women participation is still low. However, for the percentage of professional women participation in the industry, the study finding differs from that of Patel and Pitroda (2016). They reported that only 1.4% of women work in professional positions, while this study found that 68.75% of women work as professional QSs within the industry. Further finding revealed that a high percentage (93.75%) of WQS have at one point in time participated in projects on construction sites. This finding is at variance with most extant studies such as Regis

et al. (2019) who reported that women make up 10% of construction workforce on sites; Bishop (2012) reported a lesser percentage of 1.2%; while Patel and Pitroda (2016) reported that 30% of women work on construction sites majorly as site labour. Furthermore, these extant studies (except Patel and Pitroda, 2016), all reported widespread participation of women on construction sites without differentiating the various roles they play on sites either as professionals, administrators or labours, as outlined by Patel and Pitroda (2016). The finding also revealed that most WQS joined the quantity surveying profession based on the suggestion of relatives or friends. This finding could not be compared with the findings of extant studies as most of them did not research on the reasons why women join a profession in the construction; rather most studies dwell on reasons why women are not joining the industry.

The most challenging experience WQS faced in the industry is gender discrimination during recruitment. Although extant studies such as Fielden *et al.* (2000), Ksaizek and Nowak (2017) and Regis *et al.* (2019) all reported gender-biased recruitment as one of the difficulties women face in the industry, most extant studies in general highlighted several difficulties women faced without reporting the most experienced difficulty women faced in their research. Furthermore, the study finding revealed that WQS did not experience any sexual harassment and discrimination within the industry. This finding contradicts the findings of extant studies such as Fielden *et al.* (2000), Bagilhole *et al.* (2002), Madikizela and Haupt (2010), Babatunde *et al.* (2012) and Sang and Powell (2012); as they all reported that women in the construction industry experience sexual harassment and discrimination.

In order to sustain WQS participation in the industry, the study finding revealed that the most adopted measure to overcome the difficulties faced by WQS was choosing to work in firms (such as consultancy firms) that have a flexible work schedule as against firms (such as contracting firms) with a rigid and hectic work schedule. These findings agree with the recommendations made in extant studies such as Ling and Leow (2008), Babatunde *et al.* (2012) and Kolade and Kehinde (2013); as they all advocate the introduction of a flexible work schedule to encourage more women participation in the construction industry.

CONCLUSION

In exploring women Quantity Surveyors' participation in the construction industry, this study investigated their participation in the industry. The study also identified the difficulties WQS face in the industry and the measures adopted to overcome the difficulties faced. Using data gathered from registered WQS, the study found that the number of practicing WQS is on the increase in the industry even though few WQS are exploring other areas in the industry such as academia; and the most challenging experience WQS had was gender discrimination during recruitment; while most WQS did not experience sexual harassment or discrimination. Also, it emerged that the most adopted measure to overcome the myriads of challenges WQS face within the construction industry is taking up jobs in firms with a flexible work schedule as against working in firms with a rigid and hectic schedule. The implication of this result is the continuous interest of women to practice the quantity surveying profession if given the needed support, training and platform and if equal treatment is given to women, the number of WQS in the construction industry will increase.

It is believed that the findings in this study will provide insight to the participation of professional women within the construction, in this case, Quantity Surveyors and will assist both the quantity surveying professional body (NIQS), other professional bodies and researchers in the construction industry in exploring measures and adopting policies that will encourage women

participation in the industry. By revealing that most WQS had pleasant work experience in their practice, gender-inclusivity and other measures such as equal opportunities policies that sets out an organisation's commitment to fairness can improve the recruitment and retention of professional women in the industry. These policies can be adapted accordingly. The study also recommends that the government and Quantity Surveying bodies promulgate and enforce laws to mitigate gender discrimination during recruitment in both private and public organisations.

While the study contributes significantly to the body of knowledge, care must be taken in generalizing its findings; as the study was conducted in one major state of the country. Hence, future studies with broader coverage leading to much larger sample size than what is seen in this study would be of more benefit. Also, this study adopted a quantitative approach; future studies adopting a qualitative or mixed-method approach can be conducted to give a more robust research approach to the subject.

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IMPACT OF HEALTH AND SAFETY PREVENTION COST ON CONSTRUCTION COST IN KWARA STATE

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ABSTRACT

Construction activities involve risky and unhealthy operations which give rise to mortality and morbidity rate and adversely affect the overall construction cost. However, Stakeholders (especially contractors) within the construction industry believe that investment in health and safety (H&S) programme increases overall construction cost and therefore tend to neglect relevant accident prevention activities on construction site. There is limited empirical evidence to back this claim. Therefore, this study assessed the impact of H&S prevention cost on construction cost in Kwara State using cost data of previously completed projects. Data collection were through structured questionnaires. Research population constituted 40 professionals who participated in the preparation of invitation to tender and award of contract; and cost data from the archive of Kwara State Ministry of Works and Housing on sixty (60) construction projects awarded and completed between 2006 and 2016. Analyses of data were done using Relative Importance Index (RII) and Pearson Correlation. The study identified 35 elements of H&S programme, which form the basis for H&S prevention cost forecast, under 4 major components out of which safety manager on site (RII = 0.78), onsite safety inspection (RII=0.71), safety helmet (RII=0.74) and tool-box talk (RII=0.44) were the most important under each component. Health and safety prevention cost were observed to fall between the range of 1-10% of the contract sum. It was discovered that there exists a strong positive and significant relationship between H&S prevention cost and construction cost. Thus, H&S prevention cost and construction cost increases together. It was, therefore, recommended that adequate cost control measures should be adopted to checkmate H&S expenditure during construction process instead of total avoidance H&S programme.

Keywords: construction, cost, elements, health and safety programme, prevention

INTRODUCTION

Construction industry immensely contributes to the economic growth of a nation and occupies a central position in the developmental plans of developed and developing countries (CIDC, 2016). Construction activities and project execution usually take place outdoor under conditions not suitable for safety and health. Consequently, workers in the construction sites are subject to the dynamic nature of work, the location of work and the mix of worker. Overtime, this has resulted in high accident and fatalities incidence, thus affecting construction project performance negatively. In Nigeria, the construction industry has the largest employed labour and remains the riskiest of all industries in terms of health and safety hazards despite its import to national economic development (Mohd *et al.*, 2008; Mahmud *et al.*, 2015).

Every year many people fall victim to injury, harm and even death caused by health hazard and accidents on construction site and the leading causes were identified, by OSHA, and include falls, electrocution, struck by object and caught in/between (Pete, 2013). Kadril *et al.* (2014) argued that negligence was the major cause of accidents on construction sites. Faith (2014) also reports that 29%, 21% and 13% of workers who predisposed to occupational accident in construction site are unqualified workers, moulders and plumber, respectively. Kadril *et al.* (2014), in addition, confirm that labourers are the major class of workers that are mostly affected by these accidents, and further showed that they consist of 53.33%, 50% and 60% amongst the multinationals, large scale and small-scale firm respectively. Olutuase (2014), however, opines that though a

construction job or work environment is considered as highly hazardous the likelihood of accident can be control and this will largely depend on “work situation” which is humanly controllable.

Thus, the provision of aids and strict adherence to safer construction practices improves productivity because productivity of labour and project performance are directly hampered by inadequate labour safety on site (Shree and Murali, 2016). According to Rafiq *et al.* (2008), the adoption of a safety management system in the construction industry provides enormous opportunities for saving the cost of accidents including investigation costs, supervisor’s time diverted, clerical efforts, production downtime, medical expenses, damage to equipment or material/product, sick pay, repairs, expenditures on emergency supplies, legal costs, court fines, cost of insurance, public liability claims, business interruption, loss of expertise and experience, training of replacement staff, loss of goodwill or loss of cooperate image. The importance and need for implementing measures to improve the performance of construction industry is therefore a major concern to the Nigeria construction industry. One of the means identified is a conscious process of progressively monitoring the performance of projects based on relevant indicators. The UK working groups on Key Performance Indicators (KPIs) listed ten parameters for benchmarking projects, in order to achieve a good performance. These include seven project performance indicators namely: construction cost, construction time, cost predictability, time predictability, defects, client satisfaction with the product and client satisfaction with the service; and three company performance indicators namely: safety, profitability and productivity. Therefore, the traditional performance measurement of time, cost and quality have ceased to be the only benchmarks for construction projects. In recent years there is an acute focus on health and safety requirements, especially in regards to accidents prevention in construction site, because of the challenging impact of accident on construction performance (Takim and Akintoye, 2002; Shibani *et al.*, 2013).

The definition of health and safety prevention cost, otherwise referred to as accident prevention cost, is established in literature. Laufer (1987) explains the meaning of health and safety prevention cost in terms of its components. It was stated that health and safety prevention cost encompass expenses for safety planning, purchase of equipment and protective installations, training of personnel, salaries for safety staff, safety measurement and accident investigation. Elias *et al.* (2011) added that health and safety prevention cost captures the expenditures by contractors to prevent accidents on site and to ensure maximum benefit. These objects of safety expenditures relate to elements of health and safety programme and form the basis for determining health and safety prevention cost during the design stage. In addition, it is obvious from the previous discussions on the definition of health and safety that effective management practice is required to ensure good health and safety performance in construction site. Therefore, in the context of this work health and safety prevention cost are those specific H&S Management provisions put in place to prevent accidents as already discussed above.

Limpakornkul (2006) finds that safety management system in developing countries need improvement. It was observed that some stakeholders within the construction industry lack understanding of safety management and thus perceived safety cost as a burden. It was further suggested that promotion of construction health and safety knowledge in terms of cost can change the notion. Okoye and Okolie (2014) and Muhammad (2015) further assess the opinion of construction stakeholders on the relationship between health and safety programme and overall construction cost and discovered that majority of construction workers belief that implementation of H&S programme significantly increases the construction cost. It is therefore necessary to verify this claim by using actual cost data of previously awarded and successfully completed construction projects. The aim of this study was therefore to assess the impact of H&S prevention

cost on construction cost in Kwara State using cost data of previously completed projects. The objectives pursued to achieve this were: to identify the major and applicable elements of health and safety programme used to forecast health and safety prevention cost of these projects; and to determine the relationship between H&S prevention cost and construction cost.

LITERATURE REVIEW

Occupational Health and Safety Management in Nigeria

Health and safety management is a major concern to all stakeholders in the construction industry due to continuous occurrence and impact of accidents on construction site (Muiruri and Mulinge, 2014). According to Robson *et al.* (2005) health and safety management system is concern with the integration of organizational elements engaged in the continuous cycle of planning, implementation, evaluation, and continual improvement geared toward the abatement of occupational hazards on construction site. Some of these elements include organizations' health and safety relevant policies, technical resources, accountability structures and practices, hazard controls, quality assurance practices, evaluation practices, and organizational learning practices. However, the effectiveness of safety management undertaking is essential for goal realization within an organization. It is established in existing literatures that the level of effectiveness differs from country to country and from construction company to construction company. Olutuase (2014) finds that existing management system in Nigeria are poorly organised and characterised by ineffectiveness and poor documentation. Hallowell (2012) attributes these problems to transient nature of project, individuality of construction project and project complexity. Diugwu *et al.* (2012) however argue that statutory regulation to ensure proper adoption and implementation of health and safety management systems are either inadequate or ineffective. It was further revealed that organizations are unwilling to give enough attention to health and safety management. Waziri *et al.* (2015) also fault the strength of regulations and the level of compliance which account for the effectiveness of health and safety measures and performance in Nigeria. Thus, the performance of health and safety in Nigeria largely depends on the effectiveness of health and safety management system.

There is an agreement among researchers on how health and safety management in Nigeria can be improved. Waziri *et al.* (2015) suggest the enforcement of effective health and safety standards and guidelines to reduce accidents on construction sites and ensure safe working conditions. Diugwu *et al.* (2012) call for the revision of the laws guiding health and safety management and regulation. This study therefore assessed the health and safety management system for public project in Kwara State with specific reference to financial commitment and the level of implementation of health and safety programme on construction site.

Occupational Health and Safety Cost

Accidents rate in the construction industry is much higher than the average in other sectors of the economy. This has been recognized as the outcome of poor health and safety management system. In addition to the increase in accident rate, mismanagement of safety issues on construction sites also generate high economic cost, often absorbed directly by the employer and consequently results to reduction in the profits of the construction projects (Pellicer *et al.*, 2014). The health and safety cost of a construction project differs from place to place. No two organization can have the same costs, even if they choose, measure, and count the same items as components of safety costs (Prichard, 2002). Pellicer *et al.* (2014) classify health and safety cost into four categories: insurance cost, prevention cost, accident costs, and recovery costs; and these costs can be assessed during the design phase. Prichard (2002) however asserts that safety cost for inclusion in

construction bid requires a different degree of detail than justifying expansion of the corporate safety function.

There are convergent views on health and safety prevention cost in existing body of knowledge. Lopez-Alonso *et al.* (2013) define prevention cost as those incurred in order to fulfil legal requirements related to accident prevention, to implement measures to prevent accidents during construction work and to improve health and safety conditions in all areas of the work performed. According to Pellicer *et al.* (2014), safety prevention cost component includes individual protection elements, collective protection elements, safety and control systems for machinery and equipment, company medical service and first aid supplies and prevention service (of the company itself or another service provider). Similarly, Tang *et al.* (1997) highlight three components of safety investment which include safety administration personnel comprising site staff and head office staff; safety equipment such as purchasing of safety boots, googles, helmets, first-aid facilities, and any other equipment that provides safety; and safety training and promotion.

Hallowell (2011) discovers that the cost of construction accident has an immense impact on the financial success of construction organization and also increase the overall costs of construction up to 15%. Rafiq *et al.* (2008) further listed the cost of accidents which include repairs, medical expenses, damage to equipment and materials, sick pay, public liability claim, business interruption, loss of expertise, training of replacement staff, cost of insurance, production down-time and loss of cooperate. These enormous impacts are expected to spur the implementation of various management techniques to reduce the frequency of the accident. But Okoye and Okolie (2014) reveals that construction stakeholders, especially contractors, scarcely plan and implement health and safety programmes and policies. It is assumed that the implementation of health and safety programme for construction project increases the overall cost of the project without any consideration for the resultant benefits (Muhammad *et al.*, 2015). This uninformed assumption has continued to impact health and safety performance negatively in Nigeria. Hence, there is need to know the empirical relationship between health and safety prevention cost and construction cost, this will form the basis for construction stakeholders to compare prevention cost against accident cost and also improve health and safety management performance.

Health and Safety Prevention Programme

Health and safety problems are obtainable on virtually all construction sites and construction companies implement a wide variety of methods to prevent accidents on construction site (Hallowell, 2011). According to Mensah (2010), those employed to undertake construction work on site should be adequately trained, competent, and fit to carry out the task without jeopardizing their own or others health and safety; well-coordinated and given explicit instructions; have access to the appropriate tools, equipment, plant and protective clothing; have arrangements for employees' health surveillance where required, including reports on accidents or work-related illness to the appropriate authorities within a reasonable time frame.

The elements of health and safety prevention programme are well established in literature. Rajendran and Gambatese (2009) identify 50 elements of health and safety prevention programme under 13 categories. Hallowell (2011) also lists 13 elements from existing literature that are most effective they include upper management support, subcontractor selection and management, employee involvement, substance abuse programs, job hazard analyses, frequent worksite inspections, safety and health committees, project-specific training, safety manager on site, safety and health orientation and training, written and comprehensive safety and health plan, recordkeeping and accident analysis and emergency response planning. The United States

Department of Labour through its occupational safety and health administration (OSHA) also lists four major components of health and safety programme which include management commitment, worksite analysis, hazard prevention and control, and safety and health training. This study therefore made use of more generally and frequently used elements under the four identified components by OSHA, as presented in Table 1, to rank those mostly implemented in Kwara State.

Table 1: Key Elements of Health and Safety Prevention Programme

Major Components	Key Elements
Management Commitment	Health and safety policy
	Organizational communication
	Safety budget
	Support in the use of safety principle and practice
	Safety meeting
	Assignment of responsibility
	Safety and health committee
	Emergency response planning
Worksite Analysis	Safety manager on site
	Routine job hazard analysis
	Accident investigation
	Onsite safety inspection
	Safety need survey
	Safety audit
	Risk assessment
Hazard Prevention and Control	Record keeping
	First aid
	Fire protection equipment
	Respirator
	Safety belt
	Ear plug
	Eye protection
	Safety shoe
Health and Safety Training	Safety glasses
	Gloves
	Substance abuse programme
	New workers orientation
	Employee assistance programme
	Project-specific training
	Tool-box talk
	Hazard communication
	Fire safety
	Material handling
	Workplace violence

Source: Authors' Compilation of Literature (2020)

METHODOLOGY AND DATA COLLECTION

This research employed the use of both primary and secondary sources to collect data. Well-structured questionnaires were designed and distributed to professionals to gather data from the primary source while secondary source include an extensive review of literature using journal articles and other published books and cost data from the archive of Kwara State Ministry of Works and Housing. Sixty (60) construction projects awarded and completed between year 2006 and 2016 were studied in this research.

Population for the research constitutes the number of public construction projects in Kwara State supervised by the ministry of works and housing, and professionals who took part in the design, tender and implementation phases of the projects. Purposive sampling method was used to select the sample for the study. The questionnaire was developed based on the literature that examined the elements of health and safety prevention programme. These literatures include Rajendran and Gambatese (2009), Hallowell (2011) and Pellicer (2014). The identified elements in the previous studies were adapted to reflect Nigerian construction industry context as shown in Table 1. This was justified by Umeokafor (2017) who states that health and safety issues in developing countries should be addressed contextually.

Tables and figures were employed to present the data extracted from the questionnaires administered. Analysis of data was carried out using relative importance index (RII) and Pearson Correlation to determine the level of implementation of the identified elements of health and safety programme adopted in Kwara State and the relationship between health and safety cost and construction cost. The analyses were carried out with the aid of Statistical Package for Social Sciences (SPSS) software. Conclusions and recommendations made at the end of this research were based on the research findings.

DATA ANALYSIS, PRESENTATION AND DISCUSSION OF RESULTS

Description of sample

The cost data of 60 construction projects which were awarded and completed between year 2006 and 2016 were extracted. Also, 40 questionnaires were administered, and 26 were returned completed, of which 23 were valid for analysis. The response rate was 57.5% which is an acceptable response rate.

Respondents' profile

According to Table 2, a sizeable number of respondents were construction managers representing 65% of the total respondents, quantity surveyors (17%), Architects (9%) and other construction professionals (9%). This implies that majority of the respondents were construction managers.

Table 2: Background of respondents

Profession	Frequency	Percentage
Construction manager	15	65
Quantity surveyor	4	17
Architect	2	9
Others	2	9
Total	23	100

Table 3 shows that majority of the respondent constituting 70% have a working experience ranging from 5 – 10 years while 13% of the respondents have above 20 years of experience. The period in both categories of respondents are relatively long enough to provide a reliable response.

Table 3: Respondents' years of experience

Experience	Frequency	Percentage
Less than 5 years	3	13
5 – 10 years	16	70
10 – 15 years	1	4
15 – 20 years	0	0
Above 20 years	3	13

Analysis of the elements of health and safety prevention programme

The results of the RII showing the identified elements of health and safety prevention programme, in order of importance, are presented in Table 4.

Table 4: Ranking of Key Elements of Health and Safety Prevention Programme

Management Commitment	RII	RANK
Safety manager on site	0.78	1 st
Support in the use of safety principles and practice	0.74	2 nd
Organizational communication	0.73	3 rd
Safety budget	0.70	4 th
Health and safety policy	0.68	5 th
Assignment of responsibility	0.67	6 th
Emergency response planning	0.66	7 th
Safety and health committee	0.60	8 th
Safety meeting	0.56	9 th
Worksite Analysis	RII	RANK
Onsite safety inspection	0.71	1 st
Risk assessment	0.69	2 nd
Record keeping	0.68	3 rd
Safety need survey	0.65	4 th
Routine job hazard analysis	0.63	5 th
Safety audit	0.63	5 th
Accident investigation	0.62	6 th
Hazard prevention and control	RII	RANK
Safety helmet	0.74	1 st
Safety shoe	0.74	1 st
First aid	0.73	2 nd
Fire protection	0.72	3 rd
Safety glasses 0.71	0.71	4 th
Gloves	0.70	5 th
Safety belt	0.68	6 th
Eye protection	0.66	7 th
Respirator	0.63	8 th
Ear plug	0.63	8 th
Health and safety training	RII	RANK
Tool-box talk	0.44	1 st
Fire safety	0.43	2 nd
New workers' orientation	0.41	3 rd
Employee assistance programme	0.41	3 rd
Project-specific training	0.40	4 th
Material handling	0.40	4 th
Hazard communication	0.38	5 th
Workplace violence	0.38	5 th
Substance abuse orientation	0.37	6 th

Table 4 shows 35 important elements of health and safety (H&S) prevention programme under 4 components of H&S programme. These are *management commitment*, *worksites analysis*, *hazard prevention and control* and *H&S training*. Nine important elements of H&S prevention programme were identified under management commitment with RII ranging between 0.78 and 0.56. The elements here range from *safety manager on site* which is the highest ranked (0.78) to *safety meeting* which is the least ranked (0.56). Seven important elements of H&S prevention programme were identified under worksite analysis. These range between *onsite safety inspection* with RII of 0.71 and *accident investigation* with RII of 0.62. Hazard prevention and control comprises of ten important elements of H&S prevention programme ranging from *safety helmet* (RII = 0.74) to *ear plug* (RII = 0.63). The nine important elements of H&S prevention programme discovered under H&S training range between *tool-box talk* (RII = 0.44) and *substance abuse programme* (0.37).

This finding is consistent with the studies of Rajendran and Gambatese (2009), Hallowell (2010) and Pellicer *et al.* (2014). Rajendran and Gambatese (2009) use most of these elements to develop and validate a sustainable construction H&S rating system based on the degree of implementation of H&S programme. Hallowell (2010) assessed the cost-effectiveness of some of these elements. Pellicer *et al.* (2014) also alludes to some of these elements to propose an innovative method to calculate H&S costs in construction projects. Furthermore, the least ranking of emergency response planning, safety and health committee and safety meeting under management commitment category confirms the report of Muiruri and Mulinge (2014) that foremost management support of health and safety in construction site is ineffective.

Descriptive Analysis of H&S Prevention Cost and Contract Sum

The health and safety prevention cost were also analysed. In this regard, health and safety prevention cost falls between 1 – 10% of the contract sum as shown in Fig. 1.

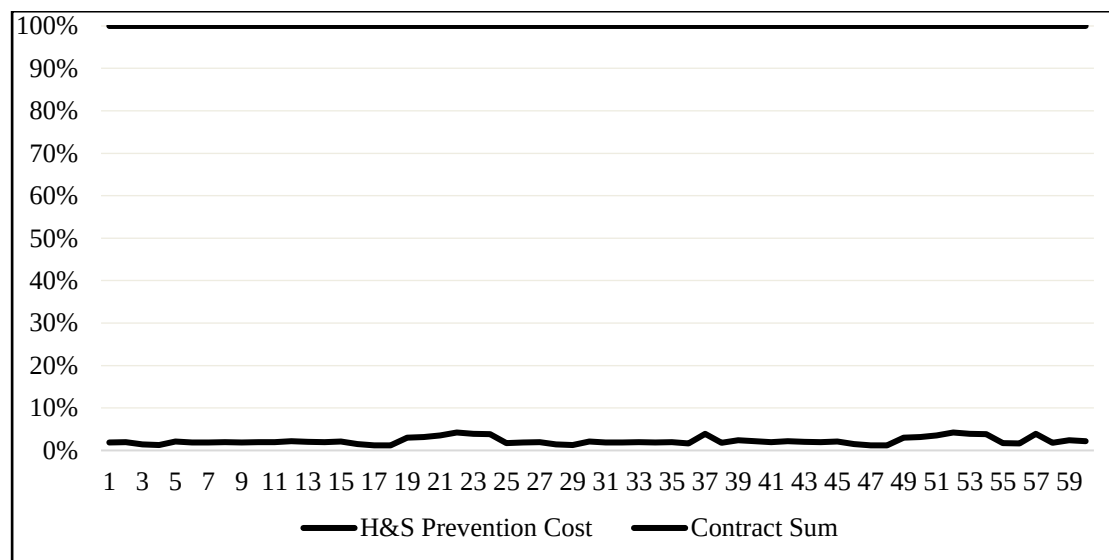


Fig:1 Percentage of health and safety prevention cost

This finding implies that the health and safety prevention cost is optimum. This is in line with the conclusion drawn by Tang *et al.* (1997) that optimal minimum safety investment on a building project is 0.6% of the contract sum.

Correlation between H&S Prevention Cost and Construction Cost

It was observed in Table 4 that, the value of the Pearson correlation was positive and very high (0.969). Correlation was found to be significant at 0.05 level (2 tailed). The “R” value 0.69 indicates a high association between the H&S prevention cost and construction cost. It was also empirically established that this relationship was statistically significant with P value 0.000 which is less than 0.05 level set.

Table 5: Correlation between H&S prevention cost and construction cost

Analysis No	Variable		Pearson Correlation (R)	P-Value	Strength of Relationship	Remark
	X	Y				
1	H&S Prevent- ion Cost	Construction Cost	0.969	0.000	Very Strong	SS

Key: SS - Statistically Significant

The implication of this result is that the cost of implementing health and safety programme and overall construction cost increases together. This outcome agrees with the findings of Okoye and Okolie (2014) and Muhammad (2015). Both studies assessed the opinion of construction stakeholders on the relationship between health and safety programme and overall construction cost. It was discovered that majority of construction workers’ belief that implementation of H&S programme significantly increases the construction cost.

Conclusion

This study has verified the assumption of construction stakeholders on the impact of health and safety prevention cost on overall construction cost by using actual cost data of 60 public projects awarded and completed in Kwara State between year 2006 and 2016. The evidence from the analysis lucidly shows that construction cost increases as health and safety prevention cost increases. The result also indicates that the health and safety prevention cost for all the 60 projects considered fall between 1 – 10% of the contract sum but the ranking of elements of health and safety programme commonly implemented on construction site reflects a weak health and safety management performance. Major elements identified include safety manager on site, onsite safety inspection, safety helmet, safety shoe, and tool-box talk. It was further revealed that elements of health and safety programme constitute the cost items of health and safety prevention cost. The following recommendations were made from the results of the findings:

- i. Management commitment to health and safety should be stepped up in order to ensure the implementation of functional health and safety programme on construction site.
- ii. Health and safety budget should be based on relevant elements of health and safety programme applicable to the proposed project to avoid excessive cost projection during design phase.
- iii. Proper cost control measure should be taken to checkmate health and safety expenditure during the construction process.
- iv. Construction industry stakeholders should avoid undue profit and cost consideration during design stage detrimental to health and safety performance since accidents cost do have greater impact than prevention cost.

In summary, the implementation of health and safety programme on construction site increases the overall construction project cost. This rise in cost can get out of acceptable proportion where there is improper health and safety planning during the design phase and ineffective management or expenditure control during the construction phase.

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APPRAISAL OF THE LEVEL OF AWARENESS AND PRACTICE OF TOTAL QUALITY MANAGEMENT (TQM) PRINCIPLES IN THE CONSTRUCTION INDUSTRY IN IMO STATE, NIGERIAN

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ABSTRACT

The quality of output of construction industry has been adjudged to be poor when compared to that of manufacturing and other services industry. Poor quality work has been responsible for structural failures in the form of physical failure, progressive failure and total / sudden failure / collapse of structures. Thus, cost and time overruns, rework, construction waste and poor performance of construction projects have remained a menace. Meeting clients' satisfaction and project needs required Total Quality Management (TQM) and continuous improvement. This study, therefore, focused on appraising the level of awareness and practice of Total Quality Management (TQM) Principles in the construction industry of Nigeria. The study adopted a survey approach in which a well-structured questionnaire was administered. Data were collected from construction professionals within Imo State, Nigeria using convenient sampling method. The collected data were analyzed using frequencies, percentiles and mean item score (MIS). The study found that there is an average awareness in the practice of QTM in the construction industry, and that purchasing of standard construction materials is the most applied TQM practice. The study recommends that government should create a policy in the construction industry which will mandate construction firms to adopt TQM principles as part of their quality strategy.

Keywords: Construction Industry, Project Delivery, Standard Materials, Structural Failure, Total Quality Management.

INTRODUCTION

Quality is a philosophy with dimensions which can be summed up as 'doing things properly' for competitiveness and profitability. It is a holistic concept and includes two different ideas of quality which are quality as 'consistency' and quality as 'fitness for purpose' (Abdurrahman, 2012). Quality can therefore be defined as "the degree of excellence in a competitive sense, such as reliability, serviceability, maintainability or even individual characteristics" (Ahmed, 2000). Management in the construction industry, on the other hand, pertains to the efficient use of machinery, labor, raw materials, tools and equipment for industrial production (Harris and McCoffer, 2002). It includes recording and storing facts and information for later use or for use by others within the organization. Total Quality Management (TQM) is therefore defined by Abdurrahman (2012) as a holistic approach to managing a project. It is a collaboration of both quality and management which involves continuous improvement, customer's satisfaction, top management support, defect-free product at first attempt, elimination of reworks, cost effectiveness, training and re-training of staff, etc. According to Telsong (2004), TQM is a process of getting rid of poor quality from production rather than getting rid of poor quality products. It is a philosophy that involves everyone in an organization in continual efforts to improve quality and achieve customers' satisfaction. TQM therefore consists of all activities managers perform to improve their quality and policy such as quality planning, quality controlling, quality assurance, quality culture, quality standardization, and quality improvement which gives workers a sense of empowerment, responsibility, and accountability thus, consistently reinforcing their good work (Harris and McCoffer, 2002).

Council of Registered Builders of Nigeria in 2006 discovered that in recent times, there have been a lot of cases on structural failure in Nigeria. This is either physical failure which occurs

when a small part of the structure fails or is affected, progressive failure which occurs where there are signs of weaknesses such as cracks which become widened with time and total or sudden failure of structures which destroys the project without showing any signs. These failures, according to Abdurrahman (2012), are often caused by absence of proper planning approval which are not adhered to by the client and contractors especially during the design stage, non-adherence to specifications, inadequate / poor reinforcement and workmanship, use of low quality and substandard materials, engagement of half-baked or unskilled professional during construction, inadequate staffing of monitoring and control team, design deficiencies due to lack of or incomplete structural design details, hasty construction, lack of proper quality inspection, ignorance on the part of contractors, supervisors and clients, etc. which are all TQM principles. Research by Orumwense (2014) proved that the need to develop effective construction project performance improvement strategies has never been greater than it is in Nigeria today. Ewurum (2001) observed that the economy is growing slowly, and is characterized by high cost of construction, low quality of materials and services, overcapacity and market stagnation, time overruns, etc.

TQM implementation has been a topic of debate in the construction industry for so many years now. The construction industry is being viewed as one with poor quality output when compared to other sectors such as the service and manufacturing industries as many criticisms have been directed to the construction industry for generally poor-quality workmanship (Sodangi et al., 2010). Research carried out by El-Kholy (2015) in Malaysia shows that the level of awareness of TQM principles remains very poor amongst construction firms in the construction industry. Findings of his research proved that many construction firms do not practice TQM as their company policy while others who practice TQM has little or no idea of the existence of TQM principles. Moreover, Adusa-Poku (2014) observed that with an increasing awareness of quality in the Ghanaian construction, contractors have no option than to ensure that clients get value for their invested money. Considering the influences of foreign construction companies and the increasing competitiveness in the construction industry, it is important that contractors deploy appropriate quality management strategies such as TQM practices to reduce cost and time overruns, and increase value / quality of projects delivered (Memon et al, 2012). The awareness and practice of TQM principles is the ultimate goal for a successful construction firm / organizational Quality Management System. The primary purpose of TQM is to achieve excellence in customer satisfaction through continuous improvement of products and processes by the total involvement and dedication of each individual who is part of a company's production process (Hoonakker, 2011). In view of this, Telsong (2004) opined that the construction industry needs proactive management methods such as TQM in order to improve quality of projects delivered, reduce re-work and time overrun, and also reduce cost of construction. Therefore, it is in view of the above short comings of the Nigerian construction industry that this research was carried out to appraise the current level of awareness and practice of Total Quality Management (TQM) in the Nigerian construction industry, through the sampling of construction professionals and construction firms in Imo State, Nigeria.

LITERATURE REVIEW

Construction is defined as 'the mobilization and utilization of capital and specialized personnel, materials, tools, and equipment to assemble construction materials on a specific site in accordance with drawings, specifications, and contract documents prepared to serve the purposes of the client' (Motwani, 2001). Throughout the world, the business environment within which construction organizations operate continues to change rapidly. Organizations failing to adapt and respond to the complexity of the new environment tend to experience survival problems (Love and Heng, 2000). With increasing higher users' requirements, environmental awareness, limited resources, and high competition for construction business market, contractors have to be

capable of continuously improving their performance in order to meet up with current standards (Samson and Lema, 2005). Therefore, Abdurrahman (2012) stated that the construction industry plays an important role in the realization of the objectives and vision of a nation's government in political, economic, sociological, infrastructural and technological growth.

For this reason, developing a competitive construction industry should be an important objective of government policy (Zhang, 2000). Nigeria's infrastructure backbones cover the entire national territory and help to integrate the different regions of the country (Ofori, 2012). The aim of government is to provide infrastructural activities in various sectors of the economy to stimulate growth and support the private sector in job generation thus improving the wealth and health of the general population. Abu *et al.* (2011) defined TQM as a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. TQM therefore consists of all activities managers perform to improve their quality and policy such as quality planning, quality controlling, quality assurance, quality culture, quality standardization, and quality improvement which gives workers a sense of empowerment, responsibility, and accountability thus, consistently reinforcing their good work (Harris and McCoffer, 2002).

Total Quality Management (TQM)

The concept of Total Quality Management (TQM) started in the manufacturing Industry giving the impression that it cannot be applied in any other industry. Regardless of the fact that construction is different from the manufacturing and service sector in terms of its uniqueness in production. Studies according to Harrington and Voehl (2012) and Low and Jasmine (2004) confirmed that the benefits and applicability of TQM in the Construction Industry helps to ensure that organizations do the right things right in their never-ending "war on waste control." TQM means thinking about quality with respect to all functions of an organization. It is a systematic approach that considers every interaction among the elements of the organization (Abu *et al.*, 2011). TQM is a proactive and prevention-based approach that focuses on organizational members and processes with customer driven leadership (Arora, 2006). In the view of this scholar, it means that all organizational activities initiated by the management should be targeted at satisfying customers with high quality products and services. This is to ensure the attainment of competitive edge in the market place. TQM therefore underscores the continuous improvement of product quality and service delivery.

Teck and Tobia (2000) defined TQM as "the continuous improvement of individuals, groups, departments and organizational processes focused on meeting customer requirements first time and always". According to Eke (2001), it is "the state of an organization in which all the activities and functions are designed and carried out in such a way that all external customer requirements are met while reducing internal tune and cost, and enhancing the workplace climate". According to Nwadukwe and Court (2013), TQM is an organizational-wide process that involves the entire workforce of any entity. Thus, human resources must be motivated with relative and commensurate rewards to stimulate optimum effort, commitment from all workers, and increase in productivity. TQM involves the understanding and implementation of quality management principles and concepts in every aspect of business activity (Cebeci and Beskese, 2002). It demands that the principles of quality management must be applied at every level, every stage and in every department of an organization.

Since TQM is a business philosophy that embodies the belief that management process focuses on integrating the idea of customer-driven quality through an organization (Aluko *et al.*, 2004), Oberlender (2002) therefore offered the following 14 management points which upholds TQM as a result of team work at all levels of an organization to improve the quality of a product and achieve maximum customer satisfaction in order to help managers improve the quality of their organizations. These include;

- 1. Constancy of Purpose:** Create continual improvement of product and service

2. **Adopt new Philosophy:** Upgrading to the new era of modern technology
3. **Cease Dependence on Inspection:** Eliminate the need for mass inspection as a way to achieve quality
4. **End 'Lowest Tender' Contracts:** End the practice of awarding business solely on the basis of price tag
5. **Improve Every Process:** Improve constantly and forever every process for planning, production and service
6. **Institute training on the job:** Institute modern methods of training on the job
7. **Institute Leadership:** Adopt and institute leadership aimed at helping people and machines to do a better job
8. **Drive Away Fear:** Encourage effective two-way communication and other means to drive away fear throughout the organization
9. **Break Down Barriers:** Break down barriers between department and staff areas
10. **Eliminate Exhortations:** Eliminate the use of slogans, posters and exhortations
11. **Eliminate Targets:** Eliminate work standards that prescribe numerical quotas for the workforce and numerical goals for people in management
12. **Permit Pride of Workmanship:** Remove the barriers that rob hourly workers, and people in management, of the right to pride of workmanship
13. **Encourage Education:** Institute a vigorous programme of education and encourage self-improvement for everyone
14. **Increases Top Management Commitment:** Clearly define top management's permanent commitment to ever-improving quality.

Awareness of Total Quality Management (TQM)

The construction industry is being viewed as one with poor quality output when compared to other sectors such as the service and manufacturing industries as many criticisms have been directed to the construction industry for generally poor-quality workmanship (Sodangi *et al.*, 2010). Mahmood, Mohammed, Misnan, Yusof, and Bakri (2006) stated that it is not only the final product that is subject to criticisms but among others includes the processes, the peoples, and the materials used for construction which are all under tremendous pressure for better quality in construction. TQM awareness, practice and implementation have been a subject of debate in the construction industry as many construction firms / construction professionals who practice TQM principles are not aware that what they actually apply in their works is TQM. Ahmed (2012) stated that the construction industry arrived late to TQM since construction professionals are unaware of TQM principles and techniques. Research carried out by El-Kholy (2015) in Malaysia shows that the level of awareness of TQM principles remains very poor amongst construction firms in the construction industry. Findings of his research proved that many construction firms do not practice TQM as their company policy while others who practice TQM has little or no idea of the existence of TQM principles.

However, researchers over time have proven that TQM is not such a new philosophy in the construction industry as there have been consistent but rather a slow and gradual shift away from the negative mentality of construction professionals and construction firms on the awareness, practice, and implementation of TQM principles as part of their organizational policies. In his research, Adusa-Poku (2014) observed that with an increasing awareness of quality in the Ghanaian construction, contractors have no option than to ensure that clients get value for their invested money. Considering the influences of foreign construction companies and the increasing competitiveness in the construction industry, it is important that contractors deploy appropriate quality management strategies such as TQM practices to reduce cost and time overruns, and increase value / quality of projects delivered (Memon *et al.*, 2012).

From the survey carried out by Manjunathgouda and Supriya (2017), it was observed that the literacy level of TQM from the survey samples is around 69%. This is a positive indication which shows that TQM is gaining grounds in the construction industry. The awareness and practice of TQM principles is the ultimate goal for a successful construction firm / organizational Quality Management System (QSM). The primary purpose of TQM is to achieve excellence in customer satisfaction through continuous improvement of products and processes by the total involvement and dedication of each individual who is part of a company's production process (Hoonakker, 2011).

Practice of Total Quality Management (TQM) Principles

According to Robson (2002), TQM involves creating an organizational culture committed to the continuous improvement of skills, teamwork, process and product service, and customer satisfaction. Therefore, the application of TQM as a management philosophy and company practice aimed at harnessing the human and material resources of an organization in the most effective way cannot be overemphasized in order to achieve the objectives of the organization. TQM principles are supported by a set of practices. These practices according to Henderick and Singhal (2001) emphasize among other things; creating a quality vision, implementing policies and structure, supporting the quality vision, engaging the continuous process, improvement, promoting teamwork and cooperation among employees and fostering participation of key external agents.

Abdurrahman (2012) stated that the principles of TQM are to produce products of high quality rather than to depend on detecting defective products through inspections. This is achievable through; continuous improvement, top management policies, quality control training, decisions based on facts rather than opinions and assumptions control in production, etc. To understand this, he considered the following;

1. **Project Quality Management Plan:** This is prepared as the formal procedures and activities of the contracting firm in relation to quality management of the project. Its functions include; to provide the means to establish, document and maintain a cost effective quality management system on the project, to ensure and demonstrate that the works carried out by the contracting company will conform to the production information issued on the project, and to provide means by which the client may derive confidence that the project is being carried out in accordance with specified quality standards.
2. **Site Management Responsibility:** In accomplishing project quality management plans, the functions of the site manager, the planning manager, the construction manager, and the purchasing manager are observed to be the key principal to TQM adherence.
3. **Measurement of Performances:** This requires collection of data to identify customer's needs and measure performance (Ijaiya, 2008). Therefore, organizations use measurement systems to understand whether customer values are being met and hence whether market share is increasing or not. Measurement systems according to Dale (2003) include those that address profitability, customer satisfaction, customer retention, and employee satisfaction and retention, client's expectation, costs of quality, identifying opportunities for improvement (quality cost), Comparing performance against internal standard (process control and improvement), and Comparing performance against external standards (benchmarking).
4. **Purchasing:** It establishes quality management procedures covering the scheduling, identification, and the procurement of the specified quality standard materials required in the construction of the project work. This procedure is applied to all goods, plants and services to ensure the project quality standards and specifications, subcontract and purchase order, and relevant legislation and statutory requirements are met. This is in line with the works of Ohimai (2006).

5. **Placement of Purchase Order:** A company's purchase order form covers the placement of all materials, ensuring that verbal orders are conformed in writing as quickly as possible. Placement procedures as opined by Fuster (2006) include material requirements, provision of supply details, transportation and packaging, delivery requirements, etc.
6. **Handling, Storage, Packaging and Delivery:** This identifies that the materials, the quality assurance requirements, their location in the works and their level of packaging where appropriate. The order will also specify any certification required to be sent to site. This according to Nworum (2001) shows the functions of the store keeper which includes recording of materials delivery on site, inspection of materials covered by specifications, etc. and the site manager's functions which includes considerations of the needs of the project and the manufacturer's recommendations in respect to storage, stacking, protection, and handling.
7. **Quality Standards in Construction:** It is the adoption of the International Standardization Organization (ISO) Act of 9000 series for quality management through quality implementations and certification.

The central principle of TQM as opted by George (2002) is that, mistakes may be made by people, but most of them are caused by faulty systems and processes. This means that root cause of such mistakes can be eliminated and repetition can be prevented by changing the process. These prevention mechanisms include.

- i. Preventing mistakes from occurring (mistake-proofing or poker-yoke).
- ii. Where mistakes cannot be absolutely prevented, it is necessary to detect them early (inspection at source or by the next operation).
- iii. Where mistakes occur, stop production until the process is corrected.

According to the Council of Registered Builders of Nigeria (2006) the company's quality plan will ensure a uniform high quality and level of workmanship through all stages of construction including planning, construction, and turnover. To meet these goals the following principles are observed;

- i. To ensure the highest level of quality by maintaining supervised controls and written instructions governing quality control procurement and practices.
- ii. To establish clearly defined responsibilities and authority for compliance.
- iii. To meet contractual requirements by conformance to contract documents and applicable standards.

RESEARCH METHODOLOGY

This research was carried out to appraise the current level of awareness and practice of Total Quality Management (TQM) in the Nigerian construction industry with a targeted population of construction professionals and construction firms in Imo State, Nigeria. Kothari (2004) pointed out that research design is the structuring of investigation aimed at identifying variables and their relationship to one another. This study employed a survey research method in determining the number of construction firms in Imo State, Nigeria. The purposive sampling method was used to sample construction professionals in each construction firm identified. Thus, the well-structured questionnaires were administered to only construction professionals (Quantity Surveyors, Builders, Architects and Engineers) in each identified construction firm to help in eliciting the necessary information for data analysis. The target population for this research consists of one hundred and seventy-two (172) construction firms registered with the Ministry of Works in Imo State as at August, 2019. Since the population is manageable, the whole construction firms were sampled.

A preliminary Survey revealed that only a total of sixty-three (63) construction firms have their head or branch offices within the study area, and were actively engaged in Imo state. These firms

were successfully identified and sampled. It was also observed that most of these construction firms operate with only two (2) construction professionals while others have three (3) or four (4) professionals in their company as the case may be. Finally, a total of one hundred and fifty-nine (159) questionnaires were distributed to the target construction professionals. 106 questionnaires of the 159 administered were completely filled and retrieved. This represent about 75% response rate which is far above the usual response rate of 20 – 30% for questionnaire surveys in construction management studies (Aghimien, 2016).

The questionnaire used was structured in line with the aim and objectives of the study which addresses the background information of respondents and their level of awareness and practice of Total Quality Management (TQM) in the construction industry on a 5-point Likert'-type scale. The questionnaire was developed with information gathered through a review of literature on TQM in the construction industry. Data analysis were carried out on collected data using frequencies, percentile, and mean score analysis (MSA). Frequencies, percentile were used to analyse the data on the background of the respondents, and in determining the level of Awareness of TQM in the Construction Industry. The MSA was used to determine the Level of Practice of TQM Principles in construction. MS-Excel'and the Statistical Package for Social Sciences (SPSS) were used in the actual data processing.

FINDINGS AND DISCUSSION

Characteristics of Questionnaire Respondents

The analysis of the background information of the respondents revealed that 36% are Engineers, 27% are Quantity Surveyors, 19% are Architects, and builders are 18%. This is a fair representation of the major professionals in the construction industry. Although, the engineers and quantity surveyors constitute over 50% of the total respondents. In terms of educational qualification, most of the respondents sampled possess HND (39%) and B.Sc / B.Tech (35%) while about 14% and 12% have PGD and M.Sc / M.Tech degree respectively. In terms of years of practicing experience, this research result proves that only about 28% have below 5 years working experience with a greater number of respondents having from 6 years and above working experience.

Furthermore, in terms of professional membership, 28.3% of the respondents are members of the Nigerian Society of Engineers (NSE). 20.8% are members of the Nigerian Institute of Quantity Surveyors (NIQS), the Nigerian Institute of Architects – NIA (14.2%), the Nigerian Institute of Builders – NIOB (13.2%). This shows a total number of 81 (76.4%), and probationer members constitute 23.6% of the respondents.

The result obtained on the background information of the respondents shows that they have the requisite professional experiences in the industry and academic qualification to aid the achievement of this study aim. Thus, information obtained from them could be relied upon for drawing conclusion for the study.

Table 1: Summary of Characteristics of Questionnaire Respondents

Category	Classification	Frequency	Percentage
Field of Specialization	Quantity Surveyors	29	27.4
	Builders	19	17.9
	Architects	20	18.9
	Engineers	38	35.8
	Total	106	100.0

Academic Qualification.	HND	41	38.7
	B.Sc / B.Tech	37	34.9
	PGD	15	14.2
	M.Sc / M.Tech	13	12.3
	Total	106	100.0
Practicing Experience	0 - 5years	30	28.3
	6 - 10years	33	31.1
	11 - 15years	22	20.8
	16 - 20years	13	12.3
	21 - 25years	6	5.7
	25 - 30years	1	0.9
	Above 30years	1	0.9
	Total	106	100.0
Membership of Professional Bodies	NIQS	22	20.8
	NIOB	14	13.2
	NIA	15	14.2
	NSE	30	28.3
	Total Members	81	76.4
	None Members	25	23.6
	Total	106	100.0

Level of Awareness of TQM in the Construction Industry in Imo State

Table 2 shows that 77 (72.6%) are aware of TQM principles, while 29 (27.4%) are not aware of the existence of TQM principle. These 27.4% were excluded from the analysis of other items in Table 2. Furthermore, a greater percentage (43.4%) representing 46 respondents has high knowledge of TQM with a little fraction of the respondents having average and low level of TQM awareness representing 18.9% and 10.4% respectively, and a missing 29 respondents representing 27.4% who have no awareness of TQM, hence, has no level of understanding of TQM principles.

When compared to research carried out by El-Kholy (2015) which states that TQM is awareness is relatively low in the construction industry when compared with the manufacturing and service industry, it can be observed that the level of awareness of TQM among construction firms in Imo State is on the increase as a total of 43.4% out of the 72.6% respondents that claim to be aware of TQM concept stated that their level of awareness of TQM is high. But on the overall population (100%) it can be said that the level of awareness of TQM is still on the average as a better part of the population (54%) claims their level of awareness of TQM concept is either on the average, low or nothing at all. In terms of application, it can be said that its application is also moderate as only 48% of the entire population claim to apply TQM in their organization. For respondents who apply TQM, high importance is however placed on its usage.

Furthermore, a total of 51 construction firms representing 48.1% apply TQM principles as part of their quality improvement program and company policy while 26 firms representing 24.5% do not apply TQM in construction. Data gathered show that among construction firms practicing TQM principles, 33 respondents stated that TQM is applied in their construction firms with a 31.1% ranking. 13 respondents (12.3%) acknowledged that TQM is highly applied in their construction firms while only 5 respondents representing 4.7% claims that TQM is fairly applied in their construction firm. Nevertheless, 26 respondents representing 24.5% claims they are aware of existence of TQM principles but their construction firms do not apply TQM principles as part of their company policy.

Since analysis was carried out based on respondent's knowledge of TQM existence, all 77 respondents representing 72.6% was analysed. This result confirms that TQM principles is of importance to construction firms since more than half of the respondents attests to its application

in construction with just a little fraction of construction firms who practice TQM principles with little or no level of its application in construction.

Table 2: Summary of Respondent's Awareness of TQM Principles used in Construction

Category	Classification	Frequency	Percentage
Awareness of TQM	Yes	77	72.6
	No	29	27.4
	Total	106	100.0
Level of Awareness	High	46	43.4
	Average	20	18.9
	Low	11	10.4
	Total Awareness	77	72.6
	Missing System	29	27.4
Application of TQM	Total	106	100.0
	Yes	51	48.1
	No	26	24.5
	Total Application	77	72.6
	Missing System	29	27.4
Level of Application	Total	106	100.0
	Applicable	33	31.1
	Not Applicable	26	24.5
	Highly Applicable	13	12.3
	Fairly Applicable	5	4.7
	Total Level	77	72.6
	Missing System	29	27.4
	Total	106	100.0

The findings of this research prove that there is a high level of awareness and knowledge of TQM among construction firms in Imo State, Nigeria as its result shows an improvement on TQM existence in the construction industry when compared to Moballeghi and Moghaddam's (2011) observation which states that "although TQM is applicable in the construction industry, there is a lack of awareness on the implementation process". This improvement can be as a result of the time difference between both researches. This is in confirmation with the research of Nawaz and Ikram (2013) which states that there is a growing awareness that a well-designed and well executed TQM process is one of the most effective routes to increase product and service quality, productivity, and profitability. Although, this research shows that there is improvement on the level of application of TQM in the construction industry, results from the findings proves that an average percentage of construction firms practicing TQM has a high level of application of TQM principles while others have moderate and fair application level of TQM respectively. This is in line with the findings of the Council of Registered Builders of Nigeria (2006) which states that TQM is not fully applied in the Nigerian construction industry. This proves that though construction firms are aware of the existence of TQM principles, majority of them practicing TQM do not place important priority on its application while others who practice TQM do not even know that what they are practicing is actually TQM. This is in confirmation with the research carried out by Hoonakker (2011).

Level of Practice of TQM Principles in the Imo State Construction Industry

Based on this research, a total of Ten (10) TQM principles were analysed. The analysis of data gathered on the level of practice of TQM principles in Imo State construction industry shows that the highest ranked principle of TQM with a mean score of 4.37 is purchasing of standard construction materials. This means that construction firms believe that the use of quality standard materials in construction is the most important key to achieving quality delivery of construction

projects than any other TQM principle used in construction. Following this, understanding and discovering better processes of construction, site management responsibility to ensures quality supervision of construction project, and quality monitoring which ensures strict adherence to quality standards during construction are also highly rated with their mean score ranging from 3.84 to 4.30 respectively. This means that for any construction firm to achieve good quality delivery of construction projects, the site manager must observe strict supervision and monitoring of ongoing site works to ensure that laborers adhere to quality standards by employing better processes during construction while using the acquired standard construction materials to achieve the project aim.

Nevertheless, the lowest ranked principle with a mean score of 3.28 is communication and effective transfer of information between employees and top managers. This means that respondents do not see communication and effective transfer of information between employees and top managers as a hindrance towards achieving quality in construction amongst construction firms and therefore place little or no importance on it. In order words, there exists a poor relationship between the laborers and top management staffs of construction firms. Furthermore, use of modern technological facilities, machines, tools and equipment on site, use of professional / skilled workers / labour, and effective teamwork are also ranked low with a mean score ranging from 3.30 to 3.54 respectively. This implies that for a construction company to observe strict adherence to use of quality standard materials, they must ensure that they employ professionally skilled workers who work together as a team and who are capable of handling modern technology, machines, tools and equipment on site to achieve the companies' objectives which must be communicated properly and must be under strict supervision of the site manager.

Table 3: Summary of Respondents Ranking on the Practice of TQM Principles

S/N	Principles of TQM	Mean	Ranking
1.	Purchasing; which involves adherence to quality in purchase of standard construction material	4.37	1
2.	Understanding and discovering better processes of construction which improves the quality standards of construction firms	4.30	2
3.	Site management responsibility; which involves the use of project / construction managers for quality supervision of construction project	3.95	3
4.	Quality monitoring which ensures strict adherence to quality standards during construction	3.84	4
5.	Project Quality Management Plan: This is a formal procedure and activity of construction firms in relation to quality management of a project.	3.81	5
6.	Quality assurance in areas of handling, storage, packaging, and delivery of construction materials	3.67	6
7.	Effective teamwork which results to greater quality output of construction project	3.54	7
8.	Use of professional / skilled workers / labour to achieve the quality standards, specifications, and policies of a construction company	3.48	8
9.	Use of modern technological facilities, machines, tools and equipment on site which enhances the quality standards of construction projects	3.30	9
10.	Communication and effective transfer of information between employees and top managers which enhances the quality of work output of the construction firm	3.28	10

This result therefore proves that with the current level of practice of TQM amongst construction firms in the construction industry, TQM practice have gradually improved with time and is useful not only to the manufacturing and service industry, but also to the construction industry when compared to other research in line with TQM.

Results obtained from the analysed data on level of practice of TQM principles shows that strict adherence to purchasing of quality standard materials used for construction is the most adhered principle of TQM practiced by construction firms in Imo State, Nigeria. This is in confirmation of the findings of Abdurrahman (2012) which states that the application of TQM principles produces products of high quality rather than depending on detecting defective products through inspections. Furthermore, practice of TQM principles leads to understanding and discovering better processes of construction thus improving the quality standards of construction firms, site management responsibility which ensures quality supervision of construction project, and quality monitoring which ensures strict adherence to quality standards during construction. This is in line with the submissions of Harrington and Voehl (2012), Harris and McCoffer (2002), and Low and Jasmine (2004). Results from the findings of this research shows that although construction firms focus more on quality in purchase of standard construction materials, there exist little or no importance placed on communication and effective transfer of information between employees and top managers to enhance quality delivery of construction projects. This means that application of TQM principles is not complete without communication since effective communication is seen as a driving force for keeping momentum and morale for quality improvement process (Thiagarajan *et al.*, 2001). Thus, effective communication is part of the cement that holds together the bricks of total quality process. Therefore, effective communication is important in directing employees towards the corporate expectations of the organizations / construction firm. Hence, it is obvious that practice of TQM principles can contribute positively towards reducing the rate of structural failure if properly implemented and applied in the construction industry.

CONCLUSION

This research appraises the current level of awareness and practice of Total Quality Management (TQM) in the Nigerian construction industry with a targeted population of construction professionals and construction firms in Imo State, Nigeria. Result from this research shows an improved awareness of TQM in the construction industry. This is a positive drift which depicts TQM to work perfectly in both construction, manufacturing and service industries. Therefore, there is a great improvement towards a general awareness of the existence of TQM principles in the construction industry especially in Imo State, Nigeria. To bring the benefits of TQM to the construction industry, more efforts must be made to spread the culture of TQM among construction professionals.

More so, this research shows that more than half of the respondents aware of the existence of TQM principles apply it as part of their quality strategy in order to derive maximum customer satisfaction while achieving organizational goals. This research revealed that purchasing of quality standard materials used for construction is the most applied principle of TQM but sadly, effective communication between managers and employees is healed with minimum importance due to lack of cordial / close relationship between them thereby making it difficult to effectively achieve TQM with the use of these quality standard materials since organizational goals are not properly communicated.

Since this research has proved that TQM is not such a new philosophy in the construction industry, it is important to create a medium for more awareness and practice of TQM in the construction industry through organization of TQM seminars, workshops, public enlightenment, sensitizations, and advertisement, etc. while professional bodies in the construction industry should include TQM as a subject in their curriculum as well as adopt it as part of their annual continuing education program. TQM forms a vital part of the construction industry as it involves various quality improvement techniques and programs, so all construction companies should consider TQM as an investment rather than expenditure. The initialization can be done by

adopting simple TQM elements like Plan-Do-Check-Act cycle or Cause and Effect Diagram (Fishbone Diagram).

Finally, this study was limited to the appraisal of the current level of awareness and practice of Total Quality Management (TQM) in the Nigerian construction industry with a targeted population of construction professionals and construction firms in Imo State, Nigeria. A similar study should be carried out in other states to get a wider view of the research topic.

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CONSTRAINTS TO IMPLEMENTATION OF PUBLIC PRIVATE PARTNERSHIP INFRASTRUCTURE PROJECTS IN NORTH CENTRAL, NIGERIA

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ABSTRACT

In spite of the increasing adoption of Public Private Partnerships (PPPs) in Nigeria, the experiences have not always been positive due to failures, delays, and revocation of concessions agreements, particularly in the North Central Region. However, there are still scant studies on Critical Failure Factors (CFFs) of PPPs in the Nigerian context despite the huge failures experienced in implementation of PPPs infrastructure projects. Therefore, to bridge the knowledge gap, CFFs constraining the implementation of PPPs were identified with a view to minimising PPP projects failure in Nigeria. A total of 12 structured interviews were conducted from three PPP case studies in Niger State. Content analysis and Failure Mode and Effects Analysis (FMEA) were employed in analysing the data. A total of 18 failure and 10 success factors were identified. Corruption in public sector and, Lack of transparency and competition in procurement processes were the 2 CFFs constraining PPPs, while 4 CSFs were responsible for certain degrees of success on the projects, namely; Transparency in procurement process, Availability of suitable financial markets, Favourable investment environment and Trust between stakeholders. Therefore, these results may serve as a reference for PPP stakeholders to develop effective strategies to minimising failure in PPP projects implementation.

Keywords: Critical Failure Factors, Critical Success Factors, Nigeria, Infrastructure Projects, Public Private Partnership.

INTRODUCTION

Public- Private Partnership (PPP) is a generic term for different forms of relationship existing between the public sector and the private sector with the aim of financing, developing, constructing and for the effective management of public infrastructure (Robinson *et al.*, 2010; Amadi *et al.*, 2014). These relationships are usually long term where the concession arrangement could last up to 35 years to enable the private sector repay loans sourced from the financial institutions (Smyth and Edkins, 2007). Globally, PPPs have become a popular institutional arrangement and many public infrastructure projects such as Roads, rail, airports, hospitals, housing, and schools among others have been procured through PPPs. Despite the increasing adoption of PPPs in Nigeria including the North Central region of Nigeria, the experiences have not always been positive due to controversies, failures, delays, and revocation of concessions agreements (Babatunde *et al.*, 2015). Similarly, Yang *et al.* (2010) asserts that some infrastructure partnerships between the public and private sectors in the past are yet to provide evidence of successful completion. Many empirical studies revealed that most PPP infrastructure projects implementation in Nigeria, including the North Central region of Nigeria are characterised by controversies, failures, delays, litigations, revocations among others; and has caused diminishing interests of both the local and foreign private investors. (Oyewobi, *et al.*, 2012; Sanusi, 2012; Babatunde *et al.*, 2015, Mudi *et al.*, 2015; Sanda *et al.*, 2016).

This research aims to examine Critical Failure Factors (CFFs) constraining PPP infrastructure project implementation. However, to examine the projects failure through CFFs, it is imperative to know the definition of failure. Oxford: Advanced Learner's Dictionary (Hornby, 1995) provides the definition of "failure" as "lack of success in doing or achieving something." Project failure can also be defined as the set of project objectives that did not hierarchically meet Program schedule, cost and specification (Trangkanont and Charoenngam, 2016).

Several studies have been undertaken to identify factors constraining the implementation of Public Private Partnerships infrastructure projects in both developed and developing countries. However, there are still scant studies on Critical Failure Factors (CFFs) of PPPs in the Nigerian context despite the huge failures experienced in the implementation of PPPs projects. Therefore to bridge the knowledge gap, this paper aims to identify the CFFs constraining PPPs, with a view to minimising PPP projects failure in Nigeria with specific focus on the North Central region of Nigeria.

PUBLIC- PRIVATE PARTNERSHIP INFRASTRUCTURE PROJECTS DEVELOPMENT IN NORTH CENTRAL, NIGERIA

Public Private Partnerships (PPPs) is one of the Public Finance Initiatives (PFIs) and is a contractual agreement between the public and the private sectors to share financial, technical and management risks in project development and management. (Oyedele, 2012). PPP is perceived by many as the almighty formula in infrastructure provision especially with the economic crunch ravaging the Nigeria economy. PPP has been adopted in the provision of public infrastructure projects in Nigeria including the North Central region of Nigeria. These Projects includes; the concession of Nnamdi Azikiwe International Airport Abuja, concession for complete infrastructure provision at Kataempe district Abuja, the concession for the provision of Minna City housing project in Maikunkele, Construction of Minna Five Star Hotel, The Concession of Benue Cargo airport which was awarded to Aerotropolis Development Company Ltd, construction of Jos Main Market, the provision of Hospital facilities in Jos East, construction of road networks in FCT as the Federal Government pursues the implementation of the Abuja Master plan, Development of 1MW Hydropower Doma Dam in Nasarawa State, among others (Adeogun and Taiwo, 2011; Ibem and Aduwo, 2012; ICRC 2012; Taiwo, 2013; Mudi *et al.*, 2015; Ojo, 2017). As the strategies in the implementation of PPP infrastructure in North Central, Nigeria are becoming increasingly popular, many infrastructure projects implemented through PPPs have experienced delays, termination failures and controversies among others (ICRC, 2012; Sanusi, 2012; Adamu, *et al.*, 2015). Unfortunately, the level of failure, delays and termination are due to the complexity and risks associated with PPP projects in the zone and this portrays the existence of unforeseen risk or investment risk (Lucas, 2011).

Constraining Factors to PPP Infrastructure Projects Implementation

Despite the huge recognition of PPPs and their increasing usage in infrastructure development, the experience of both the public and private sector with PPP has not always been positive. Some PPP projects are either held up or terminated (Kwak *et al.*, 2009). A number of researches have been carried out on the constraining factors to PPPs. For instance, Amadi (2012) in his literature search identified 45 constraints as inhibitors to the realisation of construction projects using PPPs; Kwak *et al.* (2009) identified lack of clear government objectives and commitment, complex decision making, poorly defined sector policies, inadequate legal/regulatory frameworks, poor risks management, low credibility of government policies, inadequate domestic capital markets, lack of mechanisms to attract long-term finance from private sources at affordable rates, poor transparency as well as lack of competition and efficiency. Other constraints as enumerated by Kwak *et al.* (2009) include; high tendering costs, political debates, public oppositions, and complex negotiation processes amongst others. While Izuwah (2011), identified various constraints to include; political involvement at the implementation level of projects, not enough due diligence by contracting firms, improper evaluation of financial models and risks, lack of transparency and competition in procurement processes, lack of institutional frameworks and legislation to foster PPPs and finally the inability of the public sector to appreciate partnerships in a PPP environment. Cheung (2009) identified factors constraining PPPs as unstable political environment, high bidding costs, cost overruns, excessive risks as well as lengthy bidding processes associated with PPPs. While Kaplan *et al.* (2012) in a World Bank Report posited that

lack/poor regulatory authorities as well as poor capacity building and institutional strengthening are inhibitors to the delivery of PPPs in Liberia. Double taxation as perceived by the general public, high consumer prices on the part of consumers, the continuous reliance on external consultants as well as misconceptions on the side of government officials are said to be constraining the implementation of PPPs (Colverson and Perera 2012). While Zou *et al.* (2008) opined complexity in contractual structure, inappropriate feasibility study, poorly defined sector policies, differences in interest and expectations, lack of a reliable concessionaire consortium with strong technical strength as well as unfavourable economic conditions as impeding factors to PPPs implementation. Shendy *et al.* (2011) identified lack of legislative and institutional framework, underdeveloped PPPs pipeline, and lack of coordinated public sector strategies as hindrances to PPPs. Susilawati and Armitage (2004) also found difficulty in managing partnership as a result of their mode of incorporation as partners and the dearth of transparency in partnership arrangements as impediments to PPPs. Helmy (2011) further identified long contractual procedures on the part of public agencies, lack of awareness on PPPs laws and regulations, public agency lacking experience and knowledge of PPPs, lack of land and its acquisition procedures, and frequent conflicts between consultants and clients as constraints to PPPs in Kuwait. Michael (2012) in his study in Queensland, identified dearth of specialized PPP unit, lack of independence, lack of support and political will, forecasting error as well as misplacement of risks markets in PPPs as constraints to PPPs. Wambalaba *et al.* (2012) in a study in Dakar, also identified political interference, vested interest, corruption, distrust, lack of contract transparency and lack of supportive legal structure as impediments to PPPs implementation.

Critical Failure Factors (CFFs) in PPP Infrastructure Projects

Trangkanont and Charoenngam (2014) identified CFFs as projects Risks, which once properly identified, analysed, understood and evaluated by all parties, were allocated to the party best able to manage those risks. Cheung *et al.* (2010) supported that risks allocated beyond the capacity of the parties brought about failure in PPP infrastructure projects. And also, that the legal framework of most countries was established to cope with the traditional project procurement method with emphasis on command and control, as a result, PPP infrastructure projects needed special legislation by government and the establishment of the legislation was to formulate effective contractual vehicles for PPPs. (Zhang, 2005; Algarni *et al.*, 2007). Most PPP projects were aborted/ terminated before a contract was made because of the high transaction costs and ineffective legal framework (Trangkanont and Charoenngam, 2014). The study of Li *et al.* (2005); Trangkanont and Charoenngam (2014) summarised that both the public and private sectors were the cause of PPP projects failure. Government defective PPP policy and strategy led to poor procurement incentives and lack of coordination among government agencies. Inexperienced, poor- organized and less-committed public agencies including corruption, resulted in inefficient PPP project implementation. They further stated that the private sector, due to its lack of experience and expertise to handle the legal, technical, financial and managerial issues during project execution, suffered project suspension and termination. Li *et al.* (2005); El-Gohary *et al.* (2006) also supported that, strong public opposition due to people attitude on private sector profit-making and lack of transparency in contract award brought about project delay or outright termination in delivering PPP infrastructural projects. Other researches carried out by Zhang (2005); Xenidis and Agelides (2005); Iyer and Sagheer (2010) pointed out that, uncontrollable factors were a cause of PPP project failure such as change in law, resulted in unexpected requirements, political instability led to changes in PPP policy and inflation rate fluctuation had impacts on project cost.

Critical Success Factors (CSFs) Of PPP Infrastructure Projects

Critical Success Factors (CSFs) are key factors that if satisfactorily met, will ensure successful performance of a project (Kwak *et al.*, 2009). These factors if not well handled will lead to failure of a project. Many studies employed the concept of CSF to determine the factors that influence the success of PPP infrastructure projects. CSF requires a day to day attention throughout the life cycle of PPP projects (Rowlinson, 1999). This is corroborated by Ram and Corkindale (2014) that CSFs requires constant and careful attention of management with a view to achieving organisation performance. The identification of CSFs is regarded as the first step towards the development of a workable and efficient PPP protocol (Zhang, 2005). In view of the increasing adoption of PPP all over the world, a number of researches have been carried out on the CSFs that have been seen to be responsible for the successful implementation of PPP in different countries, including Nigeria (Qiao *et al.*, 2001; Jefferies *et al.*, 2002; Jamali, 2004; Zhang, 2005; Li *et al.*, 2005; Alhashemi *et al.*, 2010; Babatunde *et al.*, 2012; Cheung *et al.*, 2012; Ibem and Aduwo, 2012; Onyemaechi *et al.*, 2015).

RESEARCH METHODOLOGY

The study utilised primary data for the analysis. The data were sourced through a face to face structured interview of purposely selected participants from both the government regulators and private developers directly involved in the selected PPP case studies projects. Qualitative data were collected from three (3) PPP case studies in Niger state using structured interviews and personal observation. A total of 12 key stakeholders comprising the public sector (i.e. Ministries, Department and agencies) and the private sector which include: consultants, concessionaires, local lenders/banks, and contractors who were directly involved in the selected 3 case studies were selected and interviewed. The respondent from the public and private sector were the Chief Executive officers and senior staff member of their organisations directly involved on the PPP infrastructure project case study.

The interview guide was prepared, consisting of questions to be asked in interviews. During the interviews, the interviewees were interrogated on each eighteen identified failure factors and ten success factors using Failure Mode and Effect Analysis (FMEA) Technique, with the interviewer completing the scoring to determine the criticality of identified failure and success factors in each case study. Similarly, personal observation and review of documentary evidence were also carried out in each case study. Failure Mode and Effect Analysis (FMEA) technique was employed for the analysis of quantitative data obtained in the three PPP case studies.

RESULTS AND DISCUSSION

Table 1 shows the background information of interviewees from both the public and private sector organisations in terms of types of organisation, designations and years of professional experience. The table reveals that 12 interviewees (representing 4 interviewees in each case study) were top management executives from both public and private sectors with their professional years of experience ranging from 7 to 27 years, and have directly involved in the aforementioned PPP project case studies from conception to the present project status. Also, Table 2 & 3 presents the full details of assessment of the criticality of identified failure and success factors in the PPP infrastructure case studies, using the FMEA techniques. Table 2 reveals that, out of the 18 failure factors assessed, 2 Critical Failure Factors (CFFs) constraining the implementation of the PPP project case studies were identified. These includes; corruption in public sector and lack of transparency and competition in procurement process. Similarly, Table 3 reveals that, 4 Critical Success Factors (CSFs) such as; Transparency in procurement process, Availability of suitable financial markets, Favourable investment environment, and Trust between stakeholders were responsible for the little success attained in the implementation of the PPP projects case studies.

Table 1: Distribution and background information of interviewees from both public and private sector

No	Interviewee organisation	Interviewee designation	Interviewee years of professional experience
Case Study 1: Concession of Konayi Housing Estate Development			
1	Public Sector: PPP Office	DG	27
2	Public Sector: Housing Cooperation	Chief QS	20
3	Private sector: Contractor	Managing Director	13
4	Private sector: Financial Institution	Manager	21
Case Study 1: Concession of Minna Five Star hotel development			
5	Private sector: Consultant	Project Manager	21
6	Private sector: Concessionaire	Manager	25
7	Private sector: Contractor	Managing Director	15
8	Public Sector: Ministry of Investment	Director	19
Case Study 1: Concession of NSDC Hostel, IBBU Lapai			
9	Public Sector: Physical planning unit IBBUL	Chief Architect	19
10	Public Sector: NSDC office	Director	14
11	Private sector: Financial Institution	Manager	7
12	Private sector: Contractor	Managing Director	21

organisations

Table 2. Summary of the assessment of criticality of failure factors using FMEA technique in PPP infrastructure project case studies

S/N	FAILURE FACTORS	CASE STUDY 1				CASE STUDY 2				CASE STUDY 3			
		Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS
i	Complex and cumbersome of PPP institutional framework	198	329	263	Less critical	448	712	580	Somehow critical	284	507	396	Less critical
ii	High transaction costs	364	228	296	Less critical	810	449	630	Somehow critical	657	715	686	Somehow critical
iii	Ineffective legal framework	171	48	110	Not critical	336	398	367	Less critical	513	420	467	Less critical
iv	Poor regulatory authorities	361	357	359	Less critical	150	745	448	Less critical	484	476	480	Less critical
v	Lack of awareness on PPP laws and regulations	510	256	383	Less critical	84	408	246		480	175	328	Less critical
vi	Lack of public sector to appreciate partnerships in PPP environment	702	648	675	Somehow critical	160	429	295	Less critical	528	508	518	Somehow critical
vii	Communication constraint between the public and private sector	364	530	447	Less critical	504	290	397	Less critical	476	410	443	Less critical
viii	Inexperience and less committed public agencies	490	390	440	Less critical	448	367	408	Less critical	484	336	410	Less critical
ix	Corruption in public sector	597	950	774	Critical	630	780	705	Somehow critical	720	800	760	Critical
x	Lack of transparency and competition in procurement processes	356	441	399	Less critical	800	867	834	Critical	576	950	763	Critical
xi	Lengthy bidding process and contractual arrangements	197	555	375	Less critical	1000	254	627	Somehow critical	336	504	420	Less critical
xii	Inconsistent risk assessment and management	66	152	109	Not critical	384	533	459	Less critical	256	399	328	Less critical
xiii	Cost overruns	261	105	183	Not critical	120	609	365	Less critical	420	495	458	Less critical
xiv	Inflation rate fluctuation	38	55	47	Not critical	30	439	235	Not critical	183	374	279	Less critical
xv	Political instability and change in Government policy	13	110	62	Not critical	60	499	280	Less critical	370	513	442	Less critical
xvi	Political involvement at the project implementation level	730	665	678	Somehow critical	700	773	737	Somehow critical	430	555	493	Less critical
xvii	Public opposition	90	150	120	Not critical	384	475	430	Less critical	544	256	400	Less critical
xviii	Distrust among stakeholders	480	357	419	Less critical	810	437	624	Somehow critical	629	512	571	Somehow critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500- Less Critical; 500-750-Somehow Critical; 750-1000-Critical

Table 3. Summary of the assessment of criticality of success factors using FMEA technique in the infrastructure PPP project case studies

S/N	SUCCESS FACTORS	CASE STUDY 1				CASE STUDY 2				CASE STUDY 3			
		Public	Private	Total	REMARKS	Public	Private	Total	REMARKS	Public	Private	Total	REMARKS
		RPN	RPN	AVG RPN		RPN	RPN	AVG RPN		RPN	RPN	AVG RPN	
i	Transparency in procurement process	810	674	742	Somehow critical	810	764	787	Critical	429	372	401	Less critical
ii	Thorough and realistic assessment of the cost and benefits	900	483	692	Somehow critical	504	509	507	Somehow critical	392	512	452	Less critical
iii	Project Technical feasibility	548	689	619	Somehow critical	900	586	743	Somehow critical	357	525	441	Less critical
iv	Consultation with end-user's	384	284	334	Less critical	160	557	359	Less critical	408	504	456	Less critical
v	Clear project brief and client requirements	810	228	519	Somehow critical	810	271	541	Somehow critical	336	218	277	Less critical
vi	Availability of suitable financial markets	327	555	441	Less critical	900	715	808	Critical	492	465	479	Less critical
vii	Favourable legal and commercially oriented laws and regulations	448	507	478	Less critical	720	567	644	Somehow critical	390	647	519	Somehow critical
viii	Good stakeholders' relationship	765	175	470	Less critical	392	476	434	Less critical	340	528	434	Less critical
ix	Favourable investment environment	427	444	436	Less critical	900	933	917	Critical	440	410	425	Less critical
x	Trust between stakeholders	696	774	735	Somehow critical	900	825	863	Critical	517	585	551	Somehow critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-1000-Critical

Assessment of criticality of the identified 18 failure factors in PPP project case studies: using FMEA technique

In this study, the infrastructure PPP project case studies investigated include the Concession of Konayi Housing Estate Development (case study 1); the Concession of Minna Five Star hotel development (case study 2); and the Concession of NSDC Hostel, IBBU Lapai (case study 3).

During the interviews, the interviewees were interrogated on eighteen identified failure factors using Failure Mode and Effect Analysis (FMEA) technique. Thus, the full details of assessment of the criticality of identified failure factors in the above three case studies are summarised and presented in Table 2, while Table 3 presents the summary of the critical success factors.

Table 2 reveals that corruption in public sector was the only critical failure factors (CFF) that made the concession of Konayi Housing Estate Development (i.e. case study 1) suffered delay and failure in its implementation. Also, lack of public sector to appreciate partnerships in PPP environment was identified as ‘somehow critical’ failure factors.

Also, lack of transparency and corruption in procurement process is the critical failure factor in the Concession of Minna Five Star hotel development (i.e. case study 2). Likewise, in this PPP case study, Complex and cumbersome of PPP institutional framework, High transaction costs, Corruption in public sector, Lengthy bidding process and contractual arrangements, Political involvement at the project implementation level, and Distrust among stakeholders were considered as ‘somehow critical’ failure factors.

In case study 3, which is the Concession of NSDC Hostel, IBBU Lapai, the results reveal 2 CFFs that are constraining the implementation of this PPP project. These include corruption in public sector, and Lack of transparency and competition in procurement processes. While high transaction costs, lack of public sector to appreciate partnerships in PPP environment, and distrust among stakeholders were indicated as ‘somehow critical’ failure factors.

Assessment of criticality of the identified 10 success factors in PPP project case studies: using FMEA technique

The details of assessment of the criticality of identified success factors in the three case studies are summarised and presented in Table 3

Table 3 indicates 5 somehow critical success factors that were responsible for the degree of success attained in the concession of Konayi Housing Estate Development, (case study 1) to include: Transparency in procurement process, Thorough and realistic assessment of the cost and benefits, Project Technical feasibility, Clear project brief and client requirements, and Trust between stakeholders.

The result of FMEA on criticality of the identified success factors in case study 2, which is Concession of Minna Five Star hotel development reveals Transparency in procurement process, Availability of suitable financial markets, Favourable investment environment, and Trust between stakeholders as the 4 CSFs that made this concession project achieved the little level of success being attained. Similarly, thorough and realistic assessment of the cost and benefits, Project Technical feasibility, clear project brief and client requirements, and favourable legal and commercially oriented laws and regulations were indicated as ‘somehow critical’ success factors (see Table 3).

Table 3 further revealed the somehow critical success factors in the Concession of NSDC Hostel, IBBU Lapai (i.e. case study 3). This includes favourable legal and commercially oriented laws and regulations, and Trust between stakeholders

Cross case analysis

Based on the assessment of the criticality of identified failure factors in the three PPP project case studies, it is important to consolidate the experience from these PPP case studies, to determine if there is any convergence or discrepancy regarding the CFFs/ CSFs that are responsible for various degrees of failure and success in the three PPP case studies. Therefore, the findings from the PPP infrastructure project case studies (case study 1-3), indicated that corruption in public sector was identified as Critical Failure Factor in case studies 1 & 3. Also, the findings reveal that lack of transparency and competition in procurement process appear as the CFF in case studies 2 & 3 (see Table 2). This finding is connected to the huge corruption been perpetuated in the public sector where construction contracts are awarded without adhering to due process and diligence in the procurement process of PPP infrastructure projects. This implies that PPP infrastructure projects in these case studies experience failures due to lack of transparency, lack of competition in procurement process and the inhabited corruption that has eaten deep to the fabrics of the public service.

In the same vein, the findings from the aforementioned three PPP infrastructure project case studies (case study 1-3) with regards to the Critical Success Factors (CSFs), table 3 indicated that transparency in procurement process, Availability of suitable financial markets, Favourable investment environment, and Trust between stakeholders were identified as the CSFs in case study 2 which is Concession of Minna Five Star hotel development. This finding confirmed that the little success recorded in case study 2 was due to the transparency exhibited in the procurement process of the PPP project. The concessionaires in the PPP case study project were able to source for funds locally (i.e. from local banks). Also, the finding indicated that the investment climate was favourable for the PPP case study to succeed, and it is most likely that the project is going to achieve appreciated success because of the trust existing between the primary stakeholders involved in the PPP case study 2. (see Table 3).

4.3 CFFs and CSFs emanating from case studies

Based on the results of assessment of the criticality of identified failure and success factors using FMEA in the three PPP case studies as previously discussed (Table 2 & 3) the results identified a total of 2 Critical Failure Factors (CFFs) that made the case studies suffered certain degrees of failures as follows:

- i. Corruption in public sector
- ii. Lack of transparency and competition in procurement processes

Similarly, the FMEA results under the aforementioned PPP project case studies (i.e. case study 1-4) identified a total of 4 Critical Success Factors (CSFs) that were responsible for certain degrees of success of these PPP project case studies as follows:

- i. Transparency in procurement process
- ii. Availability of suitable financial markets
- iii. Favourable investment environment
- iv. Trust between stakeholders.

CONCLUSION

The paper demonstrates the causes of PPP infrastructure projects failure in the North Central region of Nigeria by applying FMEA to identify, categorise CFFs, and also identify CSFs responsible for enhancing project success. The study concludes by identifying two critical failure factors (CFFs) through Failure Mode and Effect Analysis (FMEA). These include Corruption in

public sector and Lack of transparency and competition in procurement processes as factors constraining the implementation of PPPs. Similarly, four CSFs were found responsible for certain degrees of success on the PPP projects studied: Transparency in procurement process, Availability of suitable financial markets, Favourable investment environment and Trust between stakeholders. The identification of the constraining factors (CFFs) will assist the stakeholders in decision making, planning, and management of PPP infrastructure project delivery. The CSFs identified will positively influence policy development towards PPPs and the manner in which stakeholders (public sector and private sectors) involve each other in the development of PPP infrastructure projects. The paper recommends that the CFFs and CSFs identified are to be given paramount consideration by stakeholders involved in PPPs to ensure more successful implementation of PPPs infrastructure project and to prompt confidence in both local and foreign investors for investing in the Nigerian PPPs projects. Although, the research findings identified the CFFs/CSFs in only three PPP infrastructure project in North Central region of Nigeria, these lessons learned will help to minimise the probability of PPP infrastructure projects failure in Nigeria.

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PREDESIGN COST PLANNING OF BUILDING WALL ENVELOPES USING A NOVEL MATHEMATICAL MODEL

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ABSTRACT

Pre-design cost planning of key building elements such as the building envelope is essential in producing cost frameworks for budgetary and feasibility purposes when detailed project information is unavailable. Several alternative preliminary sketch designs and building shape indexes are required before pre-design envelope estimates can be computed—a repetitive and exhausting process. The aim of this research is to develop a model for pre-design cost planning of building envelope items prior to sketch or detailed design. Thus, enabling quick and reliable cost planning of building envelope items. Employing empirical and rational approaches, a new generalised mathematical model and a corresponding graphical model for vertical building envelope quantities was established by exploring theoretical shapes and fundamental mathematical theorem of integral calculus for “area under a curve”. The developed mathematical model was compared with the superficial cost model as a cost planning tool for external glazed curtain wall. The result showed that the proposed mathematical model provides better accuracy than the superficial cost model. To improve cost-certainty of building envelopes, it is recommended that coefficient of dimensions should be provided as a necessary preliminary information when a “design to cost” approach is adopted on building projects having limited financial and construction resources.

Keywords: building envelope, building shape index, conceptual envelope, cost planning.

INTRODUCTION

Cost is an important factor used in assessing the performance of construction projects, and a key performance index for project success (Toor and Ogunlana, 2010; Ahiaga-Dagbui and Smith, 2014). Cost control is an iterative process of measuring, evaluating, and adjusting progress, plans and finance (Olawale and Sun, 2010), and is critical for improving the cost performance of construction projects. An important objective of cost control is to achieve a balanced expenditure on various building elements within agreed amounts. Thereby, ensuring that final accounts approximates to the budget estimate. Quite often, at the initial stage of a building project, there is limited amount of project information to arrive at a reliable budget estimate (Jin et al., 2014). However, prospective building owners and investors are concerned about the financial commitment and anticipated capital outlay before project drawings are produced by professionals (Ranasinghe, 1996; Al-Hajj and Horner, 1998; Yeung and Skitmore, 2012). Therefore, obtaining reliable budgetary estimates when drawings are not available is important for pre-design cost planning and control when designing to cost.

An important and significant cost item that requires cost planning during design is the building envelope. According to Smith *et al.* (2016), the building envelope can represent 10% to 20% of a building cost. Building envelope materials are also important for achieving sustainable buildings (Belusko and O’Leary, 2010; Singhaputtangkul *et al.*, 2013). Hence, the building envelope is important during building design. Building shape indexes have been developed in the past to determine cost effective building envelope designs. However, a limitation exists. Building shape indexes are calculated with the use of predetermined girth and area of buildings from sketch designs. This requires that alternative building sketch designs must be prepared, or empirical data collected before assessing the most economical or effective building design shape (Wing, 1999).

The preparation of alternative sketch designs, or collection of empirical data becomes exhausting and time consuming due to abortive designs (Kirkham, 2014). For example, the “wall-to-floor ratio” building index; the most frequently used shape index in practice, requires alternative sketch drawings before the index can be computed (see Ashworth and Perera, 2015; Buxton, 2015). This means that designers must communicate several sketch design drawings to cost engineers or quantity surveyors before cost comparison of building envelopes can be made. The purpose of this research is to eliminate the time delay and exhaustive process of producing alternative sketch designs before cost engineers and quantity surveyors can carry out effective predesign cost planning of building envelope items.

The aim of this research is to develop a model for predesign cost planning of cost significant building envelope items. Although, most literature focus on using building shape indexes as a measure of cost efficiency (see Ashworth and Perera, 2015; Buxton, 2015), this research takes a different approach to the use of building shape indexes by exploring shape indexes for quantitative prediction. The major contribution of this research to the current body of knowledge in building and construction economics is the development of a mathematical model for estimating envelope quantities without the need for sketch drawings. Cost engineers and quantity surveyors can use the developed model for comparing a wide range of building envelope alternatives at the predesign stage. This will facilitate quick and accurate predesign cost planning of cost significant building envelope items. such as external wall glazing and perimeter scaffolding. Empirical and mathematical approaches were adopted to study the relationship between the coefficient of dimensions and the shortest length of a four-sided orthogonal polygon. Theoretical and practical concepts of shape indexes were also explored. The developed model in this research can be used in conjunction with cost model variables such as number of floors and building height to model quantities of building envelope elements.

Building shape indexes

Allometric analysis of buildings can reveal the relationship between girth, area and volumes of buildings as shown by Steadman (2006). Building shape indexes are mathematical representations which can capture such relationships (see Wing, 1999; Steadman *et al.*, 2009). Index numbers are measures of changes in observable phenomena (Allen, 1975; Ralph *et al.*, 2015). Index numbers can be applied to any observable physical process to describe any measure of change within or during a process. Building shape index can thus be defined as a measure of change in the measurement of variables which defines a building. Length, breadth, and height are some of the measurement variables that could be used to define the shape of a building. A characteristic feature of index numbers which must be specified is the reference point and is usually referred to as “base” (Ralph *et al.*, 2015). The base shape for most building shape index is a fundamental shape like the circle or square, although any shape can be used as a base provided the objective of the index is specified (Ashworth and Perera, 2015). An instance, the base shape for the volume compactness (VOLM) index is the hemisphere.

In relation to construction cost, researchers are interested in the cost effectiveness of shapes or perimeter-area functions of buildings after preliminary sketch design or full design had been completed (Kirkham, 2014). Building economic theories on space and shapes have also been proposed. Notable theories include the wall-to-floor ratio theory and the plan-shape efficiency

theory. The wall-to-floor ratio theory states that the lower the ratio of wall area to floor area, the lower the cost of a building. According to the plan-shape efficiency theory, the more irregular the plan shape, the lower the amount of floor area within the perimeter of the shape (Wing, 1999; Ashworth and Perera, 2015). The wall-to-floor ratio and the plan-shape efficiency are based on the premise that given a fixed area, the cost of a building would increase with an increase in the number of corners and girth of the building (Jaggar and Morton, 2003). Existing building shape indexes are influenced by the wall-to-floor ratio and the plan-shape efficiency theories, except for the VOLM index and the reciprocal plan shape index (Appendix I for all building shape indexes identified in the literature). Practically, square-shaped buildings are not necessarily the most cost-efficient buildings due to factors such as ventilation, lighting, circulation, and height (see Kirkham, 2014). Nonetheless, a square building would have the least envelope cost when compared to other shapes (Tuhus-Dubrow and Krarti, 2010). Thus, the relationship between area and perimeter is important. For example, quantities of external walls (concrete, sandcrete, glazed), external tiling, and external painting are dependent on the girth of buildings during quantities take-off. Therefore, obtaining early and accurate predesign envelope quantities can improve cost certainty and budgetary estimates of building projects.

RESEARCH METHOD

The method employed for the current research is guided by two branches of foundationalist epistemology: empiricism and rationalism. The empiricist episteme requires evidence or experience in defining knowledge (Knight and Turnbull, 2008). In empiricism, empirical data and evidence is key for the acquisition of knowledge. On the other hand, rationalist epistemology is hinged on pure reasoning and logic. It holds that knowledge can be derived from rational thoughts without the need for empirical data or observations, a dominant approach in the field of mathematics (Knight and Turnbull, 2008). The current research is purely quantitative in nature from an epistemological standpoint. A quantitative model that is based on empirical observation and mathematical fact can be considered a dependable and robust model. Therefore, a quantitative approach based on empiricist and rationalist methodologies is considered appropriate and adopted for this research.

A detailed literature review was carried out to gain insight into the applications and derivation of existing building shape indexes. The empirical relationship between the shortest length (breadth B) and area of a four-sided orthogonal polygon was established by comparing different measurement of B and different values of the coefficient of dimensions (k_c) for same area measurements. The approach in this study is similar to a previous study in which theoretical buildings of various sizes were constructed and analysed allometrically by Steadman (2006). The result of Steadman (2006) using theoretical buildings was similar to Bon's (1972) allometric analysis, which was carried out by taking measurements of forty existing residential buildings (see Steadman, 2006). The similar result obtained in the two studies is an indication that allometric analysis of theoretical buildings could be carried out with reliable results. In the current study, empirical analysis of theoretical orthogonal shapes was carried out. Upon discovery of the non-linear monotonic relationship between breadth and coefficient of dimensions, a mathematical approach was adopted to validate the observed relationship.

Conceptual building envelope model

To develop the empirical model in this study, three variables are defined. The variables are: breadth, area and coefficient of dimensions. The breadth (B) is defined as the shorter side of a four-sided orthogonal polygon (i.e., a rectangle) with metre as the unit of measurement. The area (A) is defined as the total two-dimensional surface enclosure within a four-sided orthogonal polygon and is measured as a square of metre. Lastly, the coefficient of dimensions (k_c) is defined as B/L , where B is the shorter side and L is the longer side of a four-sided orthogonal polygon. k_c is a non-unitary variable. By varying B and L ; where $B \leq L$, various values of k_c were obtained. It was observed that for any given area A , the breadth B is directly proportional to k_c as a non-linear monotonic function. The results of the observations are shown in Figure 1. The R-square value of the regression lines for all areas (10 m², 15 m², 20 m², 50 m², 100 m², 200 m², 400 m² and 500 m²) was 1. A strong indication that k_c can explain all the variability around the mean value of B . Hence, the general function for all observed trend is given as $y = \beta x^{0.5}$. Where the value of β is 3.1623, 3.8730, 4.4721, 7.0711, 10, 14.1421, 20 and 22.3606 for the area values of 10 m², 15 m², 20 m², 50 m², 100 m², 200 m², 400 m² and 500 m², respectively. The coefficient β in each case corresponds to the square root of the area of the four-sided orthogonal polygon.

Empirically (see Figure 1), $B = \beta x^{0.5}$, where $\beta = A^{0.5}$ (1)

A characteristic of a monotonic function such as $y = \beta x^{0.5}$ for $\{x \in \mathbf{R} : x > 0\}$ is that $\delta y / \delta x > 0$ for strictly increasing monotone function.

$$\frac{\delta y}{\delta x} = \frac{\beta}{2\sqrt{x}}, \{x \in \mathbf{R} : x = 1\}, \frac{\delta y}{\delta x} = \frac{\beta}{2} \quad (2)$$

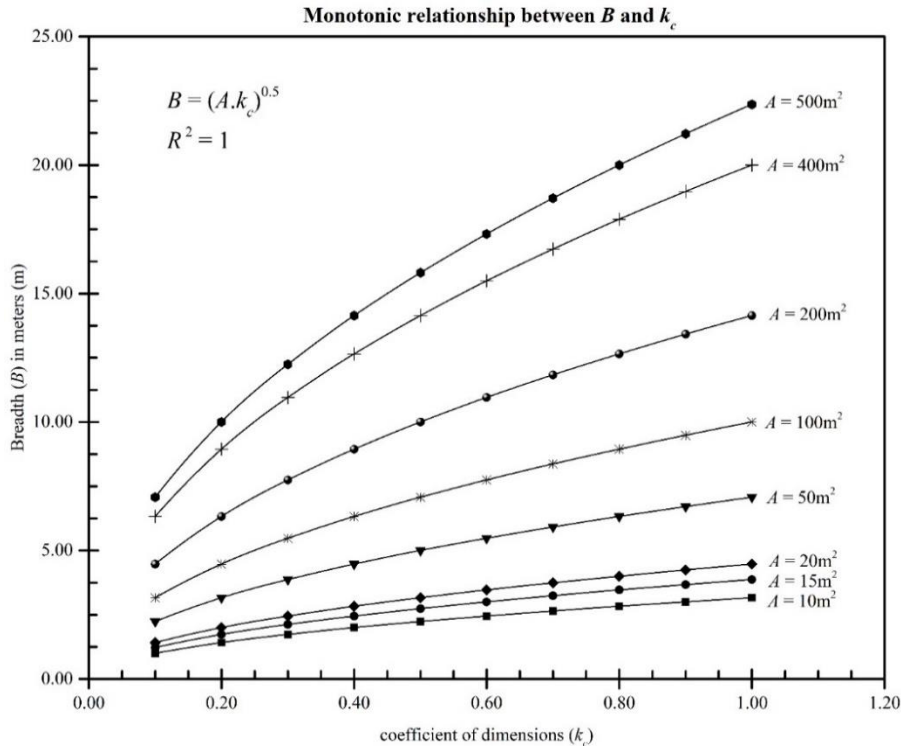


Figure 1. Breadth (B) on coefficient of dimensions (k_c) graphs

Therefore, the empirical model (Equation 1) represents a non-linear monotonic relationship between breadth B , coefficient of dimensions k_c and area A of a four-sided orthogonal polygon. The mathematical validation of Equation 1 is provided in Appendix II. Using H as building height and R_e as envelope item unit rate, the mathematical conceptual building envelope model E_c is given as Equation 3 (see Appendix II for derivation).

$$E_c = \frac{2 \int f(s) ds (k_c + 1)}{\left[k_c \int f(s) ds \right]^{\frac{1}{2}}} \cdot H \cdot R_e \quad (3)$$

The k_c as a ratio of B to L can also be expressed in algebraic form as Equation 4

$$k_c = \frac{8A}{\sqrt{|P^4 - 16AP^2|} - 8A + P^2} \quad (4)$$

Equation 3 is suitable for building plans with a single floor plan. However, in algebraic form Equation 3 can be adapted as Equation 5 for building plans with multiple floors.

$$E_c = \sum_{i=1}^n \frac{2A_i(k_{ci} + 1)h_i r_i}{\sqrt{A_i \cdot k_{ci}}} \quad (5)$$

Where i is the floor number, A_i is the area of the i^{th} floor, k_{ci} is the coefficient of dimensions of the i^{th} floor and h_i is the height of the i^{th} floor. h_i is taken from the floor level of the i^{th} floor to the floor level of the $i+1$ floor or to the topmost level of wall height where the i^{th} floor is the last floor. r_i is the envelope unit rate for the i^{th} floor.

The graphical model for the building envelope cost (see Figure 2) is the result of plotting the E_c against the plan shape efficiency values (i.e., $k_c \times 100\%$). The plan-shape efficiency value of a building is a representation of the complexity of the building shape. The range of values for the plan shape efficiency is between 0% (least-highly inefficient shape) and 100% (most efficient shape). Regardless of the number of corners and boundary configuration, two buildings with the same plan-shape efficiency values will have the same envelope area. This is shown in Figure 3 where the three envelope designs have the same plan-shape efficiency value of 40%, the same GFA of 1,000 m² and the same envelope area of 1,120 m², but different shapes for the respective vertical envelopes.

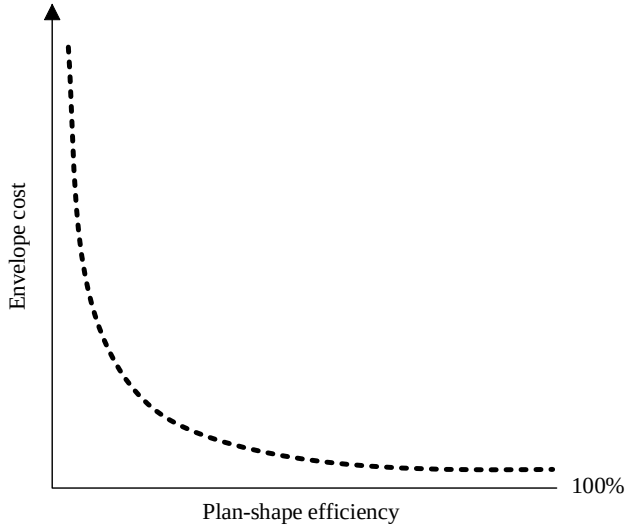


Figure 2. Building envelope cost curve

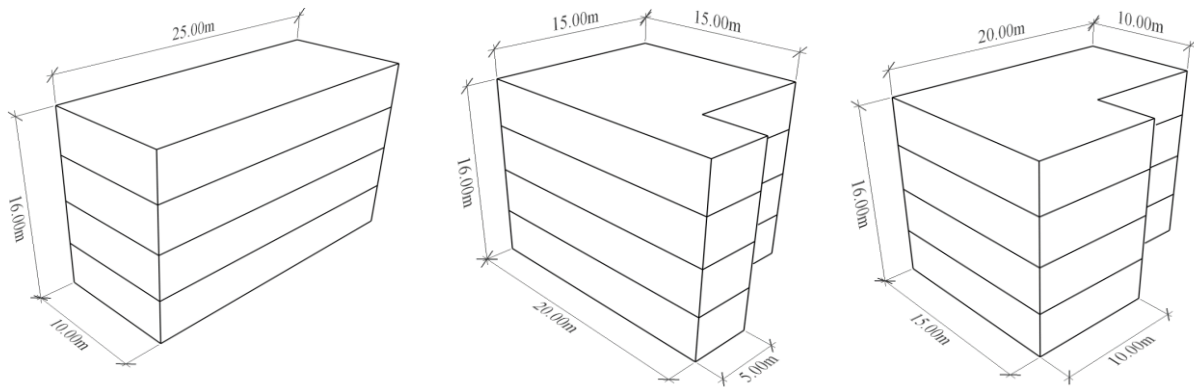


Figure 3. Three building envelope designs with the same plan shape efficiency value of 40% (k_c value of 0.4), equal girth of 70 m and equal curtain wall area of 1,120.00 m²

Model verification

Building plans are designed to various shapes and sizes; a heterogeneous characteristic of building projects. Therefore, developed models must be applicable to various shapes and sizes to be a useful model (see Runeson and Skitmore, 2008). Eight shapes shown in Figure 4 were constructed to verify the conceptual building envelope model. The constructed shapes are of different configurations, thereby simulating the heterogeneous nature of building plans. A 1 m by 1 m cell was used in constructing the shapes, and all the shapes have an equal area of 9 m² with varying girths.

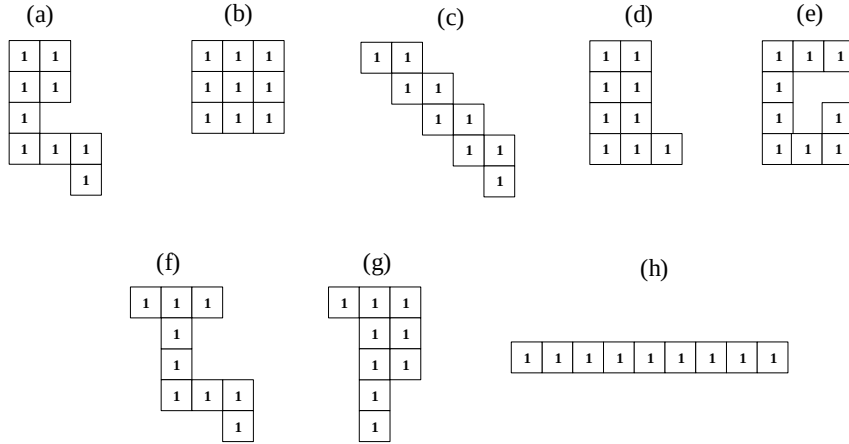


Figure 4. Different orthogonal shapes

Figures 4(c), 4(e), 4(f) and 4(h) have the highest girth of 20 m but with different shape configurations. Figure 4(b) has the lowest girth of 12 m, while Figures 4(a), 4(d) and 4(g) have girths of 18 m, 14 m, and 16 m respectively. Using the area and the girth of each shape, the k_c of the shapes can be calculated using Equation 4. The conceptual vertical envelope of the constructed shapes is obtained using the Equation 3 with height H and envelope item unit rate R_e as unitary values. The results of the conceptual vertical envelope model for the eight shapes are presented in Table 1. The precision of the conceptual building envelope model was evaluated using the absolute percentage error formulae $((abs(A_E - C_E) \div A_E) \times 100\%)$, where A_E and C_E are the actual and conceptual envelopes of the constructed shapes respectively. The error values show the deviation of the conceptual envelope from the actual envelope for each shape. The error values for all shapes ranged between 0 and 0.004%. There is no current study to the knowledge of the researchers that can be used as a benchmark for model evaluation, nonetheless the performance of the developed model can be considered reliable based on the observed deviations.

Table 1. Envelope, area and k_c of different orthogonal shapes in Figure 2

Orthogonal shape	Area (m ²)	Actual envelope (m ²)	k_c	Conceptual envelope (m ²)	Absolute percentage error (%)
a	9	18	0.1459	17.9999	0.001
b	9	12	1.0000	12.0000	0.000
c	9	20	0.1111	20.0008	0.004
d	9	14	0.3201	13.9996	0.003
e	9	20	0.1111	20.0008	0.004
f	9	20	0.1111	20.0008	0.004
g	9	16	0.2038	15.9994	0.004
h	9	20	0.1111	20.0008	0.004

Note: Values are to 4 decimal places in order to capture the slight deviations in actual and conceptual envelopes.

MODEL COMPARISON

Quantity surveyors and cost engineers use the superficial method for estimating budgetary cost of building projects at the early stage when sketch drawings are not available (Kirkham, 2014). A limitation of the superficial method is that changes in plan shape is not adequately captured. This significantly affects the accuracy of the superficial method, and judgmental adjustments are required when using the superficial method (Jaggar and Morton, 2003; Ashworth and Perera, 2015). The limitation of the superficial method can be addressed by using the conceptual envelope model developed in this paper. To demonstrate this, the budgetary cost of external glazing (curtain walling) of a proposed four storey building with a total gross floor area of 1,000m² is estimated using the superficial method (Method 1) and the conceptual building envelope model (Method 2). A hypothetical existing building project with four floors and a total gross floor area of 400 m² is used as the base project. Inflation is assumed to be constant. Also, the floor area for each floor are equal and the curtain walling is vertically installed (i.e., inclined or curved walling is not considered). The unit rate for supplying and fixing curtain wall is taken from the schedule of rates for building works in Hong Kong (see Architectural Services Department, 2016). The unit rate is exclusive of contractors' profit and overheads. Table 2 shows the project details of the hypothetical base project.

Table 2. Details of hypothetical base project

Item	Details	Value
A	Existing gross floor area (GFA)	400 m ²
B	Floor to floor height	4 m
C	Number of floors	4
D	Area of building footprint (BF) (A ÷ C)	100 m ²
E	Girth of building footprint [(2x10) m + (2x10) m]	40 m
F	Area of curtain walling (B x C x E)	640 m ²
G	Unit rate for supplying and fixing of aluminum curtain walling (Architectural Services Department, 2016)	HK\$ 2,669.30/m ²
H	Total cost of aluminum curtain walling (F x G)	HK\$ 1,708,352.00
J	Cost of aluminum curtain walling per m ² of GFA of base project (H ÷ A)	HK\$ 4,270.88/m ²

The budgetary cost for curtain walling of the proposed project using the superficial method is HK\$ 4,270,880.00 (see item E of Table 3). Different budgetary cost of curtain walling using method 2

based on various plan shape efficiency values is shown in Table 4. The lower the plan shape efficiency value, the more irregular is the building shape, consequently the higher the budgetary cost estimate. Using a plan shape efficiency of 40% as an example, the cost of curtain walling for the proposed project based on the conceptual building envelope model is HK\$ 2,989,616.00. The percentage deviation between budgetary estimates of the two methods is 42.86%. It is important to note that if the existing building and the proposed buildings were to be of a square shape, the percentage deviation between budgetary estimates of the two methods would be 58.11%. The estimate of method 2 is more accurate because the girth and height of the building are used in computing the estimate. Detailed comparison and analysis of the two methods using varying combinations of shape, height and gross floor area can be found in Idowu and Lam (2019).

Table 3. Method 1 (Budgetary cost of curtain walling for new building using traditional superficial method)

Item	Details	Value
A	Proposed GFA	1,000 m ²
B	Proposed building height	16 m
C	Proposed number of floors	4
D	Cost of aluminum curtain walling per m ² of GFA of base project (see item I of Table 3)	HK\$ 4,270.88/m ²
E	Budgetary or conceptual cost of curtain walling using superficial method (A x D)	HK\$ 4,270,880.00

Table 4. Method 2 (Range of budgetary cost of curtain walling for new building using conceptual envelope model)

Item	Details					
A	Plan shape efficiency desired	100%	80%	40%	10%	1%
B	k_c value	1	0.8	0.4	0.1	0.01
C	Proposed GFA	1,000 m ²	1,000 m ²	1,000 m ²	1,000 m ²	1,000 m ²
D	Proposed building height	16 m	16 m	16 m	16 m	16 m
E	Proposed number of floors	4	4	4	4	4
F	Proposed building footprint (C ÷ E)	250 m ²	250 m ²	250 m ²	250 m ²	250 m ²
G	Budgetary or conceptual cost of curtain walling in HK\$	2,701,160.76	2,717,988.03	2,989,616.00	4,697,968.00	13,640,763.63
H	Estimate deviation between method 1 and method 2 (Item E of Table 3 minus item G of Table 4) in HK\$	1,569,719.24	1,552,891.97	1,281,264.00	(427,088.00)	(9,369,883.63)
J	Percentage deviation	58.11%	57.13%	42.86%	-9.09%	-68.69%

FINDINGS AND DISCUSSION

The present study was designed to develop a model that could provide quantitative or parametric information on building envelope items at the conceptual stage of a building project. In the process, the relationship between the breadth and coefficient of dimension (k_c) of four-sided orthogonal shapes was explored. Based on empirical evidence in this study, the relationship between the shortest length and k_c of a four-sided orthogonal polygon was found to be a strictly monotonic function. The monotonic property of the empirical equation is important to the current study. This is because of its predictive power. If two variables from the three variables (B , k_c and A) are known,

accurate prediction of the last variable can be achieved. The monotonic relationship was validated mathematically through Equation 13 in Appendix II. The monotonic relationship underscored the predictive power of the conceptual building envelope model. It was also found that regardless of shape complexity (number of corners, form, and boundary configuration), the boundary line of a planar surface will always be equal in length to the boundary line of any other planar surface provided they have the same k_c shape index value. Practically, this implies that architects and designers can produce different building plans having the same plan-shape efficiency value. Therefore, the developed model does not hinder the designer's creativity in the process of designing to cost for building envelope.

In theoretical terms, the cost profile of a building envelope will increase as a power function with a linear increase in shape complexity. Hence, a small decrease in the plan shape efficiency values leads to a large increase in envelope cost. The plan-shape efficiency of a building project can assist in the decision-making process at the predesign stage of a building project. Construction methodology, building use and location affect construction cost and are used to guide decision making on building projects (Smith *et al.*, 2016). Similarly, the plan-shape efficiency of a building has a significant impact on building envelope cost and constructability. Hence the plan-shape efficiency should be considered as a cost bearing factor in the decision-making process of building projects. The use of envelope cost estimates that are below the envelope cost curve is not advisable. This is because there is no relationship between such estimate and the shape of the building. One important outcome of the current research was the derivation of the conceptual building envelope model. The conceptual building envelope model was compared with the superficial cost model as a cost planning tool for external glazed curtain wall. The result showed that the conceptual envelope model can provide a better accuracy than the superficial cost model for building envelope items at predesign stage when sketch drawings are not available. Therefore, the developed envelope model can increase cost certainty of budgetary estimates of cost significant building envelope items during predesign cost planning. It is important to note that the developed model is not constrained by the actual planar geometry of the proposed building. The building envelope model can be directly applied to single or multiple floors plans having varying areas and shapes. However, obtaining the conceptual envelope of multiple floors with different areas and shapes require the summation of the conceptual envelope for each floor.

CONCLUSIONS

The current study was undertaken to improve the cost certainty of building envelopes and eliminate the time delay and exhaustive process of producing alternative sketch drawings associated with the cost planning of building envelopes. Hence, the research was aimed at developing a model for the cost planning of building envelope items prior to initial sketch designs. Using an empirical approach, and mathematical validation, a mathematical model termed “conceptual vertical building envelope model” was established. The study showed that regardless of shape complexity (number of corners, form, and boundary configuration), the boundary line of a planar surface will always be equal in length to the boundary line of any other planar surface provided they have the same coefficient of dimensions (k_c) value. In practical terms, the developed model does not hinder the designer's creativity in the process of designing to cost for building envelope elements. The limitation of the developed model is that designers must be guided by the proposed gross floor area and k_c values at later stages of design process when designing to cost. Practical application of the developed model was also described in this paper. The study contributed to existing knowledge

by providing an alternative method for accurately and quickly estimating building envelope quantities and cost without the need for sketch drawings. Also, the current study extends the current knowledge on the existing plan-shape efficiency theory, by showing that a high-ordered irregular building plan shape can have the same girth and enclosed area as a low-ordered irregular building plan of similar coefficient of dimensions. The conceptual vertical building envelope model as a cost planning tool can assist quantity surveyors and cost engineers in quick and accurate assessment of predesign cost efficiency of various building envelope shapes within predefined constraints such as building coverage ratio. This will improve the cost certainty of the budgetary estimates for building envelope items when a “design to cost” approach is adopted on building projects that have limited financial resources.

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APPENDIX I. EXISTING BUILDING SHAPE INDEXES

Table A1. Building shape index showing range of values, optimal shape and optimal values

Index name	Formulae	Optimal shape	Optimal value	Range of values
Wall area to floor area (WFA) ratio [*] (Belniak et al. 2013; Buxton 2015)	$\frac{W}{F}$	None	None	0 to infinity ($0 \leq x < \infty$) Preferred: 0.3 to 0.8
Wall to floor (WF) index (J. Cook) [*] (Kirkham 2014)	$\frac{P - P_s}{P_s} \times 100\%$	Square	0	0 to infinity ($0 \leq x < \infty$)
Shape-effectiveness (SE) index (J. Cook) [*] (Kirkham 2014)	$\left(\frac{P}{4\sqrt{A}} \right) - 1$	Square	0	0 to infinity ($0 \leq x < \infty$)
Building planning 'm' index (m) (Belniak et al. 2013)	$\frac{P}{\sqrt{A}}$	Circle	3.546	3.546 to infinity ($3.546 \leq x < \infty$)
Length/breadth (LB) Index (D. Banks of London South Bank University, formerly Polytechnic of South Bank) [*] (Kirkham 2014)	$\frac{P + \sqrt{(P^2 - 16a)}}{P - \sqrt{(P^2 - 16a)}}$	Square	1	1 to infinity ($1 \leq x < \infty$)
Plan/Shape (PS) Index (D. Banks) [*] (Ashworth & Perera 2015; Kirkham 2014)	$\frac{g + \sqrt{(P^2 - 16r)}}{g - \sqrt{(P^2 - 16r)}}$	Square	1	1 to infinity ($1 \leq x < \infty$)
Plan compactness or POP ratio (POP) (Strathclyde University) [*] (Kirkham 2014)	$\frac{2\sqrt{\pi A}}{P} \times 100\%$	Circle	0.8663	0 to 0.8663 ($0 \leq x \leq 0.8663$)
Volume/Mass/Block compactness (VOLM) index (Belniak et al. 2013; Kirkham 2014)	$2\pi \left(\left[(3V / 2\pi)^{1/3} \right]^2 / A_u \right) \times 100\%$	Sphere	1	0 to 1 ($0 \leq x \leq 1$)
Reciprocal plan shape (S_R) index ⁺ (C. Wing) [*] (Wing 1999)	$S_R = a_1 A + a_2 P$	None	Undefined	Undefined

^{*} Names of persons or institutions associated with the development of the indexes in the literature

⁺ S_R Requires an empirical modelling technique such as ordinary least-square regression to obtain a_1 and a_2

W: Wall area, F: Floor area, P: Wall perimeter, P_s : Wall perimeter of a square with equal floor area with the given floor area, a: Floor area, r: Gross floor area divided by number of floors, A: Floor area, V: Volume of building, A_u : Floor area of the building, excluding the ground floor area, a_1 : Marginal effect of area on cost, a_2 : Marginal effect of perimeter on cost.

APPENDIX II. MATHEMATICAL VALIDATION OF CONCEPTUAL BUILDING ENVELOPE MODEL

Defining a function $f(s) = qs + c$, in relation to a planar origin to represent a rectangle, where q is a zero slope and c is the intercept, the area and perimeter of the rectangular geometry is given as:

$$A = \int_R f(s) ds, \quad R: a \leq x \leq b \quad (6)$$

$$P = 2 \left[\lim_{x \rightarrow \infty} \sum_{i=1}^x \sqrt{1 + [f'(s)]^2} ds + \lim_{y \rightarrow \infty} \sum_{i=1}^y \sqrt{1 + [f'(s)]^2} ds \right], \quad (7)$$

Therefore, the length and breadth of a four-sided orthogonal polygon can be written as Equations 8 and 9 respectively

$$L = \int_{x_a}^{x_b} \sqrt{1 + [f'(s)]^2} ds \quad (8)$$

$$B = \int_{y_a}^{y_b} \sqrt{1 + [f'(s)]^2} ds \quad (9)$$

Defining coefficient of dimensions (k_c) as B/L , where $B \leq L$, and $0 < k_c \leq 1$. Using the area A of rectangle in Equation 6, B and L can be defined in terms of A and k_c as shown in Equations 13 and 14;

$$L = \frac{\int_{y_a}^{y_b} \sqrt{1 + [f'(s)]^2} ds}{k_c}, \text{ since } A = L \cdot B, \text{ we have} \quad (10)$$

$$A = L \int_{y_a}^{y_b} \sqrt{1 + [f'(s)]^2} ds, \text{ therefore,} \quad (11)$$

$$A = \frac{\left(\int_{y_a}^{y_b} \sqrt{1 + [f'(s)]^2} ds \right)^2}{k_c} \quad (12)$$

$$B = \left[k_c \int f(s) ds \right]^{\frac{1}{2}}, \text{ for } k_c > 0 \quad (13)$$

Equation 13 is similar to the empirical Equation 1, and thus validates the observed non-linear monotonic relationship between Breadth (B) and k_c . Based on Equation 10 and Equation 11 L can be rewritten as Equation 14.

$$L = \frac{\int f(s) ds}{\left[k_c \int f(s) ds \right]^{\frac{1}{2}}} \quad (14)$$

The perimeter of a four-sided orthogonal polygon (Equation 7) can be rewritten as Equation 15.

$$P = \frac{2 \int f(s) ds (k_c + 1)}{\left[k_c \int f(s) ds \right]^{\frac{1}{2}}} \quad (15)$$

Since envelopes are a product of perimeter and building height (H), a generalised equation for envelope quantities (E_Q) of buildings can be given as Equation 16

$$E_Q = \frac{2 \int f(s) ds (k_c + 1)}{\left[k_c \int f(s) ds \right]^{\frac{1}{2}}} \cdot H \quad (16)$$

Equation 16 can be used to compute the vertical area of a shape for any given floor area and k_c values. Replacing the integral form of Equation 15 with an algebraic form ($P = 2A(k_c + 1)/\sqrt{A k_c}$), Area A and coefficient of dimensions k_c can also be rewritten as Equation 17 and 20 respectively.

$$A = \frac{P^2 k_c}{4(k_c + 1)^2} \quad (17)$$

The maximum area (global maximum) of Equation 17 is given as Equation 18

$$\max \left\{ \frac{P^2 k_c}{4(k_c + 1)^2} \right\} = \frac{P^2}{16}, \text{ at } k_c \begin{cases} -2, P=0 \\ 1, (otherwise) \end{cases} \quad (18)$$

Since k_c is a non-negative value of B / L , where $B \leq L$, and $P \neq 0$. Therefore, the maximum perimeter for any four-sided orthogonal polygon with area A and a k_c value of 1 can be written as Equation 19.

$$P = \sqrt{16A} \quad (19)$$

If $L \neq B$, and $B < L$, then $0 < k_c < 1$. Based on the algebraic form of (15) and (17), the variable k_c can be expressed as a Subject of formulae as shown in Equation 20.

$$k_c = \frac{8A}{\sqrt{P^4 - 16AP^2} - 8A + P^2} \quad (20)$$

k_c as a ratio of B to L could be regarded as a shape index based on the theoretical framework of shape indexes.

Equation 21 is an extension of Equation 16 for cost planning of building envelopes by integrating unit rates for different types of envelope material.

$$E_c = \frac{2 \int f(s) ds (k_c + 1)}{\left[k_c \int f(s) ds \right]^{\frac{1}{2}}} \cdot H \cdot R_e, \quad (21)$$

where H is the total height of the building and R_e is the building envelope unit rate. In algebraic form, Equation 21 is the conceptual vertical building envelope model and can be written as Equation 22.

$$E_c = \frac{2A(k_c + 1)HR_e}{\sqrt{A k_c}} \quad (22)$$

IMPACT OF NON-MONETARY INCENTIVES ON WORKERS PERFORMANCE IN NIGERIA CONSTRUCTION FIRMS

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ABSTRACT

Development of economy in every nation is based on construction projects undertaken through several types of contracts. However, construction firms are facing many challenges that affects its performance. Therefore, this paper aimed to establish the impact of non-monetary incentives on worker's performance in Nigeria construction firms. One hundred (100) numbers of questionnaires were distributed to the professionals in the construction firms in Abuja. These professionals are Architect, Quantity Surveyor, Project Manager, Builders and Civil Engineer. Thus only 92 were retrieved for computation of the result and discussion. Descriptive method of analysis was adopted for the data analysis through the uses of mean, standard deviation. The result of the analysis revealed that, send staff to conferences and seminars ranked first (1st), provide cross training opportunities ranked second (2nd), promotion ranked third (3rd), give public commendations in a meeting ranked fourth (4th) and condition of services ranked fifth (5th) as non-monetary incentives practices in Nigeria construction firms. While reducing cost and time overrun ranked first (1st), increase the efficiency of the workers ranked second (2nd), increase quality output of the workers ranked third (3rd), and procures positive peer pressures ranked fourth (4th) as significant factors of non-monetary incentives that have impact on the worker's performance in Nigeria construction firms. The paper therefore concludes that Nigeria construction firms practices non-monetary incentives to enhance the worker's performances. But the level of practices is not enough to achieve the worker's performance in the construction firms. Consequently, the paper recommended that the top management of the construction firms should encourage project team leaders to adopt the aforementioned non-monetary incentives to enhance the efficiency of the workers in order to enhance the project performance.

Keywords: *Construction firms, Construction projects, Non-monetary incentives, Performance and Workers*

INTRODUCTION

The numbers of critical research studies on non-monetary incentive on worker's performance in construction firms have been limited in the past two decades, since the commencement of the term Human Resource Development (Garavan & Morley, 2006; Olugbenga *et al.*, 2017). It is a thing of concern as previous research has not adequately addressed the impact of non-monetary incentive (NMI) on worker's performance. However, few researches have been conducted to address the influence of training and non-monetary incentive on worker's performance in Nigerian construction firms. This has left the problem of wastage, inefficiency, and poor quality and quantity targets, conflicts among the professionals of construction firms and thereby resulted in poor delivery of construction projects unsolved (Kasimu & Ahmed 2017; Emerole, 2015). Therefore, this paper seeks to address the existing research gap by established the impact of non-monetary incentives on worker's performance in Nigeria construction firms with the view of improving the collaboration, teamwork among the key players and effective project delivery.

LITERATURE REVIEW

According to Ujo (2005), non-monetary incentive is defined as the internal or external driving force that produces the willingness to perform an act to a conclusive end. The first aspect of NMI is internal incentive because the driving force comes from within an individual. The second aspect is external incentive, and is applied by the organization. This is because employees are motivated to identify with organization in order to satisfy their varied and variegate needs and desires. Until they have been identified and properly satisfied, they will never cease to impede smooth running of the organisations. NMI refers to the forces either within or external to a person that arouse enthusiasm and persistence to pursue a certain course of action (Buyens *et al.*, 2001).

However, the definition of non-monetary incentives describes this type of incentives as rewards that cannot be explicitly categorised in the financial rewards sector (Male *et al.*, 2007). These incentives are sometimes referred to as intangible or unquantifiable and are to be given usually for a good performance and loyalty. Companies need to emphasize the great importance of these rewards as they have even more powerful influence on employee behaviour, attitudes, and results. Workers are no longer motivated only by money but by non-monetary incentive such as motivation, rewards, promotion, praises and conferences/seminars (Tabassi *et al.*, 2011).

There are several types of non-monetary incentives: individual extrinsic rewards including non-monetary recognition, praise, and feedback, individual intrinsic rewards consisting of fulfilling work or giving opportunity to grow, collective extrinsic rewards involving life balance policies, voluntary incentives, learning, and development management programs, and lastly collective intrinsic reward include work system design (Armstrong, 2009). The focus of these rewards is often based on the needs people have or desire.

These requirements can be classified as the needs for achievement, recognition, responsibility, influence and personal growth. The need for achievement is identified as the need “for competitive success measured against a personal standard of excellence” (Armstrong, 2009).

Non-monetary incentives are classified as Tangible, Social and Job Related non-monetary incentives. This classification is in line with on-the-job rewards breakdown by Robert & Ben, (2006)

1. Tangible non-monetary incentives according to Martins & Jackson (2006) refer to the tangible items such as certificates, clothing, wall plaques, desk accessories, tie pins, coffee mugs, watches, rings, trophies, discounted goods, gift, key chain, free tickets to various facilities etc. Tangible non-monetary incentives can be some services provided by the organization such as piped-in music, internet access, child care centre, free food/beverage, bus service, club privileges etc. According to Osuji (2014), tangible non-monetary incentives can be awarded as recognition to a good performance so as to create a positive working atmosphere for the employees.
2. Social non-monetary incentives according to Kazaz & Ulluevli (2008) are related with subordinate-superior relationships and the social programmes within the organization. Superiors being sincere and valuing their opinions and caring in communicating with the subordinates, the degree of formal or informal recognition for a good job, just to release the stress of the work various social programmes in which employees of the same organization get together in an informal way for celebrating something or etc. Offei *et al.*, (2014) argued that all these contribute to the creation of a working atmosphere that makes employees feel themselves valuable and as part of an entity. This in turn has the high potential to motivate employees without offering monetary benefits.

3. Job related non-monetary incentives according to Stone (2002) have the potential to motivate employees intrinsically. Jobs with variety of development opportunities, tasks, autonomy, flexible working hours, responsibilities participation in decision making, are very important in satisfying employees' certain needs and they may lead to a feeling that the job itself is worth exerting more effort without need to any external incentive (Stone, 2002).

Characteristics of Non-Monetary Incentives

Adetoro (2008) identified four common characteristics which underlie the definition of NMI namely:

- a. NMI is typified as an individual phenomenon: Every person is unique and all the major theories of motivation allow for this uniqueness to be demonstrated in one way or the other.
- b. NMI is usually intentional: NMI is assumed to be under the control of the worker, and behaviours that are influenced by NMI, such as effort expended, are seen as choices of action.
- c. NMI is multifaceted: The two factors of greatest importance are:
 - i. What get people activated?
 - ii. The force of an individual to engage in desired behaviour
- d. The purpose of motivational theories is to predict behaviour: NMI is not the behaviour itself, and it is not performance. NMI concerns action, is the internal and external forces which influence a person's choice of action (Adetoro, 2008).

Types of Non-Monetary Incentives

Non-Monetary Incentive can be categorised in two ways namely: Intrinsic and Extrinsic NMI (Enshassi *et al.*, 2007).

Intrinsic NMI: Intrinsic NMI is the satisfaction a person receives in the process of performing a particular action. This is related to psychological rewards such as the opportunity to use one's ability, the sense of challenges and achievement receiving appreciation, positive recognition, and being treated in a caring and considerate manner. Psychological rewards are those that can usually be determined by the actions and behaviour of the individual managers (Enshassi *et al.*, 2007). Intrinsic Non-Monetary Incentives are concerned with the quality of work life, are likely to have a deeper and longer-term effect because they are inherent in individuals and not imposed from outside (Enshassi *et al.*, 2007).

Extrinsic NMI: It is related to tangible rewards such as security, promotion, contract of service, the work environment and conditions of service. These are what need to be done to or for people to encourage them. They are often determined at the organisational level and may be largely outside the control of the individual managers. Extrinsic NMI can have an immediate and powerful effect but will not necessarily last long (Enshassi *et al.*, 2007). People that are extrinsically NMI do not actually get encourage from the work itself. They expect to receive some rewards after having performed a certain task or else they will not feel pleased (Gagne & Deci, 2005).

Impact of Non-Monetary Incentives

A non-monetary incentives team can exert a major influence on the success of a projects (Ben & Tirriyayi, 2014). Conversely, a lack of NMI resulting from low job satisfaction that leads to high employee turnover rates and consequently to a demise of a company's talented and valuable workforce. Employee NMI affects performance and part of a manager's job is to channel NMI toward the accomplishment of organisational goals. The study of NMI helps managers understand

what prompt people to initiate action, what influences their choice of action, and why they persist in that action over time.

Non-monetary incentives carry a significant “trophy value” thus continue to reinforce the good performance and behaviours; (1) it provides tangible symbol of achievement and serve as an encouragement to other employees; (2) provide guilt-free enjoyment of reward thus increases the motivating impact (3) both extrinsic and intrinsic motivators; provide strong emotional appeal to participants’ personal wants and interests; (4) carry a higher perceived value because of the increased emotional attachment; therefore, stimulate performance better than cold cash; (5) can be attached to a particular behaviour thus stimulating a specific response in a long term and (6) participant’s family is involved in selecting and sharing awards thus multiplying the emotional value of the reward and its impact on the participant. Based upon the aforementioned factors it can be observed that the minimum level of monetary compensation, employees are more and more interested in non-monetary incentives i.e., tangible rewards rather than the cash rewards.

METHODOLOGY

This study adopted quantitative research approach via survey questionnaire to sample individuals from a population with a view towards making statistical inference about the population using the sample (Creswell, 2011). To pull out public opinion, such as beliefs, perception, ideas, views and thought about the impact of non-monetary incentive on worker’s performance in construction firms in Abuja. In order to obtain the require population for this study, the stratified random sampling technique was adopted for the selection of the construction firms that participated in this study. This selection was in line with concept of Creswell & Tashakkori (2007) that respondents are arranged in strata for the convenience in questionnaire distribution and assessment. Although, the selection of construction firms was based on the annual turnover, construction firm’s capacity and frequency of firm’s involvement in construction projects execution. Since the units of measurement are professionals in the construction firms, therefore, simple random sampling was adopted in each of the construction firms for the selection of construction professionals from the strata.

The questionnaire that was used to record the responses of each respondent contained mainly closed ended questions using a five- point Likert scale ranged from very significant, significant, moderate, slightly significant and not significant. The scores of the respondents were computed based on the variables used in the questionnaire. One hundred (100) numbers of professionals were selected from the construction firms in Abuja. These professionals are: Quantity Surveyors twenty-five (25) numbers, Architects twenty-five (25) numbers, Civil Engineers twenty (20) numbers, Builders twenty (20) numbers and Consultants ten (10) numbers. However, only ninety-two (92) numbers of those selected professionals were able to returned their questionnaires, while eight (8) of the one hundred numbers (100) of questionnaires were ignored for incorrect entry.

The inferential statistic was adopted to summarise the sample, rather than use the data to learn about the population and sample. In this paper, descriptive statistic was used to present means score, standard deviation and frequency counts. The mean score was used to ranked the respondents' opinions or responses obtained.

ANALYSIS AND DISCUSSION OF RESULTS

The results of the demographic profile of the respondents that participated in this research work were presented in section 4.1 to 4.5 respectively.

Years of working experiences of the respondent's

Figure 1 indicates that 31.52% of respondents had 1-10 years of experience, 57.60% had 11-20 years, 9.78% had 21-30 years, 1.09% had 31-40 years and 0% had Above 40 years of experience respectively. Inferences drawn from this was that the respondents sampled were knowledgeable enough to comprehend the contents of the questionnaires, thus provide suitable responses.

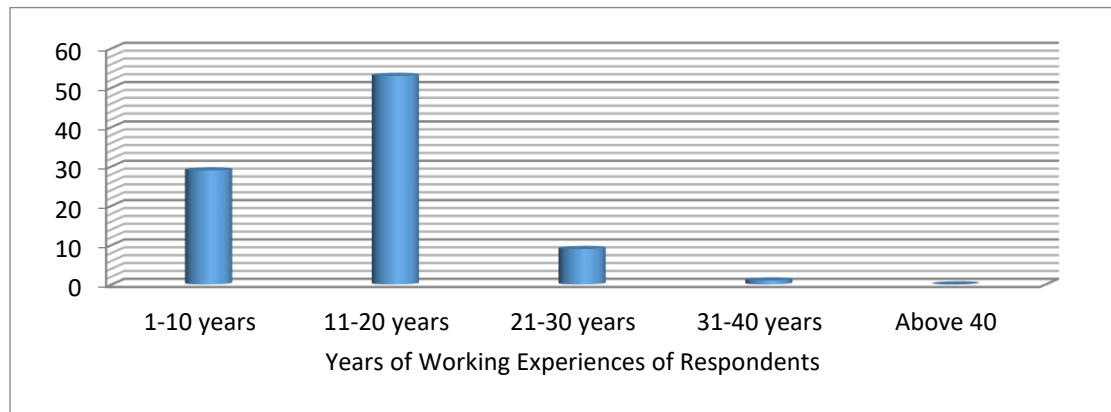


Figure 1: Years of Experience of Respondents: Field Work (2020)

Educational qualifications of the respondent's

Figure 2 indicates that 14.13% of respondents had National Diploma, 31.52 % were holders of Higher National Diploma (H.N.D) and Bachelor of Sciences (B.Sc.), 20.65% of respondents had Post Graduate Diploma (P.G.D), 30.43% of respondents had Masters of Sciences (MSc/MTech) and 03.26% of respondents had Philosophy of Doctorates (PhD) respectively.

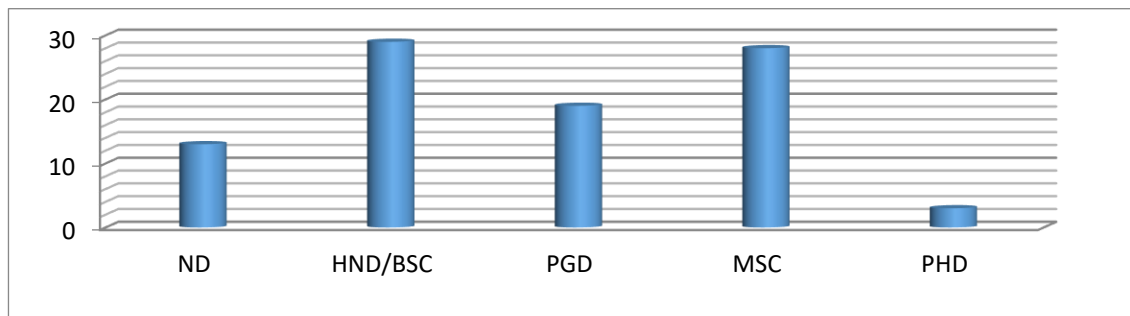


Figure 2: Educational Qualifications of Respondent: Field Work, (2020)

Nature of construction work involved by the respondent's

Figure 3 indicates that 10.87% of respondent's works are Mechanical, 11.96% of respondents are Electrical works, 50% of respondents are Civil works, 11.96% of respondents are Building works and 15% of respondents are other construction workers in the Built Environment respectively.

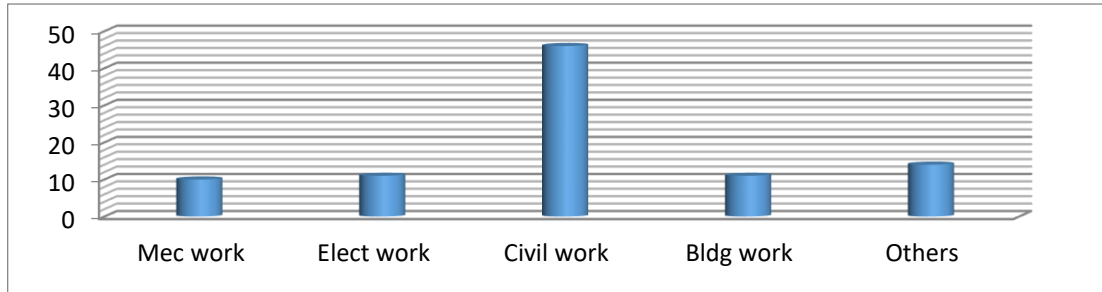


Figure 3: Nature of construction works involved by the respondent's. Field Work (2020)

Professional members of respondent's

Figure 4 indicates that 20.65% of respondents are members of Nigeria Institute of Quantity Surveyors by profession, 27.17% of respondents are members of Nigeria Institute of Architect by profession, 17.39% of respondent are members of Nigeria Institute of Builders, 22.83% of respondent are members of Nigeria Society of Engineers and 11.96% of respondent are members of other professional members of the built environment.

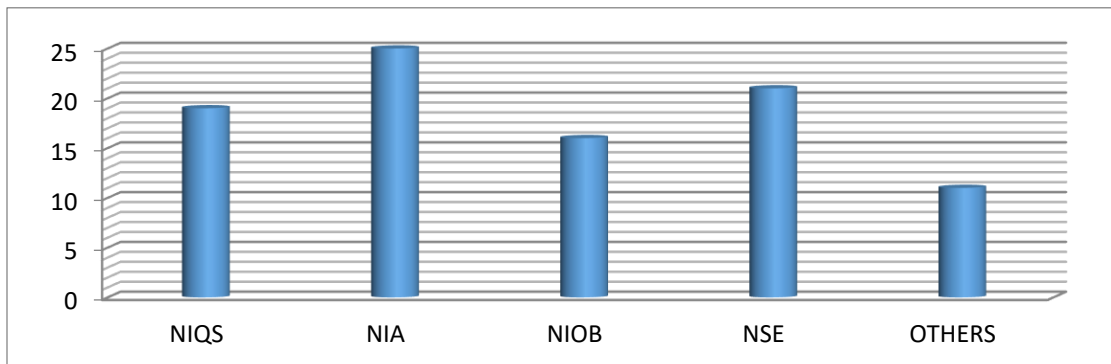


Figure 4: Professional Institutions of Respondents: Field Work (2020)

Non-Monetary Incentives Practices in Nigerian Construction Firms

The perception of the respondents on Non-monetary incentives practices in Nigerian construction firms was presented in Table 1. However, the decision rules used to rank the mean scores are as follows: (1) 0.00 to 1.49 represent Not significant; (2) 1.5 to 2.49 represent slightly significant; (3) 2.5 to 3.49 represent Moderate; (4) 3.5 to 4.49 represent significant and (5) 4.5 to 5.0 represent Very significant.

Table 1: Non-Monetary Incentive practices in Nigerian Construction Firms

NON-MONETARY INCENTIVE	MIS	SD	RANK	DECISION
Send staff to conferences and seminars,	4.78	0.87	1 st	Very Significant
Provide cross training opportunities	4.62	0.99	2 nd	
Promotion,	4.59	0.98	3 rd	
Provide public praised in a meeting,	4.54	0.94	4 th	
Condition of services,	4.52	0.94	5 th	
Psychological reward,	4.51	0.93	6 th	
Ask an employee to represent a department at an outside function,	4.51	0.84	6 th	
Security,	4.42	0.87	7 th	Significant
Encouragement,	3.34	0.90	8 th	
Contribution noted (positive attention),	3.22	0.69	9 th	
Positive recognition,	3.10	0.81	10 th	
Name,	2.78	0.68	11 th	
Appreciation,	2.62	0.84	12 th	
The work environment	2.57	0.80	13 th	
Make career development, commitment and treats,	2.53	0.87	14 th	Moderately Significant
Self-recognition,	2.52	0.84	15 th	
Provide opportunities for empowerment and self-management	2.49	0.79	16 th	
A letter of appreciation,	2.48	0.95	17 th	
Treated in a caring and considerable manner,	2.47	0.76	18 st	
Given a post for example, Manager or head of a unit.	2.38	0.87	19 th	
Contract of services,	2.33	0.64	20 th	
Gift certificate,	2.26	0.82	21 th	
Take the entire team for launch,	2.21	1.2	22 th	
Miss project deadline	2.10	0.77	23 rd	

Field work (2020)

Table 1 shows the non-monetary incentives practices in Nigerian construction firms. These non-monetary incentives practices in Nigeria construction firms were ranked to establish the major significant ones among the listed non-monetary incentives in Table 1. However, the result shows the followings as main significant non-monetary incentives practices in Nigerian construction firms. These are: (1) send staff to conferences and seminars, (2) provide cross training opportunities, (3) promotion, (4) provide public praised in a meeting, (5) condition of services, (6) psychological reward and (7) ask an employee to represent a department at an outside function. These were ranked as 1st, 2nd, 3rd, 4th, 5th, 6th & 6th with mean item scores of 4.78; 4.62; 4.59; 4.54; 4.52; 4.51 & 4.51 respectively. This result was in agreement with Latagana *et al.* (2019) that

highlighted the followings as non-monetary incentives to improve productivity: appreciation, promotion, self-recognition, provide training opportunity and psychological rewards.

In addition, the result also shows the followings as moderate in practices in Nigerian construction firms. These are: (1) provide opportunities for empowerment and self-management, (2) a letter of appreciation, (3) treated in a caring and considerable manner, (4) given a post e.g. Manager or head of unit (5) contract of services, (6) gift certificate, (7) take the entire team for launch and missed project deadline. These were ranked 16th; 17th; 18th; 19th; 20th; 21st; 22nd; & 23rd with the following mean item scores of 2.49; 2.48; 2.47; 2.38; 2.33; 2.26; 2.21 & 2.10 respectively. Findings from this study are in line with that of (Osuji, 201; Tabachnick & Fidel, 2001) who reported that motivation refers to the forces either within or external to a person that arouse enthusiasm and persistence to pursue a certain course of action. In further agreement with the findings of this study, (Tabachnick & Fidel, 2001). added that employee motivation affects productivity, and part of a manager's job is to channel motivation toward the accomplishment of organizational goals. The study of non-monetary incentives therefore helps managers understand what prompt people to initiate action, what influences their choice of action, and why they persist in that action over time.

Impact of Non-Monetary Incentive to Improve Workers Performance

The perception of the respondents on impact of non-monetary incentives to improve the worker's performance in Nigerian construction firms was presented in Table 2. However, the decision rules used to rank the mean scores are as follows: (1) 0.00 to 1.49 represent Not significant; (2) 1.5 to 2.49 represent slightly significant; (3) 2.5 to 3.49 represent Moderate; (4) 3.5 to 4.49 represent significant and (5) 4.5 to 5.0 represent Very significant.

TABLE 2: Impact of Non-Monetary Incentive on Workers Performance in construction firms

Effect Of Non-Monetary Incentive	MIS	SD	RANK	REMARKS
Reduce cost and time overrun	4.84	0.93	1 st	Significant
Increase the efficiency of the workers	4.72	0.82	2 nd	
Increase quality output of the workers	4.69	1.04	3 rd	
Procures positive peer pressures	4.57	0.88	4 th	
Enhance better understanding by individual	4.54	0.85	5 th	
Reduce mistakes and errors	4.52	0.93	6 th	
It creates good relationship among top management team	4.50	0.75	7 th	
Promote better communication	4.43	0.91	8 th	Significant
Multiplies the potential of individual members	4.36	1.08	9 th	
Increase team work among the construction players	4.21	0.81	10 th	
Enhance creativity	3.98	1.18	11 th	
Bring about new ideas and knowledge	3.76	0.86	12 th	
More efficiency use of resources – especially time	3.65	0.99	13 th	
Enhance project delivery on time	3.53	0.74	14 th	

Reduce disputes during course of work	3.51	0.88	15 th	Moderate
Improve site management	3.42	0.74	16 th	
Improve communication skills	3.37	0.95	17 th	
Increase the determination of the workers	3.25	1.05	18 th	
Assurance of job satisfaction	2.81	1.09	19 th	

Field work (2020)

Table 2 show the followings non-monetary incentives as very significant factors that have impact on the worker's performance in Niger State construction firms. These are: reducing cost and time overrun, increase the efficiency of the workers, increase quality output of the workers, procures positive peer pressures, enhance better understanding by individual, reduce mistakes and errors, and it create good relationship among top management team. These factors were ranked 1st; 2nd; 3rd; 4th; 5th; 6th; & 7th with the followings mean score items of 4.84; 4.72; 4.69; 4.57; 4.54; 4.52 & 4.50 respectively. This result was in agreement with findings of Shehu (2017) which established the followings as main impact of non-monetary incentives on employee productivity: increase better understanding by individual, enhance teamwork, reduce time and cost overruns, increase quality output and enhance the efficiency of the worker. Furthermore, the result shows the followings non-monetary incentives factors as slightly significant that have impact on worker's productivity in construction firms. These are: improving site management, improve communication skills, increase the worker's determination and assurance of job satisfactions. These non-monetary incentives factors were ranked 16th; 17th; 18th; & 19th with the followings mean score items of 3.42; 3.37; 3.25 & 2.81 respectively. Tabassi & Baker (2009) argued that a motivated team can exert a major influence on the success of a project. Conversely, a lack of motivation resulting from low job satisfaction leads to high employee turnover rates and consequently to a demise of a company's talented and valuable workforce (Kasimu & Ahmed, 2017).

CONCLUSION

In line with the findings of this research, the study established the followings types of non-monetary incentives practices in Nigeria construction firms: send staff to conferences and seminars, provide cross training opportunities, promotion, give public commendations in a meeting, condition of services, psychological reward and ask an employee to represent a department at an outside. While the followings were established as main impact of non-monetary incentives on worker's performance in Nigeria construction firms: reducing cost and time overrun, increase the efficiency of the workers, increase quality output of the workers, procures positive peer pressures, enhance better understanding by individual, reduce mistakes and errors, and it create good relationship among top management team.

The paper therefore concludes that Nigeria construction firms practices non-monetary incentives to enhance the worker's performances. But the level of practices is not enough to achieve the worker's performance in the construction firms. As result of low of level of practices, Nigeria construction firms is yet fill the impact of the non-monetary incentives on worker's performances. Consequently, the paper recommended based on the findings and conclusions that the top management of the construction firms should encourage project team leaders to increase the level of practice of non-monetary incentives to enhance the worker's performance. The non-monetary

incentives should be encouraging to serve as motivation in the Nigeria construction firms since it reduces time and cost overrun, increase quality output of workers and reduces mistake and errors.

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DETERMINATION OF ACTIVITY BASED SAFETY RISK HAZARD IN BUILDING CONSTRUCTION PROJECTS IN ABUJA, NIGERIA

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ABSTRACT

The dynamic nature of the construction projects exposes workers to multiple safety hazards and risks, resulting to high cases of fatal occupational accidents on sites. The study determined the most hazardous building construction activities and identified the most common hazards in building construction projects. The study sought opinion of construction professionals who managed and supervised construction projects in Abuja via questionnaires. 50 well-structured questionnaires were administered and 34 were returned representing a response rate of 68%. The data was analysed using descriptive statistics (frequencies and Mean Scores). The result revealed that the top hazardous work activities on building construction projects sites were steel structure construction, roof work, electrical works, mean score of 4.24, 4.21 and 3.93 respectively. Result also revealed that the most critical safety hazards are: struck by falling objects; fall from height and hazard due to machine and tools usage with mean score of 4.26, 4.21 and 3.93 respectively. It was concluded that the nature and type of activities determines the dimensions and magnitude of hazard in a building construction operation. It was recommended that hazard identification investigation should be carried out on construction site periodically. The study provides valuable information for site-based construction managers in mitigating the hazards associated with building construction projects.

Keywords: Activities, Building, Construction, Hazard Identification, Safety Risk.

INTRODUCTION

The construction industry is characterized by a high level of hazard to the health and safety of workers (Holo *et al.*, 2018). The dynamic nature of the construction projects in the industry has exposed worker to multiple safety hazards and risks, resulting to high occupational incidents and injury and fatality rates on sites (Albert *et al.*, 2014). Many factors may place construction workers at higher risk for workplace injury due to multiple workers activities that may lead to injuries and fatalities on construction site including constructing, assembling, dismantling and repairing (Census of Fatal Occupational Injuries (CFOI), 2017). Construction segment involves high risks due to its production processes and labour-intensive characteristic in addition the industry is faced with huge financial loss due to occupational accidents (Yilmaz, 2014).

The construction industry is one of the most hazardous industries in many countries (Park *et al.*, 2020). Consistently the construction industry leads other industries as one of the top industries in the number of total workers death (Bureau of Labour Statistics (2018). The construction industry in the United States accounted for 19% of the total industrial deaths in the year 2016 and worldwide

the construction industry was found to have higher fatality rate than in other industries (Chan *et al.*, 2018). According to the estimate of the International Labour Organization (ILO) over 60,000 fatal injuries occur worldwide on construction project sites and at a rate of one fatal accident every 10 minutes (ILO, 2012). Data from the Bureau of Labour Statistics (2018) reveals that in 2016 the construction industry recorded four cases of workplace injuries and illness per 100 full-time workers (BLS, 2018) and for years this rate has been constant, despite numerous improvements in the safety and health management area in the construction industry, still incidents occurs on construction sites and injury rates and fatality have been higher than in other industries (Bureau of Labour Statistics, 2018). Goh and Chua (2009) reported that the high rates of injury are due to the inability of workers in the construction site to recognize and respond to hazards.

Ramaswamy and Mosher (2017) assert that a well-identified hazard may reduce the rate of fatality and improve the safety management of construction projects. They explained further that in construction projects hazard identification and safety analysis is a challenging issue. Yang *et al.* (2017) observed that many efforts in identifying the root causes of incidents and the completion of a comprehensive safety analysis in construction projects has been hindered due to lack of available data to specifically address construction injuries and fatalities. In evaluating safety performance of a construction site, the first step is to identify the hazards, evaluate their priorities and effect and take adequate measures to avoid such hazards (Gunduz, 2020).

Occupational Safety and Health Administration (OSHA), 2002) describe hazard as any real or potential condition for an activity or to produce a harmful effect such as illness, injury or fatality. Albert *et al.* (2014) ascertained that in an industrial setting safety management involves four elements: identification, communication, assessment and selection of appropriate safety measures. To maximize the potency of safety management and safety prevention programs, hazards in the workplace need to be properly recognized. Hazard identification is fundamental to construction safety management activity; unidentified hazards presents intolerable and unmanageable risks (Carter, 2006). Construction projects are highly hazardous but limited attention has been given on hazard identification within this area (Albert *et al.*, 2014). To identify the root causes of safety incidents, workplace hazards must therefore be identified and studied. The aim of the study is to examine the potential hazards in building construction activities. The study had the following objectives: to determine the most hazardous building construction activities and to identify the most common hazards in building construction projects in Abuja.

LITERATURE REVIEW

hazards in building construction activities

Various studies have identified health and safety hazards on construction sites, the most recognized have been fall from height, struck by falling objects; fall from height; hazard due to machine and tools usage; Equipment accidents, working in confined spaces, Manual handling of machine/tool hazards, working underground, fire exposure, noises exposure and poor housekeeping (Memarian and Mitropoulos, 2013; Choi, 2015; Gurcanli *et al.*, 2015; Okoye, 2018, Ghousi *et al.*, 2018). Some studies have associated certain building trades/ activities with high fatality or injury risks while some others are associated with low risks. Baradan and Usmen (2006) study occupational injury and fatality risk analysis was performed on 16 building trades and revealed that ironworkers

and roofers were the riskiest building trades. Memarian and Mitropoulos (2013) studied accidents in masonry construction and identified the most frequent incident events to be overexertion, struck by object and contact with objects.

Choi (2015) studied aging workers and trade-related injuries in the US construction workers and identified Labourers, carpenters, iron workers and operators as the four trade groups with the highest injury rates in addition the causes of accident were struck against an object, caught in between object and falls from higher level. Gurcanli *et al.* (2015) determined activity-based risk assessment and safety cost estimation for residential building construction projects on five construction activities and 12 accident types. Finding revealed that reinforced concrete work and roof work and were the most hazardous activities and fall from height, struck by flying/falling object and building structure collapse were the highest causes of accident in construction activities. Okoye (2018) found that masonry, carpentry including formwork and roofing and iron bending are the common building trades associated with high risks and fall from height, manual handling activities and climbing step and walking platforms were the most impactful health and safety risk factors in building trades. Ghousi *et al.* (2018) who design a flexible method of building construction safety risk assessment and investigated the financial aspects of safety program and identified structural steel, excavation and building facade were the riskiest building trades and Struck by falling objects and Fall to lower level as the most critical hazard in building construction projects. Literature review have shown that the fundamental requirement to improving safety which is the identification of hazard has received little attention especially in the literature researched. Limited studies have use activity based to determine safety risk hazard in building construction projects. This is the premise of the study.

RESEARCH METHODOLOGY

The study sought the opinion of construction professionals such as Project Managers, Quantity surveyors, Site Engineer, Health and safety manager, who managed and supervised construction projects in Abuja. A well-structured questionnaire was developed and distributed to respondents to assess their perceptions in determining the most hazardous building construction activities and to identify the most common safety hazards in construction projects. Non-probability convenience sampling technique was used in identifying the study respondents. Collins *et al.* (2007) described convenience sampling technique as a sampling method that involves choosing from a sample that is not only accessible but also the respondents are willing to participate in the study. The study was such that the respondents were asked questions based on the projects they were found handling during the self-administration of the questionnaires. This may explain why the responses obtained were limited to 34 and invariably 34 construction projects were examined. The unit of analysis was construction project handled by each respondent. The data collected were analysed using the mean score value method and percentile.

METHOD OF DATA COLLECTION

The questionnaire was designed to identify the potential hazards in building construction projects in Abuja, Nigeria. It was also designed to determine the most hazardous activities in building construction projects. The questionnaire comprised of two sections. The first section captured information about the respondent's background which includes: Gender, Academic qualification,

Professional qualification and year of experience. The second part of the questionnaire focused on 17 selected common work activities for building construction projects and 17 safety risk hazards in building construction projects. Respondents were asked to tick from their wealth of experience the riskiest safety hazards in building construction projects. The other aspect of the questionnaire was based on a Likert's scale of 5 ordinal measures from 1 to 5. For the identification of the riskiest hazardous activities in building construction projects; Where: 1-Not Very risky, 2- Not risky, 3-Low risk, 4-High Risk, 5-Very High risk.

METHOD OF DATA ANALYSIS

The data was analysed using descriptive statistics which involved the use of frequencies and Mean Scores (MS). The Mean Scores (MS) was use to rank the response items according to the central tendency of responses, as represented in equation (1)

$$MS = \frac{1n_1+2n_2+3n_3+4n_4+5n_5}{n_0+n_1+n_2+n_3+n_4+n_5} \quad \text{eq (1)}$$

RESULTS AND DISCUSSIONS

RESPONSE RATE TO QUESTIONNAIRE

In this study 50 questionnaires were administered and 34 were returned representing a response rate of 68%.

Analysis of Respondents' Profile

This section offers basic information regarding the background of the respondents. The profile of respondents is given in Table 1.

Table 1. Background information of respondents

Gender of Respondents	Frequency	Percent
Male	26	76.47
Female	8	23.53
Total	34	100
Age of Respondents		
20-29	2	5.88
30-39	5	14.71
40-49	11	32.35
Above 50	16	47.06
Total	34	100
Academic Qualification		
HND	6	17.65
Bachelor Degree	14	41.18
Post graduate	2	5.88
Master degree holders	11	32.35
PhD.	1	2.94
Total	34	100
Professional Qualification		
QS	10	29.41
Arch	8	23.53
Builder	6	17.65
Engineer	6	17.65
Others	4	11.77
Total	34	100
Year of experience of respondent		

5-10	10	29.41
11-14	8	23.53
15-20	4	11.77
21 years above	12	35.29
Total	34	100

Table 1 illustrates the gender of respondents, 26 of the population sampled were male representing 76.47% and 8 were female representing 23.53%. The age of the respondents, result indicates that the highest number of respondents 47.06% were those above 50yrs of age. About 32.35% respondents were 40yrs – 49yrs of age, while 14.71% respondents were within the age of 30yrs – 39yrs and 5.88% number of respondents were between 20-29yrs of age.

The academic qualification of respondents as shown in Table 1, the largest groups of respondents were 14 (41.18%) those who possessed Bachelor Degree. Next is Master degree holders with 11(13.6%), following are respondents with Higher National diploma 6(17.65%) next are Post graduate with 2(5.88%) and the last in the list is PhD with 1(2.94). This is an indication that the respondents were competent based on their various levels of qualification attained. The various Professional qualification of the respondents as shown in Table 2; 29.41% belonged to Quantity surveying profession. 23.53% were in Architecture, 17.65% were in Building and Civil Engineering profession. While 11.77% belonged to Other professions not listed.

Table 1 illustrates the years of experience of respondents which to a large extent shows the competency regarding construction tasks and responsibilities are shown in Table 1. The highest number of respondents were those with the working experience of 21yrs and above 35.29%. 29.41% of the respondents have 5yrs – 10yrs working experience, while 23.53% of respondents having above 11yrs – 14yrs working experience and 11.77% of respondents having above 15yrs – 20yrs working experience. The result can be concluded that their responses could be considered to be trustworthy.

Analysis of Hazardous Work Activities in Building Projects

This section presents the result of the top hazardous work activities in building construction projects sites in Abuja. This is illustrated in Table 2.

Table 2 Summary of the top five Hazardous Work Activities in Building Construction Projects.

S/N	Work items in building projects.	Mean	Rank
1	Structural steel	4.24	1
2	Roof work	4.21	2
3	Electrical works	3.93	3
4	Lift installation	3.83	4
5	Concrete work	3.52	5
6	Cladding work	3.52	5
7	Mechanical works	3.33	7
8	Rebar & other metal work	3.33	7

Table 2 shows the summary of the top five hazardous work activities in building construction projects: Construction structural steel, roof work, electrical works, lift installation and cladding work with mean score of 4.26, 4.21, 3.93, 3.83 and 3.75 respectively.

Identification of Critical Safety Risk Hazards in Building Construction

This section presents the result of the Critical Safety Risk Hazards in Building Construction projects sites in Abuja. The results are presented in Table 3.

Table 3 Identification of Critical Safety Hazards in Building Construction

S/N	Safety Hazards in Building Construction Projects	Mean Score	Rank
1	Struck by falling objects	4.26	1
2	Fall from height	4.21	2
3	Hazard due to machine & tools usage	3.93	3
4	Equipment accidents	3.83	4
5	Manual handling of machine/tool hazards	3.75	5
6	Contact with electricity	3.74	6
7	Fall to the same level / Slips' trips and falls	3.74	6
8	Fall to lower level	3.61	8
9	Caught in-between Objects or Materials	3.42	9
10	Cave- ins /trench collapses	2.78	10
11	Exposure to noise	2.76	11
12	Exposure to harmful substance	2.55	12
13	Collapse of underground cavities / pits	2.43	13
14	Building/structure collapse	2.41	14
15	Struck by moving vehicles	2.33	15
16	Contact with underground lines	1.42	16
17	Traffic accident	1.88	17

Table 3 revealed that the five most critical safety hazards in building construction projects were struck by falling objects; fall from height; hazard due to machine and tools usage; Equipment accidents and Manual handling of machine/tool hazards with mean score of 4.26, 4.21, 3.93, 3.83 and 3.75 respectively and the least was Traffic accident with MS of 1.88.

Safety Risk Analysis of most Hazardous Building Construction Activities

An activity-based analysis of the top five hazardous work activities in building construction projects was conducted for the 17 safety hazards identified from literature. (see Tables 4-8).

Table 4 Analysis of Safety Hazard in the Construction of Structural Steel

Activity	Safety hazard in construction	Percentile	Rank
STEEL STRUCTURAL	Struck by falling objects	100	1
	Hazard due to machine & tools usage	82.35	2
	Fall from height	76.47	3
	Equipment accidents	70.58	4
	Building/structure collapse	70.58	4

Table 4 revealed that the three most critical safety risk hazards in the construction of structural steel were struck by falling objects; fall from height and hazard due to machine and tools usage with 100%, 82.35% and 76.47% respectively.

Table 5 Analysis of safety hazard in roof work

Activity	Safety hazard in construction	Percentile (%)	Rank
ROOF	Fall from height	100	1

Struck by falling objects	88.2	2
Equipment accidents	82.35	3
Fall to the same level / Slips' trips and falls	76.47	4
Hazard due to machine & tools usage	70.58	5

Table 5 revealed that the three most critical safety hazards in the of construction of roof work are: Fall from height; Struck by falling objects; Equipment accidents with 100%, 88.2% and 82.35% respectively.

Table 6 Analysis of Safety Hazard in the Installation of Electrical Work

Activity	Safety hazard in construction	Percentile (%)	Rank
ELECTRICAL	Contact with electricity	100	1
	Equipment accidents	70.59	2
	Contact with underground lines	58.82	3
	Hazard due to machine & tools usage	58.82	3
	Manual handling of machine/tool hazards	47.06	5

The result from Table 6 reveals that the three most critical safety hazards in the installation of electrical work are Contact with electricity, Equipment accidents, Contact with underground lines and Hazard due to machine & tools usage with 100%, 70.59% and 58.82% respectively.

Table 7 Analysis of Safety Hazard in the Installation of Lift

Activity	Safety hazard in construction	Percentile (%)	Rank
LIFT INSTALLATION	Struck by falling objects	76.47	1
	Hazard due to machine & tools usage	70.58	2
	Equipment accidents	52.94	3
	Fall from height	47.06	4
	Fall to the same level / Slips' trips and falls	46.7	5

The result from Table 7 reveals that the three most critical safety hazards in lift installation are struck by falling objects; hazard due to machine and tools usage and Equipment accidents with 76.47%, 70.58% and 52.94% respectively.

Table 8 Analysis of Safety Hazard in Cladding Work

Activity	Safety hazard in construction	Percentile (%)	Rank
CLADDING	Fall from height	88.24	1
	Fall to the same level / Slips' trips and falls	70.59	2
	Hazard due to machine & tools usage	70.59	2
	Struck by falling objects	64.71	4
	Fall to lower level	52.94	5
	Manual handling of machine/tool hazards	52.94	5

The result from Table 8 reveals that the three most critical safety hazards in the installation of electrical work are Fall from height; Fall to the same level / Slips trips and falls and Hazard due to machine & tools usage with 88.24%, and 70.59% respectively.

DISCUSSION OF FINDINGS

Seventeen main work activities were sampled and the result of the study indicates that Construction of steel structure was the riskiest common work activities in building construction

projects, this is in line with Ghousi (2018) who revealed that the most critical hazard in building construction projects was structural steel work, this could be as a result of inexperience of workers in the activity being it is a specialist job. Roof work was ranked second with MS=4.21, this is in line with Kim *et al.* (2010); Choi (2015) & Okoye (2018) who revealed that roof work had the highest safety risk in comparison with other work activities. Third in position was Electrical works with MS= 3.93. Forth in position was Lift Installation with MS=3.63 while Landscaping work had the least risk with MS=1.83.

Fourteen safety risk hazards in building construction projects were sampled and the result revealed that the five most critical safety hazards in building construction projects were struck by falling objects with MS= 4.26, this is in line with Memarian and Mitropoulos (2013); Gurcanli *et al.* (2015); and Ghousi (2018). Fall from height was second with MS=4.21. This is in consonance with the findings of the Centers for Disease Control and Prevention (2018) who reported that fatal fall are the leading cause of deaths in construction is 2016. Hazard due to machine and tools usage with MS=3.93; Equipment accidents with MS=3.83 and Manual handling of machine/tool hazards with MS= 3.75. this is in line with Udo *et al.* (2016) & Okoye (2018).

CONCLUSION AND RECOMMENDATIONS

The study examined the potential hazards in building construction projects using activity based to determine the most common hazards in building construction projects in Abuja. The result of the study revealed that safety hazards inherent in building construction activities are many and varied, demonstrating that different trade are associated with different hazards implying that depending on the nature and type of activities involved in any trade, there are different dimensions and magnitude of hazard in building construction operations. It can therefore be concluded that the nature and type of activities determines the dimensions and magnitude of hazard in building construction operation.

Based on the findings of this study, it is recommended that all construction safety plan should have provision for adequate risk assessment strategy and periodical hazard identification investigation should be carried out on construction site and provision of health and safety measures be provided on sites. Continuous training and education on safety precaution and equipment and machinery usage, should be conducted for employers periodically to minimize construction accident.

Further research should be carried out to examine the health and safety risk level of the various building construction trades/activities in Nigeria to enable stakeholder discover which work activities have high severity and frequency. The study provides valuable information for site-based construction managers and safety professionals with evidence of hazardous activities associated with different building construction trade/activities and providing a starting point for targeting worker health and safety programs in mitigating the hazards associated with building construction projects.

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MITIGATING THE EFFECTS OF DELAY ON EDUCATIONAL INSTITUTIONAL BUILDING PROJECTS IN NIGER STATE

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ABSTRACT

Construction industry contributes immensely to the development of economy of any nation. However, the industry is suffering from delay phenomenon that affects its performance. Therefore, this paper aimed at establish the mitigating measures to reduces the effects of delay on educational institutional building projects in Niger State. In order to accomplish the set target one hundred numbers (100) copies of questionnaire was distributed to the professionals in the construction industry namely: Architect, Quantity Surveyor, Project Manager, Contractor and Civil Engineer. Thus only 96 were retrieved for computation of the result and discussion. Descriptive method of analysis was adopted for the data analysis through the use of mean, standard deviation and ranking system. The result obtained from the analysis shows the following as main effects of project delay on educational institutional building projects namely: (1) abandonment of building projects, (2) cost overrun in construction projects, (3) litigations in construction projects, (4) reduction in contract profits and (5) disputes between the key players. In addition, the result also shows the followings as mitigating measures to overcome the challenges of delay on educational institutional projects namely: (1) effective strategic planning, (2) proper project planning and schedule, (3) effective site management and supervision, (4) use of appropriate construction methods, (5) systematic control mechanism. The paper therefore suggests that the management of educational institutional building projects in Niger State should develop effective proactive management strategies and systematic control mechanisms to mitigate the effects of delay on construction projects. The stakeholders should use appropriate construction method through proper planning and scheduling to mitigate the effects of delay on construction projects

Keywords: Construction Industry, Construction Projects, Delay, Educational Institutions and Mitigating Strategies,

INTRODUCTION

Delay in construction affects the key players in the construction industry including the contractors, clients and consultants. The Nigerian construction industry has suffered many setbacks in terms of completing projects on time. Furthermore, most of the construction projects in Nigeria experienced delay, which lead to the abandonment of the project (Mohammed and Isah, 2012). In addition to other countries, Malaysian construction industry has been affected by project delays for many years (Akogbe *et al.*, 2013). It is significantly interesting to study the effects of delay in construction industry because research shows that seventy percent (70%) of projects in Nigeria suffered delay in their execution (Ameh and Ogundare, 2013). These increases in project delays in the construction industry is hurting the economy because it results in wastage of resources, enhance cost of project delivery and frustration among the key players (Mohammed and Isah, 2012). Yet construction industry is one of the principal sectors that can revitalize economic growth in Nigeria (Mohammed and Isah, 2012). Investment in construction projects and related infrastructure and service has multiple direct and indirect effects on economy of the nation. Unfortunately, delay in educational institutional projects in Niger State especially buildings, will continue to plague the construction industry in the foreseeable future, unless mitigation measures are taken by the industry. Although much has been done in identifying the factors that influence projects delay in construction projects in Nigeria and yet the industry still experiences delay (Marzouk *et al.*, 2014). This is attributed to the fact that there is still lack of knowledge for the

effective mitigation measures to address the effect of projects delay. This research therefore seeks to fill the gap that exists by contribute to the attempts of previous researches in identifying further the effects of projects delay on educational institutional building projects in Niger State with a view of establishing mitigation measures to address the effects of delay on project delivery.

LITERATURE REVIEW

Delay is a term that being referred to as time and cost overrun in construction projects (Memon *et al.*, 2011). Hamzah *et al.* (2012) added that delay is time overrun or extension of time for accomplishment of a project. Construction delay is the action or situation that fallouts in finishing the project later than agreed in the contract. A delay can also affect to starting or finishing a specific activity later than planned (Mubarak, 2010). However, the definitions above captured time and cost but has to be related to the one agreed in the contract or in the inception stage. Menesi (2007) described project delay as the accumulated effect of the delays in the individual activities. Definition of project delay given here lacks some terms. Budgeted cost and contract initial period are the most important terms that supposed to be mentioned, because the factors of delay affect cost and time first before anything else in the construction industry. Amongst the key players of the industry, contractor normally became the prime victim of delay factors for the fact that contractor is responsible for all the acts and omissions of the contractor's employees, subcontractors, their agents and employees, and any other person performing work under a contract with the contractor (Ayudhya, 2011). Upon all the research conducted, different perceptions on definitions were given to projects delay. Therefore, this paper deduced from the previous researches and described delay as unconditional stoppage of construction activities for certain reasons beyond the control of the contractors.

The Concept of Delay in Project

Many studies have attempted to identify the causes that put construction projects behind planned schedule. For example, Odeh and Batttaineh (2002) investigated delay causes in building projects in the United States United Kingdom, Indonesia and Jordan and identified the followings as main causes of delay namely: design changes, poor labour productivity, and inadequate planning. Furthermore, previous studies showed that delays can be caused by owners, planners/ designers, contractors, or acts of God. However, most studies focused mainly on identifying causes of delay in the construction phase, rarely emphasizing on the planning and design phases. Sunjka and Jacob (2013) evaluated delay causes in architectural construction projects, concluded that many delays manifest during all project phases and primarily occur during the construction phase; however, delays that start in the design phases include inadequate schedule control by technologies in to a design, and ineffective coordination and/or inclusion of projects user groups. Odeh and Batttaineh (2002) identified factors at the start of project that almost certainly lead to project delay and provided insight into the reasons for the delays in Thailand. They found that the problems faced by the construction industry in developing economic like Thailand could be:

- a) Shortage of inadequacies in industry infrastructure (mainly supply of resources);
- b) Caused by client and consultant and
- c) Caused by contractor's incompetence/inadequacies. They recommended that there should be concerted effort by economy managers and construction industry association to provide the necessary infrastructure for efficient project management.

Chan and Kumaraswamy (2008) conducted a survey to determine and evaluate the relative importance of the significant factors causes delay in Hong Kong construction projects. They analysed and raked main reasons for causes of delay and classified them in to two groups:

- a. The role of the parties in the local construction industry (i.e whether client, consultants or contractors) and
- b. The type of projects.

Results indicated the five major causes of delay are namely; poor site management and supervision, unforeseen ground condition, low speed as decision making involving all project teams, client-initiated variations and necessary variation of works (Chan and Kumaraswamy, 2008). Edwin and Wooyong (2019) have addressed the causes of delay in building projects in Nigeria. They classified the causes of delay as project participants and extraneous factors. Client-related delay included variation in orders, slow decision-making and cash flow problems. Contractor-related delay identified were: financial difficulties, material management problems and shortage of manpower. Extraneous causes of delay identified were: inclement weather, acts of nature, labour disputes and strikes. Al-Momani (2000) carried out a quantitative analysis on construction delays in Jordan and highlights the followings as main causes of delay in construction of public projects were related to designers, user changes, weather, site condition, late deliveries, economic conditions and increase in quantity. Similarly, Odeh and Battaineh (1997) also conducted a survey aimed at identifying the most important causes of delays in construction projects with traditions type of contracts from the important causes of delays in construction contractors and consultants. Result of the survey indicated that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payment, labour productivity, slow decision making, improper planning, and subcontractor were among the top ten most important factors (Odeh and Battaineh, 2002).

Types of Delays

There are several types of construction delay due to their causes. They may be caused by the contractor, client, consultants and natural source. Aibinu and Jagboro (2002) discussed that delays are classified into excusable and non-excusable delays. Excusable delay is sub divided into excusable with compensation and excusable without compensation based on their happenings. But according to Yates and Epstein (2006), delay can be categorized into four (4) main groups as non-compensable excusable, compensable excusable, non-excusable and concurrent delay. However, in the past three decades back, delay was categorized into three (3) groups according to liability; compensable, excusable and non-excusable delays (Le-Hoai *et al.*, 2008 and Hamzah *et al.*, 2012). These three (3) groups of delay were confirmed by (Dayi, 2010). Therefore, this research focuses on the four (4) categorisations of delay namely; excusable compensable, excusable non-compensable, non-excusable and concurrent delay (Yates and Epstein, 2006).

Excusable Delay

Excusable delay is the type of delay that the contractor will not be penalised due to their occurrences. It can be divided into compensable and non-compensable (Tawil *et al.*, 2012). Therefore, excusable delay simply mean that they are the type of delay, which are beyond the control of the contractors or subcontractors. If it happens, the damages it caused should be on the client or none of them responsible for the cause, and in this situation a considerable time be given to the contractor to complete the project. This situation is known as “time at large” (Hackett *et al.*, 2007).

Excusable Delays with Compensation

Compensable excusable delay is the type of delay that caused by client (Yates and Epstein, 2006). It results in time extension and compensation to the contractor. These delays result from various circumstances as stated by (Yates and Epstein, 2006). The first is the inability of the client to provide work site in time, which causes project delay. Changes which were initiated by the client and client's delay in delivering order to continue work also subject the project to run in to delay. Defective designs, poor coordination of other contractor's work by the client and client's inability to supply equipment in time were also types of circumstances that cause excusable delay with compensation. Misleading of contractor due to the information of the client, interference of client with the performance of the contractor, delay in the approval of shop drawings are among the situations that lead to excusable delay with compensation. Others are changes in the contract requirements and the encountering of different site condition by the contractor (Yates and Epstein, 2006). Excusable delay with compensation at times lead to schedule extension and results to the client financial damages to the contractor (Aibinu and Jagboro, 2002). Therefore, this type of delay will affect the client funding budget because the contractor can claim for damages for all the causes emerged from the side of the client or his representatives.

Excusable Delay without Compensation

Excusable delay without compensation is the type of delay that are not caused by the client or the contractor. They are "Acts of God" or other unforeseeable causes beyond the control of both parties (Hackett *et al.*, 2007; Yates & Epstein, 2006). Contracts usually contain a clause called the force majeure clause, which enumerates the various causes of delay for which neither party is legitimately responsible.

Non-excusable Delay

Non-excusable delay can be attributed to the actions, or inactions, of the contractor. When a contractor causes delays to the completion of a project, such delays preclude the contractor from obtaining a time extension and may also trigger delay damages against the contractor. Some of more common contractor caused delay as mentioned by Muhammad, (2010) include failure of contractor to mobilize the site and start the work in a timely manner. It includes also delay in the submission of shop drawings to the client for approval, inadequate construction equipment and defective works. Others examples include deviating from the contract specification, labour, material, and other resources management deficiencies during construction, deficiency of coordination of tradesmen and subcontractors and failure to execute various portions of the work in a timely manner. More so, client can claim damages if it had been captured in the contract agreement (Muhammad, 2010). Therefore, contractor is liable to pay damages to the client in this type of delay. It is important to note here that contractor is to look at all the possibilities of avoiding the delay for him to attain a meaningful margin at the end of the project execution.

Concurrent Delay

On a typical construction project, delay do not constantly fall into one of the three previous categories discussed but quite often there are multiple factors that cause or contribute to delay (Yates and Epstein, 2006). Therefore, Ibbs *et al.* (2011) defined concurrent delays as ordinarily labelled as two or more delay that happen at the same time, either of which would cause a project delay.

Effects of Projects Delay in Construction Performance

Based on the research conducted by Gündüz *et al.* (2013), time frame extension, increase in cost due the extension of time, government periodic budget and plan execution, and cost overrun are the effects of delay on construction projects. Gündüz *et al.* (2013) further added reputation is always at stake in delay cases and the government risks losing public confidence, also the depressing condition is subject to litigation and arbitration. Gündüz *et al.* (2013) stated in their research that delay has serious effect on construction organisations, which results to increase in cost of the project, loss of opportunity cost, damage in reputation, arbitration, litigation and even to the worse situation of abandonment of the project. However, scholars concerned on the effects of delay on construction organisation in general, but there is need to look at the effects on the reputation of the organisations since reputation is an intangible asset and it affects future business.

Delay in completion of projects includes an increased overheads and loss of opportunity of taking on other profit-earning projects with the resources tied down on the delayed project (Ndekugri *et al.*, 2008). This indicate that delay has effect on the construction projects. The effects of this delay affect the contractors, clients and consultants in the projects. However, the paper confirmed various effects of delay in construction projects. Cost and time overrun, disputes, arbitration, litigation and total abandonment were the effects of projects delay on construction projects (Motaleb & Kishk, 2010; Abedi *et al.*, 2011; Gündüz *et al.*, 2013). In addition, Mehdi Riazi *et al.* (2011) mentioned that, loss of opportunity cost and reputation damage was the effects of delay in construction projects delivery. Ashnaari *et al.* (2010) conducted a research and confirmed that increased disputes and costs, loss of outputs, create social problems, affects social and economic conditions in the project is being built were effects of projects delay. Although Alnuaimi *et al.* (2010) stated mentioned effects of projects delay as time overrun, claims and disputes, cost overruns, affect the performance and moral of labour and additional costs due to variations.

According to Akinsiku and Akinsulire (2012), effects of delay are always unbearable on construction projects. The effects are cost and time overruns, interest accumulation on capital to finance, wastage and under-utilisation of man power resources and claims (Akinsiku and Akinsulire, 2012). Abedi *et al.* (2011) stated that under-utilisation of equipment, loss of confidence on the contract (therefore jeopardizing the reputation of contractor in the case of future tendering chances) and late returns of income are effects of delay. Among the effects also include reduction of employment opportunities, dispute between parties involved, aids the decrease in the tempo of economic activities in the nation, additional insurance charges, extra taxes and dues due to delay (Asadi *et al.*, 2018).

Mitigating Measures to Reducing Projects Delay

Proactive to mitigate risks help achieve a project's objectives (Zhang and Fan, 2014). Previous studies have suggested various measures to mitigate delay adverse on project performance. Wang *et al.* (2004) suggested optimal mitigation measures that respond to various risk events and developed a risk management framework that suggests a proper mitigation measures in accordance with country, market, and project risks, respectively. Kim *et al.* (2018) also developed a risk assessment and mitigation model to support decision-making for investment in a steel-plant project. They selected six representative risk factors related to the target project and measured various mitigation strategies. Asadi *et al.* (2018) insisted that project risk management is a critical method to improve the cost, schedule and quality management. They introduced the risk

management guideline and suggested the risk management tool using fuzzy model. The strategies that mitigate project delay include three main critical factors: project mission; top management's support, and project scheduling, all of which project performance during phases of implementation. Tripathi and Jha (2018) derived the six organisational success factors for project performance. Among the experience and performance, top management competence, project factor, supply chain and leadership, availability of resources and active cost control measures, they ranked the top management competency highest. Guo *et al.* (2018) validated the project performance between non-supervised project and supervised project by engineer using evolutionary game theory. They recommended that the compulsory supervision is way to control project performance. Su *et al.* (2018) emphasized on the accurate the time estimation skill for delay management. In particular, they suggested the solution of float ownership to prevent the delay and conflict between owner and contractor.

Critical factors are key issues or areas of activities in which favourable results are necessary for a project manager to achieve his/her target (Rockart, 1982). Project mission and schedule, top management's support, client consultations and acceptance, technical tasks, monitoring as well as feedback, communication, and troubleshooting are some the factors that influence project success (Edwin and Wooyong, 2019). Nguyen (2019) recommended five possible factors that may be used to minimise project delay, these includes experienced project manager, satisfactory funds throughout project life cycle, experienced project team, project stakeholder's commitment, and resources availability. Moreover, Nguyen (2019) emphasized the relationship between client satisfaction and the team behaviour-related strategies such as project planning and organising, coordination, contractor assurance and empowerment. Aibinu and Jagboro (2002) suggested that the speeding up of site activities, and incidental stipend could be applied to reduce project delay. Odeh and Battaineh (2002) proposed the following approaches creating and classifying human resources through appropriate training; consideration of capability and experience of contractor more than price during contract award, and adoption of design-build and construction management contracts. Li *et al.* (2019) reviewed the publications from 2005 to 2018 on dealing with critical success factors for project performance. Thereby suggested the most frequently cited success factors such as communication and cooperation, project planning and controlling, owner's involvement and commitment and clear goals and objectives in order. Edwin and Wooyong (2019) added the following: project's adequate financing and arrangement, previous work experience on similar projects, donors' influence, close project supervision, suitable time estimation skills, availability and quality of the workforce, and availability of materials and equipment as major mitigating strategies to overcome the effects of projects delay. Furthermore, timely payments of completion certificates, good presentation of information during tendering, finishing the design on time, workers' motivation and morale, capacity building training, good logistic management (Transportation), top management's support, and site location were identified as strategies to mitigate project delay (Edwin and Wooyong, 2019).

RESEARCH METHODOLOGY

This study adopted quantitative research approach via survey questionnaire to sample individuals from a population with a view towards making statistical inference about the population using the sample (Creswell, 2011). And also, to pull out public opinion, such as beliefs, perception, ideas, views and thought about the effects of delay on educational institutional projects in Niger State. In order to obtain the require population for this study, the stratified sampling technique was

adopted for the selection of the construction firms that participated in this study. This selection was in line with concept of Creswell and Tashakkori (2007) that respondents are arranged in strata for the conveniences in questionnaire distribution and assessment. In addition, the simple random sampling was adopted in each of the construction organisations for the selection of construction professionals from the strata.

The questionnaire that was used to record the responses of each respondent contained mainly closed ended questions using a five- point Likert scale ranged from very high; high, slightly high, low and none. The scores of the respondents were computed based on the variables used in the questionnaire. As earlier explained that simple random sampling techniques was adopted in each of the construction firms for the selection of construction professionals. 100 numbers of professionals were selected from the followings: (1) Niger State Ministry of Work and Housing, (2) Niger State Housing cooperation, (3) Niger State Urban Development, (4) Work and services Department of Niger State owned educational institutions, (5) Consultants and (6) Contractors. These professionals are: Quantity Surveyors twenty numbers (20), Architects twenty numbers (20), Civil Engineers twenty numbers (20), Contractors ten numbers (10), Consultants ten numbers (10) and Project managers twenty numbers (20). However, only ninety-six (96) numbers of those selected professionals were able to returned their questionnaires, while four (4) of the one hundred numbers (100) of questionnaires were ignored for incorrect entry.

In this paper, descriptive statistic was used to present means score, standard deviation and frequency counts. The mean score was used to rank the respondents' opinions or responses obtained.

FINDINGS AND DISCUSSION OF RESULTS

The results of the demographic profile of the respondents that participated in this research work were presented in section 4.1 to 4.4 respectively.

Nature of Organisation

Figure 1 shows that 28% of respondents works with construction firms 19% were with consulting firms while 37% and 16% were from client and project financier organisations.

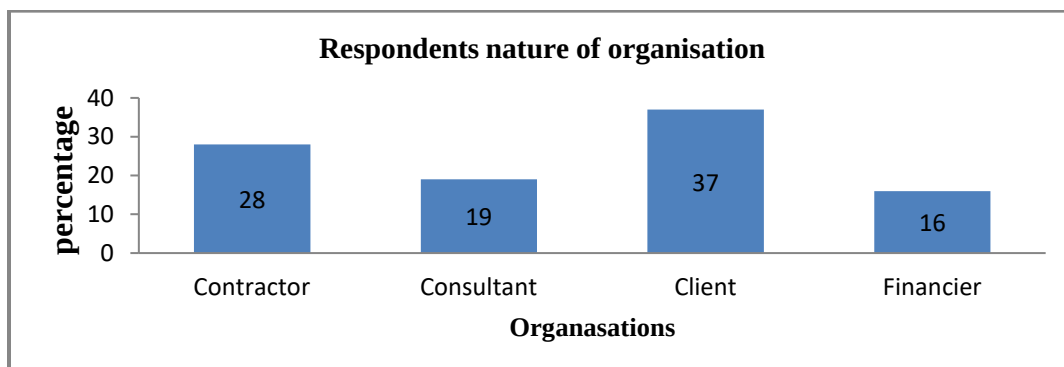


Fig. 1 Nature of organisation (Field Work, 2019)

Respondents Position in the Organisation

Figure 2 indicates that 11% numbers of respondents sampled for the study were Architects in their respective organisations, 26% were Quantity Surveyors, while 18% 24% and 21% held positions of Project Managers, Contractor and Civil Engineers respectively. Inferences drawn from this was that the respondents sampled are knowledgeable enough to comprehend the contents of the questionnaires, thus providing suitable responses.

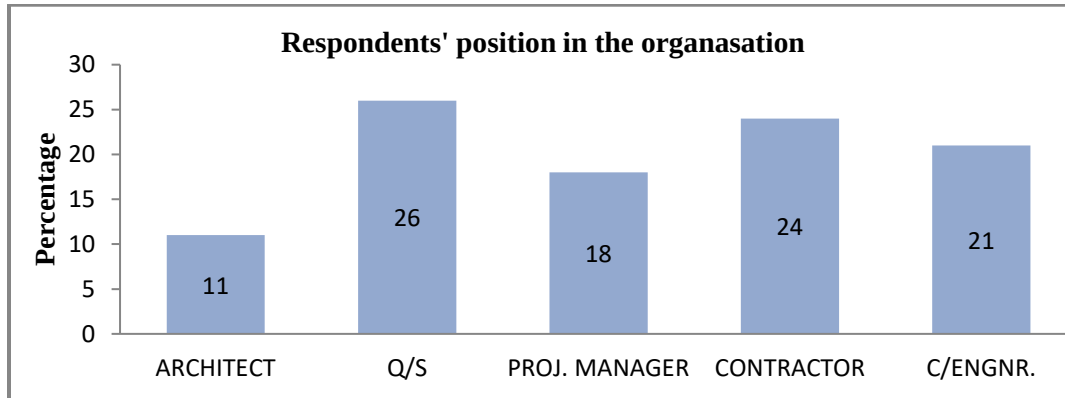


Fig. 2 Respondents position in organisation (Field Work, 2019)

The Professional Bodies of Respondents

Figure 3 indicates that 19% of respondents had professional membership of Nigerian Institute of Builders (NIOB), 28% were holders of Nigerian Institution of Quantity Surveyors (NIQS), while members with NIA, NSE and NITP were 22%, 17% and 14% respectively. Inferences drawn from this was that the respondents sampled are certified professional with adequate knowledge related to the aim of this study to comprehend the contents of the questionnaires, thus providing suitable responses.

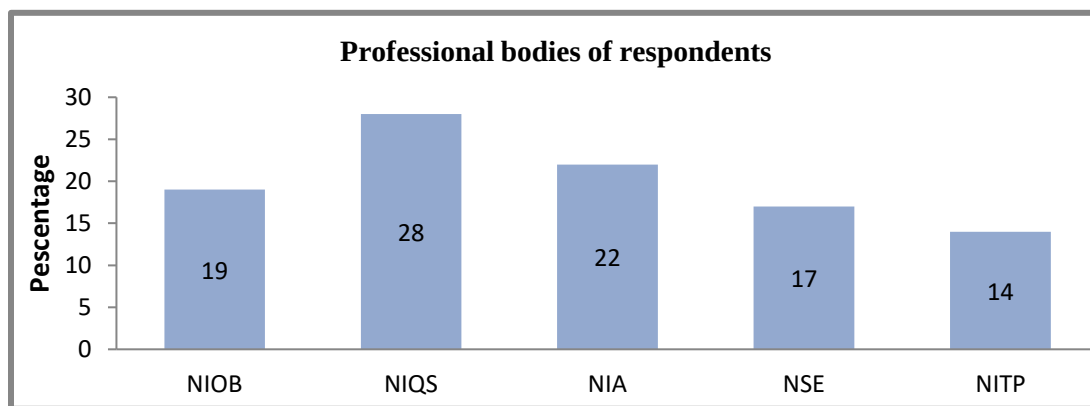


Fig. 3 Respondents professional body (Field Work, 2019)

Years of Experience of Respondents in Construction

Figure 4 shows that 10% of respondent's sample had years of working experience of less than 5 years in the building industry, 19% had between 5- 15 years of working experience, while 30% had spent 11 -15 and 41% had 15 years of working experiences in the building industry. This above

indication that the respondents had spent reasonable time within the industry to have familiarises with issues related to delay in building projects.

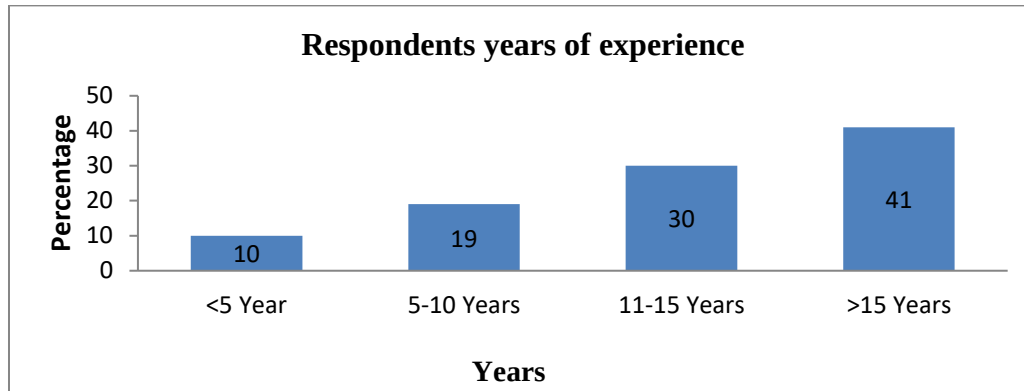


Fig. 4 Years of experience of respondents in construction (Field Work, 2019)

Result and Discussion of the Effects of Projects Delay in Educational institutions.

The results obtained on the analysis of the effects of projects delay in educational institutions are presented in Table 1.

Table 1 Effects of projects delay in educational institutions

Effects of Construction Delayed	Mean scores	S. dev	Rank	Remarks
Abandonment of building projects	4.87	1.05	1	Very High
Cost overrun in construction projects	4.72	1.11	2	
Litigation in construction projects	4.69	1.12	3	
Reduction in contract profits	4.54	1.01	4	
Dispute between contractor and client	4.52	1.14	5	
Arbitration in construction projects	4.51	0.98	6	
loss of confidence on the contract by the community	4.51	1.23	7	
Low performance of contractor	4.48	1.03	8	High
Late payment to sub- contractors	4.43	1.24	9	
Rescheduling of works in projects	4.10	1.06	10	
Loss of productivity in construction projects	3.87	1.21	11	
Inadequate planning	3.64	1.15	12	Moderate
Variation of project scope	3.52	1.00	13	
Incompetent project manager	3.48	0.95	14	
Delay in progress payment by client	3.23	1.08	15	
Reduction of employment opportunities	3.09	1.11	16	
Faulty design	2.98	1.20	17	
Wrong estimate	2.87	1.11	18	
Unrealistic contract duration by the clients	2.69	1.26	19	
Shortage of materials	2.54	1.15	20	
Blacklist by authorities	2.52	1.01	21	

Difficulties in attracting foreign loan	2.50	1.27	22	Low
Variation of project scope	2.43	.92	23	
Inadequate cost control	2.38	1.08	24	
Lack of efficiency by the contractors	2.21	1.10	25	
Termination of contracts	1.97	.74	26	
Quality of work	1.76	.97	27	
Reduction of contractor's confidence on economic activities	1.61	1.16	28	
Wastage and under-utilization	1.55	1.20	29	

Source: Researchers' data (2019)

The results obtained in Table 1 shows the following as main effects of delay on educational institutional projects. These are abandonment of building projects, cost overrun of construction projects, litigations in construction projects, reduction in contract profits, disputes among the key players, arbitration in construction projects and loss of confidence on the contract by the community. These were ranked 1st, 2nd, 3rd, 4th, 5th, and 6th, with the followings mean scores 4.87, 4.72, 4.69, 4.54, 4.52 & 4.51 respectively. However, the finding from the study were in agreement with Aibinu and Jagboro (2002) and Tumi *et al.* (2013) that delay affect the client funding budget because the contractor can claim for damages for all the causes emerged from the side of the client or his representatives. In addition, Ibbs and Nguyen (2011) conducted a similar study and established the followings as effects of delay on construction projects: in adequate planning, loss of confidence on the contract by the community, abandonment of projects, low performance of contractor and time and cost overrun. Conversely, Zakaria *et al.* (2012) argued that the main impact of delay on construction projects are time and cost overrun disputes among the key players, wastage of resources and low-quality output.

In addition, the following were considered with as low effects on educational institutional projects. These are variations of project scope, inadequate cost control, lack of efficiency by the contractors, termination of contract, reduction of contractor's, quality of work, confidence on economic activities, wastages and underutilization. These were ranked low with followings mean scores 2.43, 2.38, 2.21, 1.97, 1.76, 1.61 and 1.55 respectively.

Results and Discussion on the Mitigating Strategies to Overcome the Challenges of Delay Factors

The results obtained on the analysis of mitigating strategies to overcome the challenges of delay factors are presented in Table 2.

Table 2 Mitigating Strategies to Reduce Delay Factors

Mitigating Strategies	Mean scores	S. dev	Rank
Use of appropriate construction methods	4.42	.918	1
Systematic control mechanism	4.33	.937	2
Proper emphasis on past experience	3.93	1.11	3
Developing human resources in the construction industry	3.80	1.20	4
Comprehensive contract administration	3.77	1.11	5
Use up to date technology utilization	3.74	1.26	6
Clear information and communication channels	3.67	1.15	7
Effective strategic planning	3.64	1.01	8

Proper project planning and schedule	3.64	1.27	9
Effective site management and supervision	3.62	.92	10
Perform a preconstruction planning of project tasks and resources need	3.58	.996	11
Frequent coordination between the parties	3.55	.798	12
Improving contract award procedure by giving less weight to prices and more weight to the capacities and past performance of contractors	3.53	.771	13
Frequent progress meeting	3.51	.921	14

Source: Researchers' data (2019)

Table 2 established the factors employed to mitigate the occurrence of delayed of construction project. It was revealed that the factors identified in the study were very effective in tackling delays of project delivery in tertiary institutions in Niger State, use of appropriate construction methods (4.42), systematic control mechanism (4.43), proper emphasis on past experience (3.93), developing human resources in this construction industry (3.80), comprehensive contract administration (3.77), use up to date technology (3.74), effective strategic planning (3.64), frequent coordination between the parties (3.58).were ranked 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th respectively. Edwin and Wooyong, (2019) conducted a similar study on causes and mitigating strategies of delay in power construction projects and established the followings as mitigating strategies to reduce the effects of delay on construction projects. These are comprehensive contract administration, effective strategic planning, frequent coordination between the client and contractors and systematic control mechanism. In addition, the factors with least mean scores are; Improving contract award procedure by giving less weight to prices and more weight to the capacities and past performance of contractors and frequent progress meeting were ranked 13th and 14th respectively.

CONCLUSION

The increase in delay on educational institutional projects is hurting the economy of the State due to wastage of resources and frustration among the key stakeholders in the construction firms. This paper addresses the above challenges by the evaluating the perception of key stakeholders in relation to delay on educational institutional projects in Niger State with a view of mitigating the effects of delay for effective project delivery. Therefore, the paper establishes the followings as main effects of delay on educational institutional projects in Niger State namely: (1) abandonment of building projects, (2) cost overrun in construction projects, (3) litigations in construction projects, (4) reduction in contract profits, (5) disputes between the key players and (6) arbitration in construction projects. In addition, the followings were established as mitigating measures to overcome the effects of delay on educational institutional projects in Niger State namely: (1) effective strategic planning, (2) proper project planning and schedule, (3) effective site management and supervision, (4) use of appropriate construction methods, (5) systematic control mechanism, (6) proper emphasis on past experience.

The paper therefore, concludes that delay have negative effects on the key stakeholders and investment in construction projects and related infrastructure and service that has multiple direct and indirect impact on economy of the State. Consequently, the paper recommended the following based on the findings: (1) the management of construction projects of educational institutions should use appropriate construction methods and systematic control mechanism to during the course of building projects. (2) there is need for development of human resource management and proper emphasis on past experiences in order to improve delivery. (3) there is need for

comprehensive contract administration through the use of up to date technology. (4) the top management of construction industry need to adopt effective strategic management approach, through proper planning and scheduling.

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CRITICAL SUCCESS FACTORS FOR THE ADOPTION OF LEAN PRINCIPLES IN CONSTRUCTION FIRMS IN ABUJA

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ABSTRACT

Lean construction reduces waste and improves value in the construction process that leads to enhancements in the performance of construction projects in the construction industry. Despite the potential benefit of lean construction, its adoption is very challenging. Therefore, this paper aimed at establish the critical success factors for the adoption of lean construction principles in construction firms in Nigeria. A total of 120 numbers of questionnaires was distributed to Civil Engineers, Quantity Surveyors, Builders and Architects in the construction firms in Abuja. The descriptive method of analysis was used to analyse the data obtained from the survey. The result shows that the level of awareness of the lean construction principles are still at the lowest level in the construction firms. In addition, the followings are established as critical success factors for the adoption of the lean construction principles in Nigerian construction firms. These are: (1) team work (2) quality of leadership (3) continuous improvement (4) commitment of top management (5) the presence of scheduling & planning (6) adequate knowledge of begin the projects (7) workers within the company with multiple tasks and experiences (8) desire to lean the company and their crews. The paper concludes that there is low level of the awareness of the lean principles in constructions firms, and this will have significant impact on the lean principle's adoption in construction firms in Abuja. The paper therefore suggest that the top management of the Nigerian construction firms should be committed towards quality leadership by ensure teamwork and continuous improvement in the project's delivery. There should be adequate knowledge of the projects by the professionals and proper planning and scheduling before the commencement of the construction works.

Keywords: *Construction Firms, Critical Success Factors, Lean Construction, Lean Principles and Project Performance*

INTRODUCTION

Nigerian construction industry produces nearly 70% of the nation's fixed capital formation yet its performance within the economy has been and continues to be very poor (Isa *et al.*, 2013). This can be attributed to the movement of employees away from long term employment relationships and long-term rewards and the efforts are focused on short-term rewards (Osuji, 2014 and Idrus & Sodangi, 2007). The Nigerian economy continues to grapple with a number of challenges that has hampered efforts at economic transformation. The economy is yet to achieve the necessary structural changes required to start rapid and sustainable growth and development due to some challenges facing the nation (Isa *et al.*, 2013 and Azevedo *et al.*, 2010). However, construction industry in both developed and developing nations are generally characterized by low productivity, cost overruns, errors, poor reputation, shortage of skilled labour and poor safety (Hosseini *et al.*, 2012; Radhika & Sukumar, 2017). The Nigerian construction Industry is not different from its counterpart around the globe in term of waste generation. Thus, it is the duty of the professionals to gear up and put into action, new ways of avoiding this common problem. Moreover, the lean construction principles have been established as means of minimizing the waste in the process, duration, cost and labour of construction projects (Aigbavboa *et al.*, 2016; Kasimu *et al.*, 2019). Due to its great potential in meeting the customer's objectives in terms of increasing added value and productivity, lean construction (LC) is seen as an alternative approach that might be

implemented by the construction industry (Ahmed & Forbes, 2011 and Marhani *et al.*, 2013). Despite the potential benefits of lean construction principles, the stakeholders in Nigeria construction firms are still left behind in the adoption of lean construction principles to improve on the performance of building projects. Therefore, Nigerian construction firms should focus attention on the adoption of lean construction principles in order to reduce or eliminate wastage, since it's have been characterized with poor quality performance. Although, the concept of lean construction is still considered as a new paradigm among Nigeria Construction practitioners (Mohammed *et al.*, 2019). Consequently, there are certain challenges that impeded the lean construction principles adoption in Nigeria construction firms. In spite of the commitment of top management and stakeholder's readiness for the adoption of lean construction to improve projects performance (Mohammed *et al.*, 2019). Therefore, the aim of this paper is to establish the critical success factors for the adoption of the lean construction principles in Nigeria construction firms in Abuja with a view of improving the projects delivery towards satisfaction of client's needs.

LITERATURE REVIEW

Over the past decades, the construction firms within Nigeria has been characterised by poor quality work, cost and time overruns (Oyewobi *et al.*, 2011), resulting from poor project definition during planning (Olusegun & Michael, 2011; Oke & Ogunsemi, 2011), incomplete designs during the design stages (Aina & Wahab, 2011, Windapo & Martins, 2010), unethical behaviours in the form of fraudulent practices and kickbacks (Mansfield *et al.*, 1994, Olomolaiye *et al.* 1987), waste generation due to bureaucracy, variations, delay from suppliers and poor site management (Oke & Ogunsemi, 2011; Dlakwa & Culpin, 1990).

Although these problems are peculiar to Nigeria and some other developing countries suffer from similar low productivity in terms of costs, delivery time and quality of construction projects. However, Ballard & Howell (2003) acknowledged that lean construction has made an immense contribution within the construction industries of developed and emerging economies like UK, US, Australia, Brazil, Finland, Singapore, Peru, Chile, and Denmark. Furthermore, some other developing countries like Singapore, Ecuador, Indonesia and Columbia has also recorded improvements after implementation (*ibid*).

It was observed that lean construction in recent times has attracted a lot of attention in the construction industry as it tends to increase construction's process reliability, reduce total lead times and improve the quality of projects produced (Sacks & Goldin 2007). Although, the previous researchers (AlSehaimi *et al.*, 2009; Alarcon *et al.*, 2005; Salem *et al.*, 2005; Ballard *et al.*, 2009; Gonzalez *et al.*, 2008; Loong *et al.*, 2010; Yu *et al.*, 2009) have investigated the implementation of lean principles within developed and emerging countries. The results have been positive and it was observed to improve the performance of projects where they were applied.

Lean Construction Tools and Techniques

Lean production has several tools and techniques that have evolved since the beginning of it is application in the construction industry (Abdelrazig, 2015 and Abubakar *et al.*, 2010). These tools and techniques continue to develop as more understanding and experience develops. Lean construction has been identified as trying to develop a list of the most prominent and exhaustive tools and techniques that are being implemented in today's construction industry and that might also impact performance practices. Some of the tools related to the topic of study are: [Constraint analysis, look-ahead planning, the Percent Plan Complete (PPC) measurement, concurrent

engineering, just-in-time, resources managing, immediate problem detection, standardization, detection of incompatibility and discrepancy, process evaluation, team integration, use of visual indicators and continuous improvement]. The implementation of such lean tools and techniques had significantly reduced waste and improved performance in construction projects (Abdelrazig, 2015; Aziz & Hafez, 2013).

Critical Success Factors (CSF) for the adoption of Lean Construction principles

According to Salem *et al.* (2006) CSFs enables the adoption of lean construction principles that can help the building industry to improve its productivity by ensuring effective communication and collaboration between all project stakeholders from inception to completion of building projects. Several lean constructions related studies have been reported, especially those that have to do with its success stories and inherent benefits. There are numerous case studies from the previous studies (Garnett *et al.*, 1999; Dulaimi & Tanamas, 2001; ENR, 200; Mossman, 2009) that provide evidences to support the fact that the use of lean construction makes the building process more efficient and effective. However, drivers/facilitators identified in several studies and a thorough review of research by Alarcon *et al.* (2002); Castka *et al.*, (2004); Olatunji (2008); Alinaitwe (2009); Abdullah *et al.* (2009) & Mossman (2009) established that top management support and commitment, education and skills development, client interest in the use of lean construction in their project, commitment and cooperation of professional bodies, attitudinal change, government policy and availability of trained professionals are among the CSF that can facilitate the adoption of lean construction principles across organizations. Song & Liang (2011) conducted a similar study and highlighted the followings as main CSFs for the lean construction principle implementation namely: teamwork, involvement of company employees in business activities, continuous improvement, decentralization and motivation, quality leadership and top management commitment and supports. Sarhan *et al.* (2016) highlights the followings as a critical success factors namely: decentralization and motivation, desire to lean the company and their crews, good network of contracts in the company, multiplicity of tools used in project application and commitment of top management. In addition, the followings are critical success factors for the implementation of the lean construction principles: decentralization and motivation, adequate knowledge to begin the project, teamwork, management commitment and good network of contracts in the company (Aigbavboa *et al.*, 2016; Hosseini *et al.*, 2012). Dulaimi & Tanamas (2001) expressed that adoption of lean construction enable to eliminates non-value steps such as waste and better meet client demands and dramatically improves the Architectural/ Engineering/ Construction (AEC) process and products with significant benefits.

RESEARCH METHODOLOGY

The quantitative research approach was adopted through the use of survey questionnaire. The survey questionnaire was adopted to sample construction professionals from a population with a view towards making statistical inference about the population using the sample (Creswell, 2003). Also, the study pulls out professionals' opinion, such as beliefs, perception, ideas, views and thought about CSF for the adoption of lean construction principles in construction firms using the questionnaire. In order to obtain the require population for this study, the stratified sampling technique was adopted for the selection of the construction firms that participated in this study. The construction firms were categorised into three group i.e large, medium and small firms. The selection was based on their annual turnover, capacity, frequency of involvement in the construction firms and experiences. This selection was in line with concept of Creswell and

Tashakkori (2007) that respondents are arranged in strata for the conveniences in questionnaire distribution and assessment. Since the units of the measurement is professionals in the construction firms, therefore, simple random sampling was adopted in each of the construction firms for the selection of construction professionals from the strata.

The questionnaire that was used to record the responses of each respondent contained mainly closed ended questions using a five- point Likert scale ranged from None, Low, Moderate, high and very high. The scores of the respondents were computed based on the variables used in the questionnaire. As earlier explained that simple random sampling techniques was adopted in each of the construction firms for the selection of construction professionals. 120 numbers of professionals in the Construction Industry were selected. These professionals are: Quantity Surveyors fourth numbers (40), Architects thirty numbers (30), Builders thirty numbers (30) and Civil Engineers twenty numbers (20). However, only ninety- five (95) numbers of those selected professionals were able to return the questionnaire, while five (5) of the ninety-five (95) were ignored for incorrect entry.

The inference statistic was adopted to summarise the sample, rather than use the data to learn about the population and sample. In this paper, inference statistic was used to present means score, standard deviation and frequency counts. The mean value was used to rank the respondents' opinions or responses obtained and percentages was used to establish the critical success factors for the adoption for the adoption of lean construction principles in construction firms.

ANALYSIS AND DISCUSSION OF RESULTS

The results of the demographic profile of the respondents were presented below:

Years of Experiences of Respondents in Construction Firms

Figure 2 shows years of experiences of respondents, thus with 11-15 years of working experience represent 34.41%. while 6-10 years of working experiences represent 25.81%. In addition, respondents with 16-20 years of working experiences constitute 19.35%. Furthermore, thus with 20 years of working experiences constitute 12.9%. And respondents with 1-5 years of working experiences which represent 7.53%. This indicate that majority of the respondents have working experiences in construction projects.

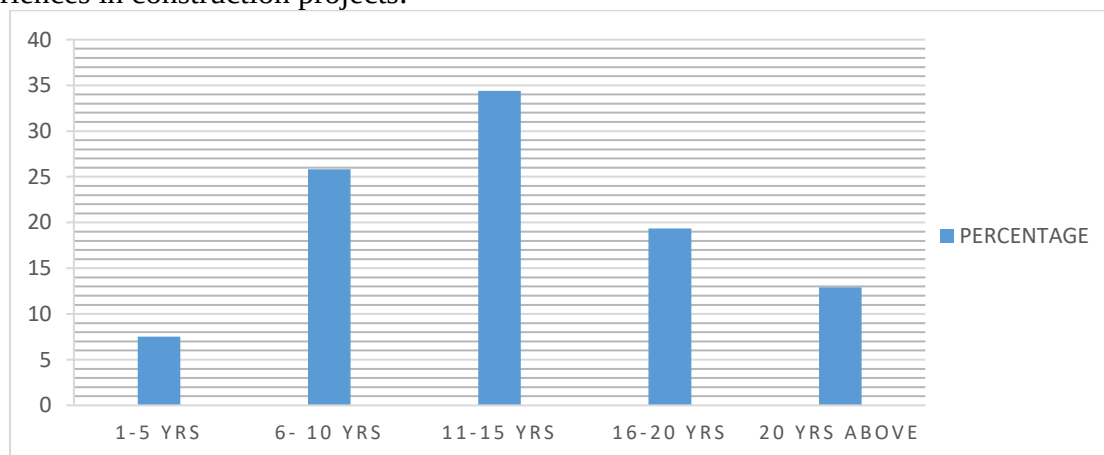


Figure 2. Years of experience in construction projects

Qualification of the respondents

Figure 3 shows that 34.41% have B.Sc/B.Tech degree, 24.73% have MSc/M.Tech degree. In addition, 22.58% have HND and 6.45% have PGD. This signify that the respondents have required qualification in different background of knowledge of construction.

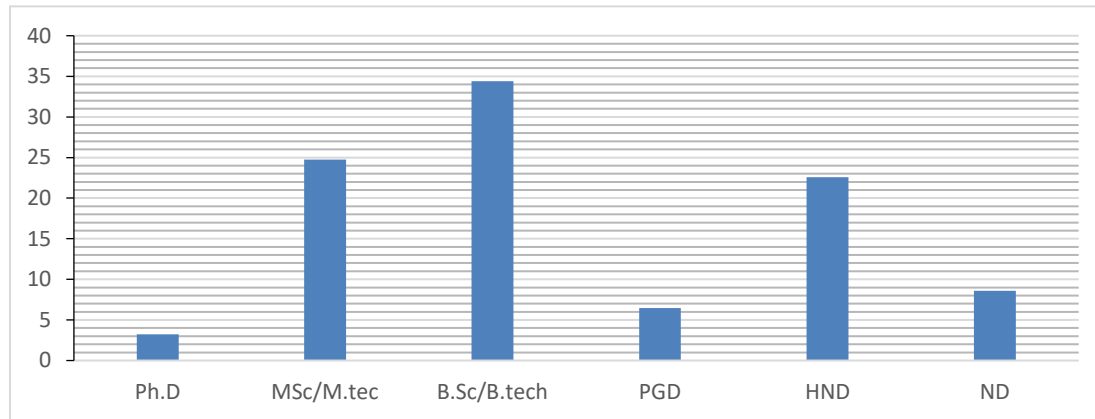


Figure 3: Qualification of Respondent

Profession of Respondents

Figure 4 shows 38.71% of respondents are Quantity Surveyors, 26.88% are Architect; 18.28% are Builders and 16.13% are Civil Engineers. This reflect that the professions of the respondents are relevant to construction.

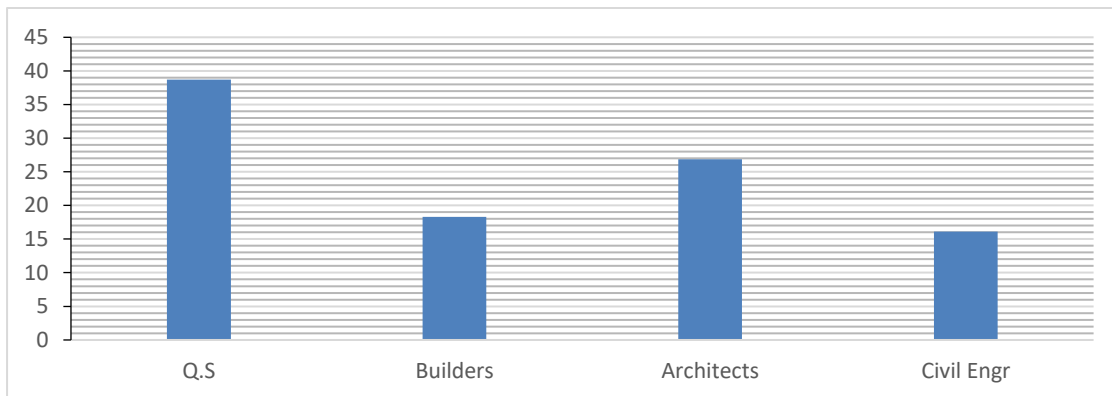


Figure 4: Profession of respondent in construction projects

Types of Lean Construction Principles Practices

Figure 5 shows the types of lean construction principles practices in construction firms namely: just in time, total productive maintenance, continuous improvement, design for manufacturing and assembling, supplier management and effective human resource management in Nigerian construction firms are low in terms of awareness. In addition, the result shows that total quality management practice as moderate. This result implies that all the six variables used to examine the types of lean construction principles practices in the study area are very low except total quality management. This result was in line with the views of previous researchers that lean construction is achieved through a set of mutually reinforcing practices, including just-in-time (JIT), total

quality management (TQM), total productive maintenance (TPM), continuous improvement, design for manufacturing and assembly (DFMA), supplier management, and effective human resource management (Jadhav, 2014; Jørgensen & Stephen, 2008; Marhani *et al.*, 2013).

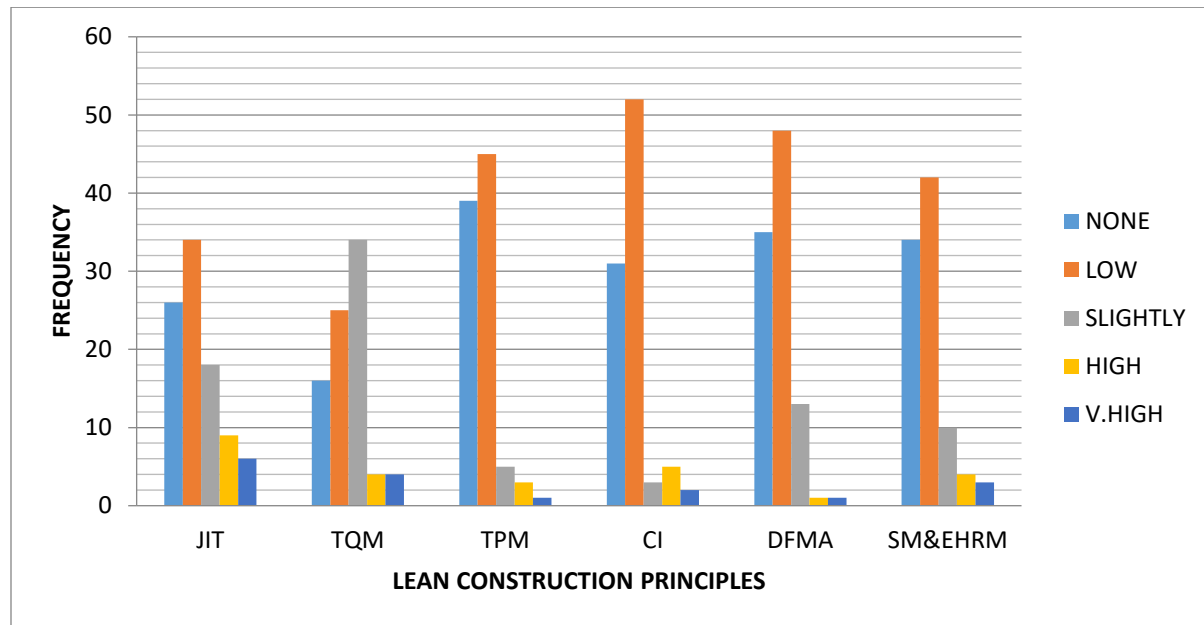


Figure 5: Types of lean construction principles practices

(Note: JIT= Just in time, TQM= Total Quality Management, TPM = Total productive maintenance, CI= Continuous Improvement, DFMA= Design for Manufacturing and Assembling and SM&EHRM= Supplier management and effective Human Resources Management.)

Critical Success Factors for the Adoption of Lean Construction Principles

The perceptions of the respondents on critical success factors for the adoption of lean construction principles by Nigerian construction firms was presented in Table 1. However, the decision rules used to rank the mean scores are as follows: (1) 0.00 to 1.49 represent None; (2) 1.5 to 2.49 represent Low; (3) 2.5 to 3.49 represent Moderate; (4) 3.5 to 4.49 represent High and (5) 4.5 to 5.0 represent Very high.

Table 1: Critical success factor for the adoption of lean construction principles

Critical Success Factors	Mean	Standard Deviation	Ranked	Decision
Team work	3.89	1.175	1	High
Quality leadership	3.87	0.723	2	
Continuous improvement	3.61	1.104	3	
Commitment of the top management	3.58	0.584	4	
The presence of the scheduling and planning	3.53	0.321	5	
Adequate knowledge to begin the project	3.51	1.210	6	

Workers within the company with multiple tasks and experiences	3.49	0.982	7	Moderate
Desire to learn the company and their crews	3.47	0.905	8	
An integrated characterization of the work on the project	3.45	1.207	9	
Business combinations and make a unified system	3.33	1.188	10	
Periodic maintenance of the company's equipment	3.31	0.647	11	
Decentralization and motivation	3.21	0.502	12	
Multiplicity of tools used in project applications	3.18	1.117	13	
Show the required information visually	2.89	0.498	14	
Involving company employees in business activities plans	2.81	0.417	15	
Begin as soon as possible with an important and visible activity	2.74	0.456	16	
Good network of contracts in the company	2.49	0.512	17	Low
A mandatory clause in the contract	2.45	0.932	18	
Necessary changes in the organizational culture	2.31	1.132	19	

Source: field work (2020)

Table 1 shows that team work, quality of leadership, continuous improvement, commitment of the top management and the presence of the begin the project were ranked 1st, 2nd, 3rd, 4th, 5th & 6th with mean scores of 3.89, 3.87, 3.61, 3.58, 3.53 & 3.51 respectively. This indicates that the aforementioned factors are the main CSF for the adoption of lean construction principles in Nigerian construction firms. Aigbavboa *et al.* (2016) and Hosseini *et al.* (2012) both conducted a similar study and agreed with finding that the followings are the major critical success factors for the implementation of the lean construction principles: decentralization and motivation, adequate knowledge to begin the project, teamwork, management commitment and good network of contracts in the company.

In addition, the result also shows that good network of contract in the company, a mandatory clause in the contract and necessary changes in the organizational culture were ranked 17th, 18th, & 19th with mean scores of 2.49, 2.45 & 2.31 respectively. This implies that good network of contract in the company, a mandatory clause in the contract and necessary changes in the organizational culture are the lowest CSF for lean construction application in contracting firms. Dulaimi and Tanamas (2001) agreed that adoption of lean construction enable to eliminates non-value steps such as waste and better meet client demands and dramatically improves the Architectural/ Engineering/ Construction (AEC) process and products with significant benefits.

CONCLUSION

The study establish that the followings are types of lean construction principles practices in construction firms are low. These are (1) total quality management, supplier management, (2) effective human resource management, (3) continuous improvement, (4) total productive maintenance and (5) just in time. Furthermore, the followings are established as main critical success factors for the adoption of lean construction principles in Nigerian construction firms namely: (1) team work (2) quality of leadership (3) continuous improvement (4) commitment of top management (5) the presence of scheduling & planning (6) adequate knowledge of begin the projects (7) workers within the company with multiple tasks and experiences (8) desire to lean the company and their crews. This implies that, the aforementioned critical success factors are the main factor to be considered for the adoption of lean construction principles in Nigerian construction firms.

The paper concludes that there is low level of the awareness of the lean principles in constructions firms, and this will have significant impact on the lean principles' adoption in construction firms in Abuja. The paper therefore suggest that the top management of the Nigerian construction firms should be committed towards quality leadership by ensure teamwork and continuous improvement in the project's delivery. There should adequate knowledge of the projects by the professionals and proper planning and scheduling before the commencement of the construction works. There is also need for advocacy by the management of Nigerian construction firms and professional bodies to educate their members on the need to practices lean construction firms in order to reduces wastage, rework, errors, delay, variation and mistakes during construction works. etc.

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FRAMEWORK FOR INTEGRATED WEB-BASED PRICE ANALYSIS TO INCORPORATE BUILDERS MARK-UP'S DECISION

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ABSTRACT

The existing web-based price databases such as “NIQS Cost Data Bank”, “RS-Means” and “BCIS Online” show tremendous potential for construction cost estimating. These databases have the capacity to produce approximate cost estimates, assembly rate analysis and unit rate analysis and are used to support both manual and 5D BIM-based cost estimating. However, these databases do not incorporate bidder's mark-up decision in their price analysis and also do not adhere to local cost estimating standards of other countries. To address this gap, this research developed a framework for integrated web-based price analysis that incorporates contractor's bid mark-up decision and captures local cost estimating standards of other countries such as Nigeria, China, South Africa and lots more. Using design science research method, the functional requirement of the web-based price database was first established from the review of relevant literature and the assessment of existing databases. Subsequently, bidders' mark-up framework was developed and incorporated into the proposed web-based integrated framework. The framework is part of a larger study that aims at developing an integrated web-based cost database that incorporates bidder's mark-up decision and captures local cost estimating standards of other countries such as Nigeria, China, South Africa and lots more. The study concludes that the framework developed, integrates with BIM platforms which enhances collaboration real time among construction professionals, which is one of the benefits of BIM and also recommend the adoption of this framework by the Nigerian Institute of Quantity Surveyors (NIQS).

Keywords: 5D BIM, Bidders' mark-up decision, Building Information Modelling (BIM), Cost estimation, Programming, Web-based price database.

INTRODUCTION

Cost estimation (CE) can be traced back to the year 1785 when quantity surveying firms were first recorded (Seeley & Winfield, 1999). Construction cost estimating is considered one of the most important and critical phases of a construction project (Samphaongoen, 2010). Preparing reliable and accurate estimates to help decision-makers, is the most challenging assignment that cost estimators face (Seeley & Winfield, 1999). A cost estimate is not only necessary for proposal preparation but also for several project management functions; Despite the importance of cost estimating, it has remained a very time-consuming process (Zima, 2018). According to Seeley & Winfield (1999), CE involves two major activities; Quantity take-off and unit rate computation. However, the traditional CE approaches have long been criticized to be laborious and error-prone process that is performed manually (paper-based) by cost estimators leading to unwanted delays, and eventual lawsuits between the various parties in a project team (Samphaongoen, 2010). There is a need to automate CE, which gives quantity surveyor the opportunity to shift more attention to

providing knowledge and expertise-intensive advice to the project team (Eastman, Teicholz, Sacks, & Liston, 2008; Ibrahim & Abdullahi, 2016).

Efforts to improve on the traditional paper-based approaches resulted in the development of various quantity take-off and cost estimating tools such as Computer-Aided Design (CAD) (Eastman *et al.*, 2008; Ibrahim & Abdullahi, 2016). Traditional 2D estimating software such as On-screen take-off was developed to assist estimators in having a visual representation of what materials have been quantified. The major weakness to on-screen take-off is the lack of automatic change management among multiple drawing selection for take-off, making it quite difficult to map similar quantities proactively (Pittard & Sell, 2017).

Building Information Modelling (BIM) is underpinned has on the need to provide a platform that addresses the weaknesses of the previous CAD technologies by providing an extended 3D model that stores all building information of a project to aid stakeholders make informed decisions (Eastman *et al.*, 2008). BIM tools for design production such as: Revit architecture suite, Bentley BIM Suite, ArchiCAD, Planswift, Sketch-up, Tekla structures, Vectorworks and a lots more; have allowed the construction industry to begin to move toward BIM-based cost estimating which is known as 5D modelling (Olsen & Taylor, 2017; Zima, 2017). According to Ibrahim & Abdullahi (2016), the ability of BIM platforms to perform automated quantity take-offs does not produce a cost estimate. To prepare estimates, the quantities generated from BIM models are assigned price/rates and descriptions based on a standard format (Eastman *et al.*, 2008). Researchers proposed three approaches of performing BIM-based cost estimating: firstly, exporting building object quantities to estimating software; secondly, using BIM Quantity Take-off tools; thirdly, bridging the BIM tool directly with estimating software such as: Autodesk Quantity Take-off, BIMmeasure, Cost X, Cubicost, Primus, Navisworks, Sigma estimates and lots more (Eastman *et al.*, 2008). According to researchers, due to the time consuming, error-prone process and the need to constantly update prices of the first and the second approach, bridging the BIM tool directly with estimating software is the most preferable for cost estimation (Eastman *et al.*, 2008; Ibrahim & Abdullahi, 2016).

Existing web-based price databases such as “NIQS Cost Data Bank”, “RS Means” and “BCIS Online” show tremendous potential for BIM-based cost estimating. The capacity of the existing database is Approximate estimates, Assembly analysis and Unit rate Analysis (Gordian, 2019; RICS, 2019). According to Presto (2017), these databases contain thousands of materials, labour and equipment prices, also due to the use of parametric concepts. Some of the price estimates can be downloaded or subscribed through the internet at no cost, others require a fee. Every database has its own coding system for work units and resources, which prevents a real interchange of information among users. Price databases are considered very useful (Niknam & Karshenas, 2015; Liu, Li, & Jiang, 2016; Zhou, Li, Huang, & Yu, 2016). Most estimates are created by simply picking predefined concepts from databases, creating only the very specifics items needed in a particular project (Presto, 2017). Possible drawbacks to adoption of existing web-based price database in Nigeria construction industry are that; contractors bid mark-up decision is not considered, the expensive nature of subscription to the packages, local cost estimating requirement is not captured and Existing web-based price database is best suited for government construction project and construction project with heavy financing, because of the use of economic indices to

calculate prices (Wu, Wood, Ginige, & Jong, 2014; Ibrahim & Abdullahi, 2016; Abanda, Kamsu-Foguem, & Tah, 2017).

Various price database systems that support both manual and 5D cost estimating have been developed. These systems facilitate price analysis and cost modelling of construction projects. However, existing price databases do not incorporate bidder's mark-up decision in their rate calculation and don't adhere to local cost estimating standards of other countries such as Nigeria, China, South Africa and lots more (Abanda *et al.*, 2017; Abdullahi, 2018; Ma & Liu, 2018; Akanbi, Zhang, & Lee, 2019; Chao & Liaw, 2019). In addition, these existing systems are based on the standard classification systems of where they are developed. Hence this research seeks to fill this gap by developing a framework for integrated web-based price analysis

The aim of this study was to develop a framework for integrated web-based price analysis. This was achieved through the following objectives which are: To identify the information requirements for integrated web-based price analysis, to develop a framework for integrated web-based price analysis. to validate the framework for integrated web-based price analysis

LITERATURE REVIEW

Web-Based Price Database

Web-based price database is a collection of construction price data, generally stored, accessed, managed and updated electronically from a computer or computing device.

According to Presto (2017), these databases contain thousands of materials and work units, also due to the use of parametric concepts. Some of them can be downloaded or consulted through the Internet at no cost, others require a fee. Every database has its own coding system for work units and resources, which prevents a real interchange of information among users. But the coding for the groups or chapters is not intended for acting as a WBS -Work Breakdown Structure-, so every professional uses its own WBS. So, the requirement for using specific databases in public works does not result in a common WBS for the estimates. Price databases are considered very useful. Most estimates are created by simply picking predefined concepts from databases, creating only the very specifics items needed in a particular project (Presto, 2017).

According to research, the most used web-based database is RS Means closely followed by BCIS Online. Therefore, RS Means and BCIS Online was chosen for review (Presto, 2017).

RS Means

Gordian (2019), RS Means is a 75 years old proprietary pricing tool that provides cost information to the construction industry, so contractors in the industry can provide accurate estimates and projections for their project costs. For decades, RS Means has been recognized in the construction industry and by the government as an authoritative source of reliable construction costs. Contractors use RS Means to quote and invoice full-service construction jobs; all the way from the building, to the services, to install, to incidentals needed, to price a requirement (Gordian, 2019). RS Means comes in four forms to be utilized by the contractor:

1. Reference books
2. CD Software
3. Online cost estimator
4. Plugin to BIM tools

at a very conceptual level stage for new construction. Below is the RS Means structure overview (Gordian, 2019).

Challenges associated with existing web-based price analysis

After the careful review of RS Means and BCIS Online, the following issues were identified as possible drawbacks to adoption of existing web-based price data based in Nigeria construction industry;

1. The existing web-based database does not capture the local classification/format of other countries such as Nigeria, China, South Africa and lots more.
2. The expensive nature of subscription to the packages.
3. Locations do not capture local states in Nigeria.
4. Bidders' mark-ups decisions are not considered.
5. The existing database does integrate with BIM authoring tools.
6. The existing web-based price database is best suited for government and project with heavy financing because of the use of economic indices to build up prices.

Existing web-based price database such as RS means, BCIS Online that are supposed to link up with a BIM authoring tool to produce cost estimate: the classification system currently in use in the existing web-based price database is the MasterFormat UniFormat, OmniClass, and UniClass classification systems, which do not capture local requirements in most cases (Ma, Zhenhua, Wu, & Zhe, 2011). According to Wu *et al.* (2014), it is worth noting that the measurement standards in Nigeria (BESMM) are developed independently of the BIM development process. They are designed for the presentation of the building cost during the design and construction process. Inevitably, their classification system and measurement rules have not been taken into consideration of the BIM development and their information structure is not fully compatible with the BIM data structure (i.e. IFC structure or Revit object structure).

The cost of subscribing to an existing web-based price database, when converted to Nigerian currency ranges from N100,000 – N250,000 on a monthly basis; this said to be too high for the Nigerian cost estimating expert to afford because the estimator has other overheads to settle (Abdullahi, 2018). Locations consideration of existing web-based price database do not capture Nigerian states, it is important to capture the local states in Nigeria because, the nature of the price of material, labour, and equipment vary from state to state (Aiyeleso, Ibrahim, Abdulrazaq, & Kolo, 2014). A review of the existing web-based price database revealed that the web-based price database does not consider bidders' mark-up decision, the BCIS online which considers contractor mark up, gives a mark-up of 5% across all projects. In Nigeria, contractors are given the leverage

to choose their mark-up, ranging from 0% to 100% or as required, so as to enable the contractor to meet up with his overhead to ensure the survival of the firm (Ganiyu, 2016).

Bidders' Mark-Up Decision

Liu & Ling (2005), have defined mark up as the difference between the contract sum and that required to pay for overheads site costs, labour, plant, and materials to complete the contract. The amount or percentage allowable as profit is a function of many variables. Mohamed *et al.* (2017), posit these variables as the form of contract, the size, and nature of the contracting firm, the organisation of the contracting firm, the client and even the disposition of the project consultants. In addition, the risks associated with the project also affect the nature of the profit allowable.

The techniques and methods applicable in the calculation of overheads revolve on the policy of the contracting firm and the type of overhead involved. According to Seeley & Winfield (1999), with site overheads, each contract will have a calculated allowance in the tender, but head office overheads require a different method of assessment. One approach is to calculate the budgeted overheads as a percentage of budgeted turnovers and to apply this to all contracts. Similarly, Mohamed *et al.* (2017), described how most contractors use systems which record past and present overheads, the projection of overheads are being recovered. An important part of a contractor's general overheads is the cost of financing construction works in advance payment, which needs to be calculated and included in the tender. The appropriate addition for head office overheads according to Dikmen *et al.* (2007), varies with the extent of centrally provided services and the size of an organisation, but could be in the range of 4% to 8% of turnover.

Factors that affect contractors' mark-up decision

Project cash flow, inflation in material prices, experience in similar old projects, availability of required cash, availability of qualified staff, degree of safety, procurement method, size of contract, duration of project, specifications, need of work, location of the project, cost contract, past profit in similar projects, uncertainty in cost estimate, number of competitors tendering, productivity measurement, owner (Private/Public), degree of difficulty, current workload, establishing long relationships with the client, price contract, availability of other projects, risk involved in investment, management contract, use of nominated subcontractors, consultant, percentage of insurance premium, documents required, tendering duration, bidding document price, tendering method (Mohamed *et al.*, 2017).

RESEARCH METHODOLOGY

The study adopted Design science research (DSR). DSR was adopted because an information system (web-based price database) is being proposed and DSR is the most suitable (Vaishnavi & Kuechler, 2004). Design science research involves two primary activities to improve and understand the behaviour of aspects of Information Systems: These activities are; the creation of new knowledge through design of novel or innovative artefacts (things or processes) and the

analysis of the artefact's use and/or performance with reflection and abstraction (Vaishnavi & Kuechler, 2004). The artefacts created in the design science research process include the web based price database and the prototype system add-in to Revit, but are not limited to, algorithms, human/computer interfaces, and system design methodologies or languages (Vaishnavi & Kuechler, 2004).

Information requirement identification

This was archived through an extensive review of relevant literature and the assessment of existing web-based price analysis platforms.

Functional requirements: Functional requirement defines the capabilities and functions that a system must be able to perform successfully. In software engineering and system engineering, a functional requirement defines a function of a system or its component (Zima, 2017). These functions are the set of inputs, the behaviour, and outputs of the system in question. In other words, it captures the intended behaviour of the system. This behaviour may be expressed as services, tasks or functions the system is required to perform and it shows the features that differentiate the system from other systems. Functional requirements should include: Descriptions of data to be entered into the system, descriptions of operations performed by each screen, descriptions of work-flows performed by the system, which can enter the data into the system and how the system meets applicable regulatory requirements (Vaishnavi & Kuechler, 2004).

Non-functional requirements: These define system properties and constraints e.g. reliability, response time and storage requirements. Constraints are I/O device capability, system representations, etc. It is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. This should be contrasted with functional requirements that define specific behaviour or function (Vaishnavi & Kuechler, 2004).

Development of the framework for integrated web-base price analysis

An application was developed using different programming models and languages which include HTML, CSS, and PHP (for the front-end interface) and MYSQL (for the backend) and served through a web server, APACHE. The use of HTML and CSS, which is a mark-up language for information presentation and a styling language respectively, allow for the user-interface to be designed and properly laid out. To enable dynamic content generation, PHP (a web scripting language) is used to generate dynamic content based on the user of the system and the corresponding content stored in the backend database which is managed by MySQL. The web server is used to serve the webpages to users when they are needed, and also to interpret the PHP scripting commands contained in the page. In other words, the computer will simply act as the medium for estimators to select price estimates for cost estimation and report such an outcome.

Validating the framework for integrated web-based price analysis

Validating the framework for integrated web-based price analysis for the purpose, it was developed for: With regards to efficiency and effectiveness of the developed framework for construction cost

estimation. Through a focused group discussion with 6 experts, the experts consisted of practicing professionals and contractors working in the construction industry. The rationale for choosing 6 experts to validate the framework is hinge on the fact that it is a focus group meeting, there is no specification as to the number of participants from literature. Target

RESULTS AND DISCUSSION

Established functional requirements of the integrated web-based analysis

The prototype system functional requirement adopted, was established from (Gordian, 2019; RICS, 2019). They are highlighted below:

1. The system will have a homepage where respective users (administrator & estimators) can log in to perform their different operations.
2. The system will have the test page where the estimator would be presented with price estimates to be able to select his/her choice. The system then automatically maps the prices with the quantities to give the cost estimation of a work item.

Justification for adopting the functional requirements is that it conforms with the scope of this work.

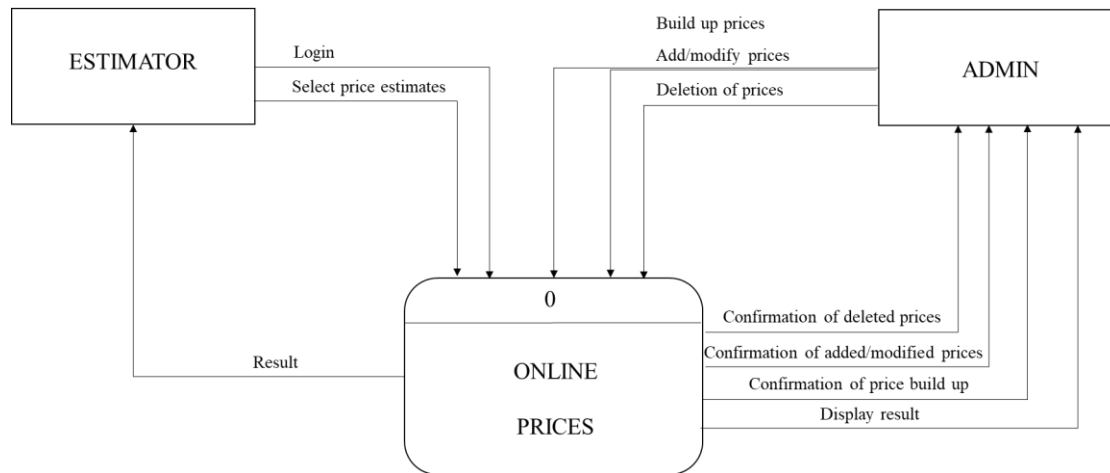


Fig. 1. Architecture of the integrated web-based price analysis platform.

The requirements were modelled into the architecture of the prototype system. It is the minimum requirement expected of the prototype system to enable it to perform cost estimation. This was achieved through extensive literature review and review of existing BIM-Based cost estimating tools.

Established non-functional requirements of the integrated web-based analysis

The non-functional requirement is:

1. Bidders Mark-up analysis frameworks were identified, however, (Dikmen *et al.*, 2007) framework was adopted and incorporated into the prototype system because the framework was able to capture bidders mark-up decision unambiguously.
2. Several cost estimating standards were identified, however, the BESMM and provision for adding more classification format was adopted. The 36 states price indices in Nigeria were also identified and captured in the prototype system; so as to capture the uniqueness of the construction.
3. Materials cost, labour cost, and plant cost were used to calculate the construction prices unit rate per assemblies in the prototype system.

The framework for bidders mark-up decision adopted is by Dikmen *et al.* (2007), the framework is integrated with price analysis, so as to enable bidders, who have no idea on mark-up calculation to be able to generate their firm's mark-up decision automatically. For those bidders with knowledge of calculating mark-up decision, they can generate their bid mark-up decision externally and input it into the prototype system.

Framework for Integrated Web-Base Price Analysis

Load BIM authoring software (such as Revit, Planswift Etc.), import the 3D design with at least LOD 300 into the BIM authoring software, prepare a schedule of work inside the BIM authoring software, extract the quantities into the schedules column in the BIM authoring software and link to the integrated price database.

Load the integrated price database user interface. Generate bid mark-up decision automatically or input bid mark-up decision manually to carry out price computation. Select the items on the schedule list in the price database to perform cost estimation. Export report of price computation information to CSV, TXT, where price information can be further edited and utilised for preparing bill of quantities; also, can be shared on the BIM 360 platform which supports collaboration for all project participant to utilize.

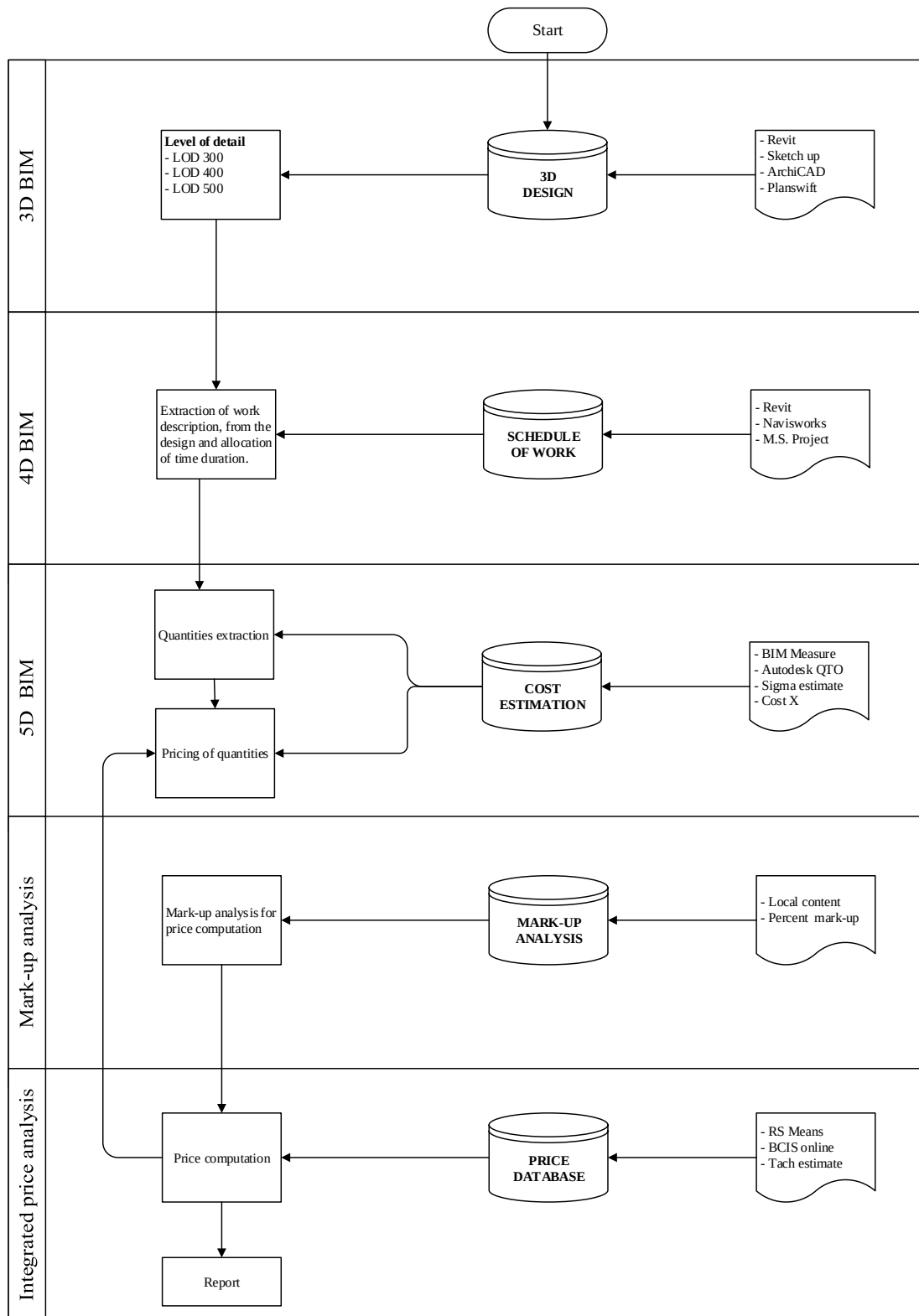


Fig. 2. Framework for integrated web-based price analysis

Validating the Framework for Integrated Web-Based Price Analysis

The reason for validating the framework for integrated web-based price analysis was to check for effectiveness (Does the framework capture the minimum requirement for cost estimation, accuracy of the framework and the number of features) and efficiency of the system for cost estimation (does the framework have the ability to save time, ability to save cost and minimal effort required to use the feature).

Table 1: Result for validation of the Integrated Web-Based Price Analysis framework

	Poor	Fair	Good	Very Good	Excellent
Efficiency.					
Ability to save time.	-	-	1	5	-
Ability to save cost.	-	-	3	3	-
Minimal Efforts required to use the system.	-	-	0	6	-
Effectiveness.					
Quantity of Features/ problem solved.	-	-	0	6	-
Accuracy.	-	-	4	2	-

The objective of the focus group meeting was to check if the exported information was accurate and reflect information use in the bill of quantities templates for cost estimation and also the efficiency of the framework. This is achieved through the employment of a case study project.

The table 1 result shows that, the experts agree the framework is effective and efficient for cost estimation.

CONCLUSION AND RECOMMENDATION

The minimum required functionality expected of the framework is a webpage where respective users (administrator & estimators) can access, to perform their different operations. Bidder's mark-up decision criteria framework was identified and was incorporated with the framework for integrated web-based price analysis for automatic bid mark-up decision calculation. The framework is part of a larger study that aims at developing an integrated web-based cost database that incorporates bidder's mark-up decision and captures local cost estimating standards of other countries such as Nigeria, China, South Africa and lots more. The framework developed, integrates with BIM platforms which enhances collaboration real time among construction professionals, which is one of the benefits of BIM. Validation of the framework for integrated web-based price analysis developed was carried out and found to be adequate for cost estimation. Benefits of this framework to construction practitioners includes realistic rates, fast and accurate price computation real time.

The study concludes that a framework for integrated web-based price analysis was developed. The framework also incorporates bidder's mark-up decision that adhere to local cost estimating standards of any country. The developed framework was validated, by 6 cost experts in the construction industry and deemed adequate for cost estimation.

The study recommends the adoption of this framework for integrated web-based price analysis, by the Nigerian Institute of Quantity Surveyors (NIQS) for BIM-based cost estimation. The benefits include realistic rates, fast and accurate price computation real time.

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PRACTICES OF PERFORMANCE MEASUREMENT OF CONSTRUCTION FIRMS IN ABUJA, NIGERIA

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ABSTRACT

Performance measurement is an important way of keeping firm on track in achieving its strategic objectives. However, there are construction firms who do not measure their performances. This attitude has caused a lot of setback to construction firms' performance by affecting the quality and timely delivery of their products. The paper aimed at investigating the current practices of performance measurement of construction firms in Abuja and determine the extent at which the construction firms used the performance measurement frameworks in measuring performance. In achieving this aim, twenty construction firms in Abuja were sampled randomly, purposive sampling was used to sample the respondents in these firms. A total number of eighty (80) questionnaires were distributed. Seventy-two (72) questionnaires were retrieved. The opinions of the respondents were sampled using Likert scale of 5-1 starting from very high extent to low extent. Simple percentage analysis was used to determine the current practice of performance measurement of sampled construction firms. 30% agreed that they practice performance measurement to a very large extent, the remaining 70% are either practicing rarely or not practicing at all. The paper recommended adequate understanding of performance measurement by all staff in construction firms and enforcement of implementation of performance measurement in construction firms by the stakeholders.

Keywords: construction, firms, measurement, performance, practices.

INTRODUCTION

The construction industry globally is a fundamental economic sector that permeates most of the other sectors as it transforms various resources into physical, economic and social infrastructure necessary for socio-economic development (Oladinrin *et al.*, 2012). In Nigeria, the construction industry occupies an important position in the economy and has great potentials of becoming one of the biggest construction markets, yet it contributes less than other industries (Olowa, 2018). Omolo (2017) opined that the Nigerian construction industry occupies a significant portion of the capital base of the Nigerian economy, adding that its success or failure has positive or negative impacts on the nation's economy, if this statement is true there is need to focus on things that affects the growth of construction industry. There is a high correlation between economic growth and the nature of the construction industry as economic growth influences the nature of construction organisations in any economy (Ugwu and Attah, 2016). This is evidenced in the resultant construction boom in countries like the United Arab Emirates through its oil fuelled economic growth, and China through its industrial export driven growth, amongst others. The construction industry in China for example, has been driven by plans for new developments, and urban revitalization (Omolo, 2017).

The Nigerian Construction Industry (NCI) contributes only 3.2% to the Gross Domestic Product (GDP) which is very low (Paul *et al.*, 2016). The NCI is faced with problems such as construction delays, time and cost overruns, abandonment of projects at various stages of completion, lack of

skilled local labour, power shortage, unavailability of materials, corruption, unethical practices and lack of capacity to deliver all these problems is due to inaccurate or lack of performance measurement (Oyelami and Oyedele, 2015; Oyewobi *et al.*, 2015). Odediran *et al.* (2012) reported that, Nigeria construction industry contributed less to the national GDP compared to other sectors this is why Nigeria economy always suffers decline in its GDP. Consequently, the declining nature of the Nigerian construction industry as always experienced, despite the gigantic infrastructure the country possesses. The decline in the contribution of construction industry to national GDP is expected to continue except there is quick intervention by all the stake holders on the issues that causes the decline (Odediran *et al.*, 2012).

The performance of the industry has been a concern to its stakeholders who have called for regular performance measurement to enable the stakeholders monitor the performance of the industry in order to know the areas that need improvement (Munir and Baird, 2016). According to Nalwoga and Van-Dijk (2016) performance measurement (PM) is vital for continuous and progressive improvement in most businesses and organisations. Hence, Aje *et al.* (2015) noted that measurement of organisations performance helps organisations to identify the key areas of adjustment, then when a firm neglect measuring its performance it will be difficult to identify area of improvement. This can lead to bankruptcy or folding up. Measuring of firm's performance is a process of measuring the actual output result of a firm as against its intended outputs or goals and objectives (Sarhan, and Fox, 2013). It is one of the ways of improving and sustaining competitiveness in the long-term (Nalwoga and Van Dijk, 2016).

In developed countries, like the United Kingdom (UK) and United States of America (USA), performance measurement is practiced by construction organisations, because they believe it positively affects their business in the longer-term (Asuquo and Effiong, 2017). However, in developing countries like Nigeria, most construction firms do not see any reason for measuring their performances, while those that realised the need to measure their performances do it with little or less knowledge of performance measurement (Paul *et al.*, 2016). Odediran *et al.* (2012) further decries the poor growth of construction organisations in Nigeria is due to lack of accurate and regular performance measurement, this has led to unnecessary spending by government. Thus, Tunji-Olayeni (2016) and Asuquo and Effiong (2017) emphasised the need of construction firms' stakeholders having deep knowledge of performance measurement so as to help in realising an accurate measurement of performance that will improve the performance of construction firms.

Construction professionals believe that measuring of performance by construction firms will help the firms to achieve a better and improved firm which will in turn contribute more to the nation economy (Paul *et al.*, 2016). The Frequent cases of failed and abandoned public sector projects are consistently causing serious nightmare to all the stakeholders within the construction industry, these problems can be solved if there are proper monitoring of firm performance before contract are awarded to them (Iheme and Chiagorom, 2018; Ugwu and Attah, 2016; Oyelami and Oyedele, 2015). Oladimeji and Aina (2018) lamented the alarming figures of abandoned public sector projects in Nigeria.

Performance Measurement

Performance measurement is the numerical or quantitative indicator that shows how well each objective is met (Bakotić, 2016). However, performance measurement requires an extensive use

of quantitative and qualitative data, with clear definitions and specific frequency for analysis, so the choice between them depends on the purpose of the measurement and, in many cases, the availability of the data (Yang and Lu, 2013; Latiffi, 2012). The past scholarly effort has led to the modern invention, exploration and development of new things such as varieties of performance measurement systems (Bakotic, 2016) and creation of new approaches for performance measurement practices (Khan, 2016). However, as Bassioni *et al.* (2013) pointed out, performance measurement is a topic, which is often discussed but rarely defined, it can be an integral part of management and thus may have been exercised for as long as management has existed. Performance measurement is a task undertaken by most organisations using different approaches, different techniques have been employed globally to measure performance, and it has attracted attention of researchers in recent years (Molina *et al.*, 2016).

The field of performance measurement has long been dominated by the concepts of management accounting procedures and techniques as well as management control systems (Asuquo and Effiong, 2017). It started when Peter Drucker in 1954 suggested that balanced measurement systems should be developed to quantify performance and the unanticipated consequences of quantification, since then, throughout the 1980s and early 1990s, numerous authors suggested measurement frameworks that might be appropriate (Jenatabadi, 2013). The result was that a dominant research question was raised in the mid-1990s, among the management community on how to develop and deploy a balanced performance measurement system. A stream of research works followed on the design and deployment of such systems; this was resulted in a research report on development of processes for designing measurement systems and barriers to their successful implementation (Bassioni *et al.*, 2013). Performance measurement is seen as an opportunity to gain insight into the future of an organisation. It allows organisations to forecast its financial measures and to plan. The procedure is by simply looking at an organisation's current innovation and learning processes and its achievements in business (Latiffi 2012). Performance measures means that the term can be observed according to the different financial and non-financial types of objectives, which, in turn, are associated to a multiple number of indicators (Sarhan and Fox, 2013; Moullin, 2017).

According to Ryan (2018) the limitations of traditional performance measures based on costs some these limitations areas listed below:

- i. The exclusion of a strategic perspective;
- ii. The lack of focus on success factors; and
- iii. The poor consideration of stakeholders' needs and expectations.

Traditionally, the success of a company has been evaluated by the use of financial measures. Although financial measures can appear in several different forms, three of the most common ones can be explained as Profit Margins, Return on Assets (ROA) and Return on Equity (ROE) (Yang and Lu, 2013). For example, distinguishes five types of performance objectives that have on an operation system: cost, dependability, flexibility, quality and speed. In a perspective of traditional productivity, numerous measures can be found in the literature, but usually two traditional types of index productivity measures are distinguished: partial productivity and total productivity (Moullin, 2017; Ryan, 2018). Increasing number of organisations have been measuring performance areas that are not financial but could affect profitability, such as customer loyalty and employee satisfaction (Sigalas, 2015; Saunila, 2016).

Performance measurement in the construction industry

In construction industry, performance measurement is being used and implemented by most large construction firms. Its implementation can help to improve their business performance, which includes business processes, products and management of people for facilitating continuous improvement (Parida *et al.*, 2015). There is a growing awareness among organisations in the construction industry that measurement systems are important for monitoring and controlling their performance (Ryan, 2018). Sarhan, and Fox (2013) agreed on the same idea and state that performance measurement is developing in the construction industry. There are three reasons, the continuous rapid development of performance measurement in other sectors during the 1990s created a massive interest in its development for the construction industry, increasing complexity of construction projects requiring appropriate measurement tools and frameworks to improve performance and the development and challenges of construction project management as well as building technology in recent years (Yu *et al.*, 2017). Ryan (2018) concluded that, one of the six goals of Construction Best Practice is that the improvement and achievement of an organisation can be done and established through measurement. This shows that measuring performance is important and is recognised as one of the important criteria for Construction Best Practice.

The Theoretical Frameworks of Available Performance Measurement

Gutierrez *et al.* (2015) mentioned that the revolution in performance measurement that had happened since the late 1980s brought to the development of varieties of tools and frameworks that can be grouped into two categories: those emphasising self-assessment and those designed to help managers measure and improve business processes. Gambo and Said (2014) stated that self-assessment is a comprehensive, systematic and regular view of an organisation's activities and results against a model of business excellence. Its process allows the organisation to discern clearly its strengths and areas in which improvements can be made and culminates in planned improvement actions which are monitored for progress. Self-assessment implies the use of a model on which to base the evaluation and diagnostics. Some examples of self-assessment as mentioned above are the European Foundation for Quality Management (EFQM) Excellence Model (widely used in Europe) and the Malcolm Baldrige National Quality Award (MBNQA) in the USA (Mehralian *et al.* 2017; Yu *et al.*, 2017). Some examples for the second category are Capability Maturity Matrices, The Performance Pyramid, The Balanced Scorecard (BSC) (Paul *et al.*, 2016).

The European Foundation for Quality Management (EFQM) excellence mode

The EFQM Excellence Model is a national quality award to recognise deserving organisations which have excelled in quality management practices (Nalwoga and Van Dijk, 2016). It has been developed by EFQM based on the practical experiences of organisations across Europe (EFQM, 2017). Figure 1 shows all the essential management approach that need concentration so as to achieve effective performance. Since its launching in 1991, thousands of European organisations have used the excellence model as a framework for assessment of their performance (Gutierrez *et al.*, 2015).

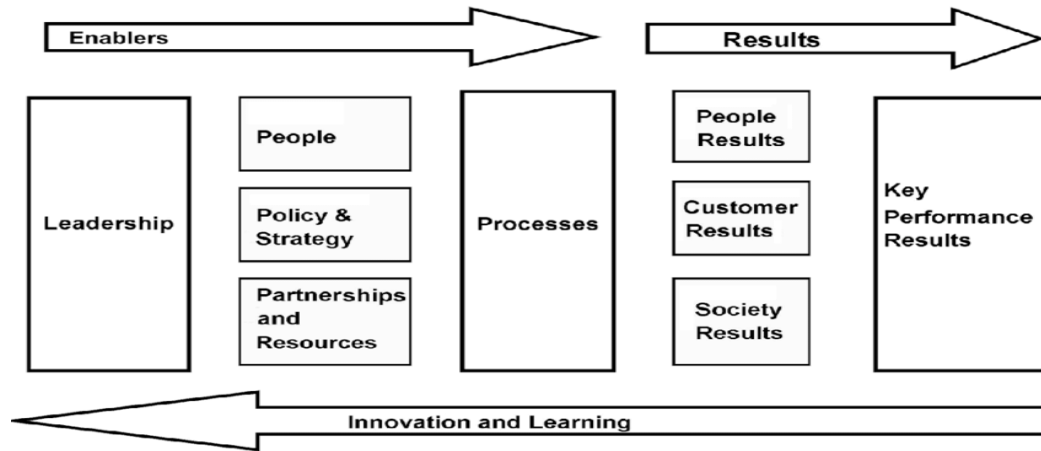


Figure. 1 EFQM excellence model

Source: EFQM (2017)

The Malcolm Baldrige national quality award (MBNQA)

The MBNQA is a National quality award used in the United States of America (USA). It was developed and used by organisations before 1997 to stimulate western organisations in other to compete better with the high levels of quality being attained by their Japanese competitors at that time. The Japanese developed the Deming Award to spur quality improvement (Ryan 2018). It is based on similar principles and methodologies of the EFQM Excellence Model which has been used in self-assessment, a technique supporting many different core values and a tool of TQM (Baird, 2017). Ryan (2018) stated that the most comprehensive list of actions needed to get to world-class quality is in the MBNQA. It consists of seven criteria: leadership, strategic planning, customer and market focus, information and analysis, human resource focus, process management and business results. These criteria of measurement using MBNQA are as show in figure 2.

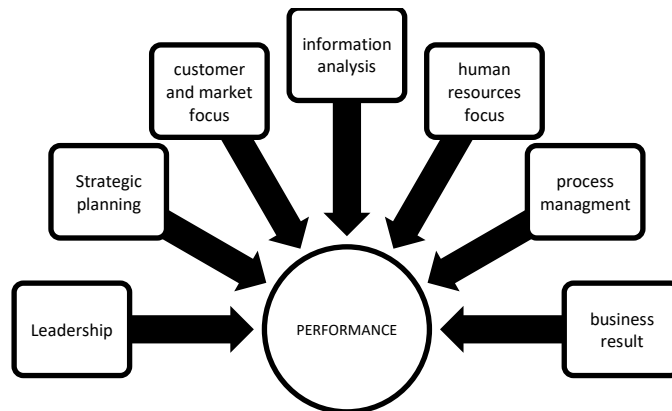


Figure 2 The Malcolm Baldrige National Quality Award (MBNQA)

Source: Ryan 2018

Sink and Tuttle model

This is a classical approach to a performance measurement system, which claims that the performance of an organisation is a complex interrelationship between seven performance criteria as follows (Kulatunga *et al.*, 2011). Effectiveness, which involves doing the right things, at the same time, with the right quality. In practice, effectiveness is expressed as a ratio of actual

output to expected output; Efficiency, which means, doing things right and it is defined as a ratio of resources expected to be consumed to resources actually consumed; Quality and it is measured at six checkpoints (to make it tangible); Productivity, which is defined as the traditional ratio of output to input; Quality of work life, which is an essential contribution to a system which performs well; Innovation, which is a key element in sustaining and improving performance; Profitability which represents the ultimate goal for any organisation.

Furthermore, Ryan (2018) states that although much have changed in industry since the model was first introduced, the seven performance criteria are still important. However, like other frameworks, it has several major limitations. For example, it does not consider the need for flexibility, which has increased markedly during the last few decades and it is also limited by the fact that it does not consider the customer perspective (Kulatunga *et al.*, 2011).

Balanced scorecard (BSC)

The BSC includes financial performance measures giving the results of actions already taken and also complements the financial performance measures with more operational non- financial performance measures, which are considered as drivers of future financial performance (Kulatunga *et al.*, 2011 and Ryan, 2018). The objectives and measures of the scorecard are derived from an organisation's vision and strategy (Nuru *et al.*, 2017). It translates an organisation's vision and strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system.

The BSC allows managers to look at a business from four important perspectives, which are financial perspective, internal business perspective, innovation and learning perspective as well as customer perspective, this is demonstrated in Figure 5 (Soderberg *et al.*, 2011; Niven, 2014; Sigalas, 2015 and Mehranlian *et al.*, 2017). It is a framework for focusing the organisation, improving communication, setting organisational objectives and providing feedback on strategy (Ryan, 2018). Neely *et al.* (2001) clarify that although the BSC is a valuable framework and it suggests important areas in which performance measures might be useful, it provides little guidance on how the appropriate measures can be identified, introduced and ultimately used to manage business.

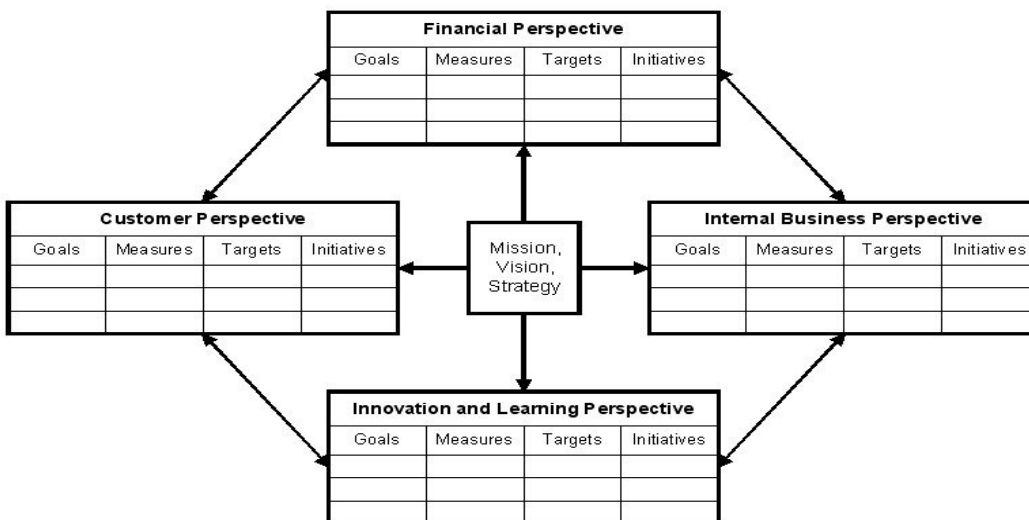


Figure 3 **Balanced score card BSC**

Source: Soderberg *et al.* (2011); Niven (2014); Sigalas (2015); and Mehranlian *et al.* (2017)

Performance Prism

The Performance Prism is a thinking aid and is known as a multi-faceted framework see Figure 4. It is a comprehensive measurement framework that addresses the key business issues to which a wide variety of firms, profit and not-for-profit, will be able to relate (Neely *et al.*, 2001). The performance prism was developed to overcome the shortcomings in the balanced scorecard approach. It purposefully takes a broader view of stakeholders and encourages organisations to address the following questions. Who are our key stakeholders and what do they want and need? What strategies do we have to put in place to satisfy these needs? What processes do we need to have in place to execute our strategy? Which capabilities do we need to perform our processes? What do we expect from our stakeholders in return? (Soderberg *et al.*, 2011; Niven, 2014; Sigalas, 2015 and Mehranlian *et al.*, 2017).

It consists of five-faceted performance framework, top and bottom facets are stakeholder satisfaction and stakeholder contribution respectively. The other three facets are strategies, processes and capabilities (Soderberg *et al.*, 2011; Niven, 2014; Sigalas, 2015 and Mehranlian *et al.*, 2017). The performance prism has a much more comprehensive view of different stakeholders (such as investors, customers, employees and suppliers) than other frameworks (Ryan, 2018). It includes a new dimension in identifying the stakeholders' contribution, required to maintain and develop these capabilities.

The performance prism enables a balanced picture of the business to be provided, significantly highlighting external and internal measures as well as enabling financial and non-financial measures, and measures of efficiency and effectiveness (Bititci *et al.*, 2012). It considers new stakeholders (such as employees, suppliers and alliance partners) who are usually neglected when forming performance measures (Ryan 2018).

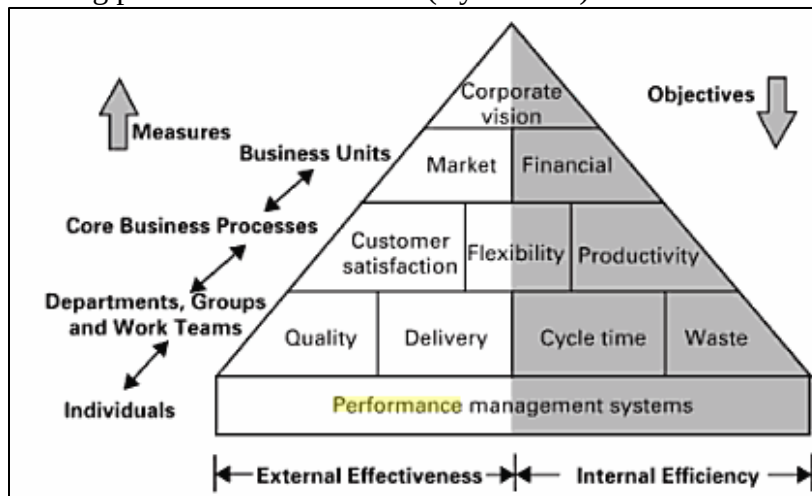


Figure 4. Performance prism

Source: Toor and Ogunlana (2010) and Upadhaya *et al.* (2014)

The choice of the appropriate tools for measuring firms performances is dependent on the understanding and the capability of the organisations that use the tools, it is advisable for firms to choose their own relevant dimensions and weightings rather than use any standard one-size-fits-all tool with more attention being paid to the process by which their own business frameworks and strategy are developed (Wu, and Liu, 2010). Furthermore, all tools developed have the same purpose and intention that is, to help firms identify areas in their organisations that need improvement for better future in business. The paper is limited to the above frameworks only because they are the major frame works available in Nigeria construction industry.

METHODOLOGY

The study covered construction firms (building and civil and heavy) that are into performance measurement, practising in Abuja, the Federal Capital Territory of Nigeria. The list of these construction firms was drawn from the Federation of Construction Industry (FOCI) directory. Abuja has been selected because it is one of the Nigeria cities that have the highest concentration of construction firms. Also, it has the highest concentration of on-going construction works. Abuja being Federal Capital Territory FCT has the highest number of constructions firms more than other cities in Nigeria, all these facts are all available in literatures (Oladimeji and Aina, 2018).

The paper used survey strategies approach with the use of survey questionnaires. The areas of study for the research are civil and building firms active and practicing in Abuja Nigeria. The survey strategies approach provides a focus for this research with the efforts to address the research problems. This provides stronger relevance in terms of the applicability of the research results and the impact that the consideration of the results could have on a specific firm.

The target population for the study were management members of construction firms practicing in Abuja Nigeria who are into performance measurement. The list of twenty (20) of these firms were drawn out from the Federation of Construction industry (FOCI). The respondents were professionals and non-professionals members who are management members of these firms. This is because they are the main people involved in performance measurement. The type of non-probability sampling adopted is purposive sampling techniques, this is because the research has interest in seeking the views and opinion of management staff of the firms under study in order to assess performances measurements practices. Therefore, the firms and the respondents were selected using purposeful sampling techniques. Simple percentage analysis and Mean Index Scores (MIS) were used to analyse the responses gotten from structured questionnaires

RESULT AND DISCUSSION

Table 1 shows the background of the respondents and the firms. The respondents have more of male (68%) than female, also the firms that had staff strength of 50 to 100 were also more (33%). This just confirms the previous studies that usually reported Nigerian construction industry as one of the employers of large labour force. The firms visited were highly experience because 42% of them have been in practice for 10 to 20 years. The majority of the respondents were degrees and higher national diplomas graduates 49%. More information on respondents' background and construction organisations profile is as shown in Table 1.

Table 1: Profile of the respondents

Gender of the respondents	Frequency	Percentage
Male	49	68
Female	23	32
Total	72	100
Age of the respondent		
20 -29	16	22
30 – 39	32	45
40 – 49	14	19
Above 50	10	14
Total	72	100
Year of firms in practice		
1 – 5	11	15
6 – 10	20	28
11 – 20	30	42
20 – 30	8	11
above 30	3	4
Total	72	100
Staff strength		
0 – 10	3	4
10 – 20	12	17
20 – 50	13	18
50 – 100	24	33
100 and above	20	28
Total	72	100
Qualifications of the respondent		
OND	28	39
BSC/HND	35	49
MSC/MTECH/MBA	3	4
PHD	0	0
Others	6	8
Total	72	100

Researchers' survey (2020).

Table 2 shows the results of the assessment of frameworks that are commonly used by the 20 firms under study. 60% of the firms were using basic score cards why none of the firms use performance prism, sink and turtle and any other performance frame works. Also 30 and 10 % use MBNQA and EFQM respectively. Many of the firms have less knowledge of any other frameworks apart from basic score cards they are using, this finding is in line with the finding of Paul *et al.* 2016.

Table 2. The performance measurement frameworks usually adopted when carrying out performance measurement in construction firms

Performance measurement frameworks	Frequency	% of Firms
Basic Score Card	12	60
Performance Prism	0	0
Sink and Tuttle Model	0	0
The Malcolm Baldrige National Quality Award (MBNQA)	2	10
European Foundation for Quality Management (EFQM) Excellence Model	6	30
others specify	0	0
Total	20	100

Researchers' survey (2020).

Table 3 shows the response on the effectiveness of the performance measurement in relation to firms' annual turnover. In the table 31% 38% and 6% agreed that the frameworks adopted by their firm's management are highly effective, very effective and effective respectively. The degree of the effective considering the percentages is very high and significant. Only 10% agreed that their frame works and the rate of returns are not significant. From the output of the result. From the result it can be concluded that if all the construction firms in Abuja carried out performance measurement there will be an improvement in their annual turnover.

Table 3. Effective is the performance measurement you adopted in relation to your firm's annual turnover

Response	Frequency	%
High effective	22	31
very effective	28	38
Effective	4	6
Rarely effective	11	15
Not effective	7	10
Total	72	100

Researchers' survey (2020).

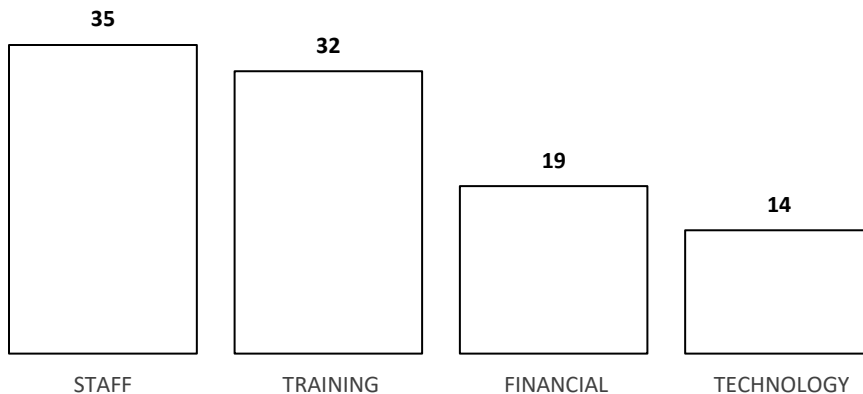


Figure 1. Resources allocated in percentage towards performance measurement in construction firms

Researchers' survey (2020).

The response on the resourced allocated towards performance measurement show in figure 1, agreed that their firms allocated staff (35%) as a resource than training, financial and technology. There is need to make these staff have adequate knowledge of performance measurement to enable then measure adequately and accurately. Training is also very important it has 32%. That shows that the construction firm have knowledge of resources that needed in carrying out performance measurement.

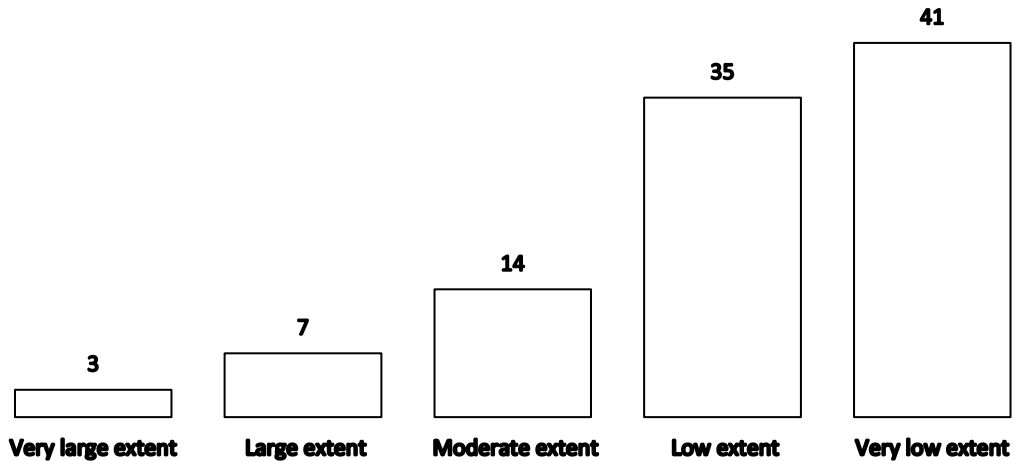


Figure 2. Response on the extent to which the construction firms used the performance measurement frameworks in measuring performance.

Researchers' survey (2020).

Figure 2 shows the responses on the extent to which these construction firms made use of performance measurement. The construction firms made use of performance measurement at a very low extent of 41%. This is highly unsatisfactorily, there is need to educate the management of the construction firms on the need to make use of performance measurement framework when carrying out performance measurement, this will enable the measurement to be accurate as indicated in the literature.

Table 4. Involvement of management members in performance measurement

Response	Frequency	%
Very high	22	31
High	14	19
Moderate	18	25
Low	12	17
Very low	6	8
	72	100

Researchers' survey (2020).

The responses on involvement of the management members in performance measurement show that the involvement of management members is very high (31%), the findings agreed with the literature on the management members being the people solely responsible for the performance measurement task.

Table 5. Factors that affect implementation of performance measurement in construction firms

Factors	MIS	Rank
Time and expense factors.	3.75	1 st
Lack of highly developed information system.	3.75	1 st
Concentration of feedback solely on short-term results	3.73	3 rd
Failure of senior management team to reach consensus on how to achieve a desired vision for their firms	3.73	3 rd
Lack of quantify results in areas that are more qualitative in nature.	3.73	5 th
Difficulty in decomposing goals for lower levels of the firms as they are not involved at the beginning of the performance measurement process	3.69	6 th
Lack of linking Strategy to resource allocation.	3.67	7 th
Striving for perfection and denying results of measurement if they conflict with those expected by the firm	3.65	8 th

Researchers' survey (2020).

The factors that affect implementation of performance measurement of the construction firms under study was as shown in table 5. Time and expense factors and lack of highly developed information system was ranked highest with mean index scores of 3,75 while striving for perfection and deny results of measurement if they conflict with the expected ones was ranked 8th with a mean index score of 3,65. This shows that time and financial power is very important when implementing performance measurement. these factors should be put into serious consideration in order to achieve a smooth and uninterrupted implementation.

Table 6. Steps taken for Implementation of performance measurement by the firms

Steps taken for Implementation of performance measurement by the firms	Frequency	%
Executive board formed performance measurement teams to run performance measurement	23	32
Executive board ensured that there is plans for implementing performance measurement	19	26
performance measurement teams have knowledge of performance measurement	10	14
performance measurement teams understand the tasks involve in carrying out performance measurement	8	11
Organisation has developed a policy for guiding the firm in implementing performance measurement activities	12	17

Total	72	100

Researchers' survey (2020).

Table 6 shows the response on the step taken by the firms on the implementations of performance measurement. Different firms take different steps. It is always advised to take the step that will suit the firms. Every firms can determine the steps that suit their firms through a thorough study by the management.

CONCLUSIONS

From the discussions of results the following conclusions were made;

1. Basic Score Card (BSC), European Foundation for Quality Management (EFQM) Excellence Model and The Malcolm Baldrige National Quality Award (MBNQA) are the three frameworks commonly used in Nigeria construction firms.
2. Carrying out performance measurement has a significant relationship with rate of return of a firm in form of annual turnover, it improves firm rate of returns since it helps in know where to improve in business.
3. Staff, training, financial and technology are the main resources that required to be committed by firms when measuring performance measurement.
4. The level at which construction firms carry out performance measurement is still very low and unsatisfactory.
5. The level at which construction firms made use of performance measurement frameworks is also very low and unsatisfactory.
6. Management members are very involved in carrying out performance measurement in construction firms.
7. Time and expense and Lack of highly developed information system are the major factors affecting the implementations of performance measurement in Nigerian construction firms
8. Executive board formed performance measurement teams to run performance measurement is the most commonly set used by the construction firms.

The use of performance measurement frameworks by Nigerian construction firms is very low. This is due to lack of adequate information system and knowledge by the management of these firms.

RECOMMENDATIONS

1. There is need for improvement on these three methods so as to provide a comprehensive framework that will be suitable for Nigeria market.
2. Management and all the stakeholders in the construction industry should enforce performance measurement among the construction firms so as to improve their turn over.
3. Adequate arrangement should be made by the management to ensure availability of the resources required for performance measurement.
4. There should be a policy by the stake holders on enforcements and implementations on the measurement of performance of construction firms.
5. The government and the stakeholders should provide adequate facilities for information system in Nigerian construction industry.
6. There is need for training and re - training of the management team to enable them handled the performance measurement frameworks adequately.

7. There is need for adequate understanding of performance measurement by all staff in construction firms.

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MOTIVATION AS A MANAGEMENT STRATEGY FOR IMPROVING PRODUCTIVITY IN CONSTRUCTION PROJECTS IN ABUJA

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ABSTRACT

The strategy adopted in managing human resources has a great influence on the performance of the workers. This study assessed motivation as a management strategy to improve productivity in construction project sites. Productivity of construction operatives has been established to be very low due to poor motivation. The objective of this study is to identify the motivation factors that enhance performance of construction workers on sites in Abuja. This study is quantitatively conducted through questionnaire administered to management, supervisors and craftsmen in the selected construction firms in Abuja. The study adopted both descriptive methods of analysis. The study identified 26 motivational factors enhancing the productivity of construction workers in the study area. Among the motivational factors enhancing productivity identified is good work environment and opportunity to be promoted and move forward in the carrier was ranked 1st with a mean score of 4.40, followed by satisfaction derived from work itself that was ranked second with a mean score of 4.30. The groups of respondents that is management, supervisors and craftsmen agreed on the ranking of the motivational factors. The study concludes that if the identified motivational factors are adopted, they would help to enhance the productivity of workers. The study therefore recommends that there should be a better, effective, prompt promotion and prompt developmental training. These would definitely motivate and increase the performance of the workers.

Keywords: improvements, management, motivation, performance, productivity, strategy.

INTRODUCTION

Historically, motivation in form of monetary and non-monetary incentives is believed to have significant effect on the productivity of labour in Nigeria. Fagbenle *et al.* (2014) studied issue of training to attain greater workers' productivity on construction sites. Zhou (2004) affirmed that motivation, when it is combined with work experience and education (training) is an important factor in improving performance. Motivation of employees is an important factor for the success of any organisation and explains why some workers with fewer capabilities often contribute more to achieving goals than co-workers who have greater abilities, and why some work harder than others do. Inadequate motivation of labourers in Construction is one of the most daunting human resource problems in developing countries such as Nigeria (Ugulu, Makhotsa, Mahlatse, Morongoa and Allen, 2016).

Few studies conducted on motivation for productivity improvement concentrated on management perspectives, while construction foremen, site supervisors and craftsmen that are on site to oversee

things were neglected. Parkin *et al.* (2009) affirmed that intrinsic and extrinsic factors do impact construction workers in different ways. In order to get the best out of the workers both the workers themselves and their working perceptions must be considered. Motivation is a process that starts with a physiological deficiency or need that activates a behavior or a drive that is aimed at a goal incentive (Muñoz, 2017). It composes of three elements (need, drive and incentive) which are interacting and interdependent (Muñoz, 2017). Motivation is a psychological process initiated by the emergence of needs involving a goal directed action and behavior aimed at satisfying a particular desire (Chete *et al.*, 2014). Motivation helps energize workers to work. The key to motivating employees is finding proper ways to satisfy their needs and desires. Each individual has different needs, wants and desires (Chete *et al.*, 2014). Even with the best strategy in place and appropriate organizational structure, an organization will be effective only if the members are motivated to perform at a high level (Muñoz, 2017).

Productivity has been an essential contributor to corporate success. This is as a result of its direct translation into cost savings and profitability. Productivity has also been a key to long-term growth and sustainable improvement and when associated with economic growth and development generates non-inflationary increases in wages and salaries (Caldas *et al.*, 2014). The construction firm generally plays a vital role in a national economy due to the usage of its products such as roads, buildings and dams for the production of goods and services. An enhanced productivity has a positive effect on the gross domestic product (GDP) of every nation. In spite of the immense size and significance of the construction firms to the economies of most nations, its productivity is one of the controversial and least understood factors (Homberg, 2017). Productivity in the Nigerian construction industry is largely unmeasured due to the unavailability of data for its determination. Poor performance in the Nigerian construction sector in most cases stem from dissatisfaction among workers due to low motivation on the part of employer. Akinloye *et al.* (2004) the workplace, low motivation manifest itself in various ways including lackadaisical attitudes towards work, low quality work, low productivity, lateness, stealing of companies' property, corruption, insecurity, laziness, a high rate of complaints by the workers, and high staff turnover among the professional staff (Akinloye *et al.*, 2014). This study therefore assessed motivation as a management strategy to improve productivity in construction project sites. Productivity of construction operatives has been established to be very low due to poor motivation. The objective

of this study is to identify the motivation factors that enhance performance of construction workers on sites in Abuja.

LITERATURE REVIEW

Concept of Motivation

Concept of motivation has been defined by several authors in different ways. For instance, Jean *et al.* (2006) and Afuye (2016) defined motivation as individual's effort to produce greatest possible work result. Cox *et al.* (2005) in Barg *et al.* (2014) defined motivation as providing a push to satisfy needs. Anthony (2011) defined it as a drive within a person that is responsible for the extent, course and diligence of efforts expended at work. From the above definitions, motivation can be seen as an incentive, catalyst, stimulus or a driving force that directs the behavior of an individual towards achieving a given sets of objectives with a view to meeting personal needs and achieving organizational goals. Therefore, to every effort expended by an individual, there is a reason or motive, this is considered to be in the best interest of the person concerned. Motive is a reason behind an action. Motivation is derived from a Latin word 'movere' which is understood to mean move Hodgetts & Kuratko, 1991 in (Afuye et al, 2016). In summary motivation can be define, as a way of providing internal drive through provision of incentives so as to achieve organizational goals and meet worker's needs.

Motivation Factor's that Enhance Productivity of Construction Workers

Afuye *et al.* (2016) researched on impact of motivation on productivity of craftsmen in construction firms in Lagos, Nigeria. In research sixteen motivational factors were identified which includes; safety provision, good salary, bonus, appreciation of efforts, recognition by authority, skill development, challenging work, opportunity to be promoted, job security, good supervision, cooperation from others, satisfaction at work, good work environment, freedom at work, taking part in decision and working overtime. The paper concluded that motivation strategy that will enhance productivity should be adopted for workers in the industry.

Jacinta (2013) investigated the impact of motivation on employee performance. The study identified four motivational factor which are money, participation, quality of work life and job enrichment. Based on the findings, the study concludes that in most of the organizations HRM

policy was proactive; that symbolic rewards e.g. praise and recognition were the most common form of motivation adopted by the organisation; that motivation affects performance, that supervisors have the ability to work with others at all levels ready to try out new ideas and methods; that there is a link between job satisfaction and performance in their organisation, that the organisation regularly evaluate the HRM policy especially with regard to motivation, that respondents felt the need for esteem and status through promotions, need for self-actualizations through encouraging self-fulfilment and also need for belonging through employee membership and associations.

Emmanuel (2009) in his study seeks to unravel the factors that affect construction workers' motivation and the corresponding effect of the identified motivational factors on workers' performance and overall productivity. The survey revealed that, among the top ten critical factors (i.e. teamwork, late payment of interim certificate, work based on contract, supervision based on leadership by example and provision of equipment) had great effect on motivation as well as impact on productivity. More so communication, love and belongingness, opportunity to undertake challenging task, identification with goal and over time were among the critical factors. Famakin *et al.* (2014) evaluates job satisfaction of quantity surveyors in Ondo State, Nigeria. The study identified twenty motivational factors security of employment, salary, prospect for promotion, feelings of personal satisfaction and accomplishment, ability to maintain one's confidence, adequate tools for job performance, personal health, participation in a working team, participation in decision making, opportunity to do challenging and creative work, recognition for the achievements above normal responsibility, motivation of work from co-workers, regular feedback on performance, education level compared with that of co-workers, length of service, opportunities for social interaction and the development of close friendships, age factor, low degree of supervision and encouraged to show initiative, gender of employee, and race of employee. The research revealed that security of employment, salary, and prospects for promotion are the most important factors which promote feeling of satisfaction as quantity surveyors in Ondo State. Based on the above, this identified 26 motivational factors from the reviewed literature.

METHODOLOGY

This paper uses a quantitative method approach through questionnaire survey. The primary data was collected through a structured questionnaire after thorough literature review. In view of the

research questions the research population was registered building construction companies within Abuja metropolis and V connect (2019), there are six hundred and sixty-one (661) building construction companies which are, 351 in Abuja Municipal, 99 Garki, 96 Wuse I, 61 Wuse II, and 54 Gwarinpa. The targeted population of this research was primarily the management staff, supervisors and craftsmen located within the selected construction firms in Abuja. 254 well-structured questionnaires were randomly retrieved and analyzed out of the 300 questionnaires administered on 50 selected building construction in the following pattern: 127 from supervisors (50%), 76 from craftsmen (30%) and 51 (20%) from management staff of the firms. Multi-stage sampling technique was adopted for this study. The respondents were divided into strata's; which implies that each of the selected category of respondent's (management, supervisor and craftsmen) was identified as a stratum. Hence the stratified sampling technique. Secondly, the simple random sampling technique was adopted for the selection of respondents within each of the three strata. Relative Importance Index (RII) was used to rate factors affecting construction workers productivity at the work place. The spearman rank correlation was use to established the degree of agreement, between two variables on a ranked order.

RESULT AND DISCUSSION

Results of Motivational Factors That Enhance Productivity

The findings from the field surveys as shown in table 1 reveals that good work environment is the first and most important motivating factor that enhance productivity of construction workers in selected firms in Abuja, going by the overall ranking of the three categories of respondents, with MIS of 4.23. While it with was also ranked 1st with MIS of 4.00 by the supervisors and ranked 3rd and 1st with MIS 4.30 and 4.40 by craftsmen and management staff respectively. Opportunity to be promoted and move forward in your carrier ranked 2nd with MIS of 4.15. the same factor was ranked 2nd with MIS of 3.85 by the supervisors, 4th with MIS 4.20 by craftsmen, and ranked 1st with MIS 4.40 by the management staff. Good salary was ranked 3rd with MIS 4.14 as ranked by all categories of the respondents. This factor was also ranked 3rd with MIS 3.71 by the supervisors, 1st with MIS 4.50 by the craftsmen, and 3rd with MIS 4.20 by the management staff. Recognition by authority as a factor was ranked 4th overall with MIS 4.07. The supervisors ranked it 3rd with MIS 3.71; craftsmen ranked it 2nd with MIS 4.40, and management staff, 4th position with MIS 4.10. Satisfaction derived from work itself had overall ranking of 5th with MIS of 4.02.

Appreciation of effort and reward was ranked 6th in overall ranking by the respondents. This same factor was ranked 2nd with MIS of 3.85 by the supervisors and 5th with MIS of 4.00 by craftsmen and management staff also ranked it 3rd with MIS of 4.20.

Opportunity for skill development was ranked 7th in the overall ranking of the respondents. Although, supervisors ranked it 3rd with MIS of 3.71, while craftsmen ranked it 6th with MIS of 4.10. The management ranked it 3rd with MIS of 4.20. Training and development was also ranked 8th with MIS of 3.97 by overall ranking of the respondents. Supervisors ranked the same factor 3rd with MIS of 3.71 and craftsmen ranked it 6th with MIS of 4.10 and management staff 4th with MIS of 4.10. Job security was also ranked 9th with MIS of 3.82 by overall ranking of the respondents. Supervisors ranked the same factor 6th with MIS of 3.28 and craftsmen ranked it 2nd with MIS of 4.40 and management staff 7th with MIS of 3.80. Good supervision was also ranked 10th with MIS of 3.77 by overall ranking of the respondents. Supervisors ranked the same factor 3rd with MIS of 3.71 and craftsmen ranked it 11th with MIS of 3.50 and management staff 4th with MIS of 4.10.

Table 1: Motivational Factors That Enhance Productivity

SN	Motivation factors	Overall		Supervisors		Craftmen		Management	
		MIS	Rank	MIS	Rank	MIS	Rank	MIS	rank
1	Good work environment	4.23	1	4.00	1	4.30	3	4.40	1
2	Opportunity to be promoted and move forward in your carrier	4.15	2	3.85	2	4.20	4	4.40	1
3	Satisfaction derived from work itself	4.02	5	3.85	2	3.90	7	4.30	2
4	Appreciation of effort and reward	4.01	6	3.85	2	4.00	5	4.20	3
5	Opportunity for skill development	4.00	7	3.71	3	4.10	6	4.20	3
6	Good salary	4.14	3	3.71	3	4.50	1	4.20	3
7	Training and development	3.97	8	3.71	3	4.10	6	4.10	4
8	Good supervision	3.77	10	3.71	3	3.50	11	4.10	4
9	Recognition by authority	4.07	4	3.71	3	4.40	2	4.10	4
10	Bonus	4.02	5	3.57	4	4.50	1	4.00	5
11	Taking part in decision making	4.02	5	3.57	4	4.50	1	4.00	5
12	Compliance with safety provision	3.67	12	3.42	5	3.60	10	4.00	5
13	Administrative practices	3.67	12	3.42	5	3.70	9	3.90	6
14	Challenging work	3.70	11	3.42	5	3.80	8	3.90	6
15	Personal goals	3.54	17	3.42	5	3.40	12	3.80	7

16	Cooperation from other workers	3.57	16	3.42	5	3.50	11	3.80	7
17	Job security	3.82	9	3.28	6	4.40	2	3.80	7
18	Working overtime	3.49	23	3.28	6	3.50	11	3.70	8
19	Holiday abroad with pay	3.66	13	3.28	6	4.10	6	3.60	9
20	Freedom in your workplace	3.52	18	3.28	6	3.70	9	3.60	9
21	facility, e.g. Official car	3.65	14	3.14	7	4.20	4	3.60	9
22	Provision of transportation	3.48	19	3.14	7	3.70	9	3.60	9
23	Health Care Service	3.64	15	3.14	7	4.30	3	3.50	10
24	Sharing Profit	3.64	15	3.14	7	4.40	2	3.40	11
25	Company Policy	3.13	20	3.00	8	3.30	13	3.10	12
26	Telephone Services	2.89	21	2.57	9	3.00	14	3.10	12

Source: Author's field work (2020)

Results of Correlation Analysis by management and supervisors ranking

Table 2 shows that, the Spearman correlation value was positive and very high (0.876). The resulting R² value was also very high at 87.6%. Correlation was found to be significant at the 0.05 level. The “R” value of 0.876 indicates a high relationship between the management and supervisors on the ranking of the motivational factors enhancing construction workers productivity. It was also empirically established that this relationship was statistically significant with P-value 0.035 which is less than 0.05 levels (2-tailed). The coefficient of determination (R²) indicated about 88% relationship between the views of the respondents.

Results of correlation Analysis by supervisors and craftsmen ranking

Table 2 shows that, the Spearman correlation value was positive and very high (0.875). The resulting R² value was also very high at 87.5%. Correlation was found to be significant at the 0.05 level. The “R” value of 0.875 indicates a high relationship between the supervisors and craftsmen on the ranking of the motivational factors enhancing construction workers productivity. It was also empirically established that this relationship was statistically significant with P-value 0.002 which is less than 0.05 levels (2-tailed). The coefficient of determination (R²) indicated about 88% relationship between the views of the respondents.

Results of Correlation Analysis for management and craftsmen ranking

Table 2 shows that, the Spearman correlation value was positive and very high (0.876). The resulting R² value was also very high at 87.6%. Correlation was found to be significant at the 0.05

level. The “R” value of 0.876 indicates a high relationship between the management and craftsmen on the ranking of the motivational factors enhancing construction workers productivity. It was also empirically established that this relationship was statistically significant with P-value 0.000 which is less than 0.05 levels (2-tailed). The coefficient of determination (R²) indicated about 88% relationship between the views of the respondents.

Table 2: Results of correlation analysis for Management and supervisors, Supervisors and Craftsmen and Management and Craftsmen on ranking.

Variables		Spearman Correlation (R)	R ² -values (%)	P-value	Strength of Relationship	Remark
X	Y					
Management	supervisors	0.876	87.6%	0.035	Very strong	SS
Supervisors	Craftsmen	0.875	87.5%	0.002	Very strong	SS
Management	Craftsmen	0.876	87.6%	0.000	Very strong	SS

Key: SS = Statistically Significant NS = Not Significant

DISCUSSION OF FINDINGS

The following deductions were made: There are numerous Strategy for improving productivity in construction projects in the study area but the most paramount among them are discussed based on the earlier analysis. The findings based on the overall ranking of the respondents revealed that good work environment that is working conducive environment in terms of management and facilities is the most important factor that can enhances workers’ productivity. Good salary, bonus, recognition by authority and appreciation all falls within the first five factors that enhances workers’ productivity. Provision of telephone services such as provision of call credits and browsing data was ranked the least important factor by all respondents at 21th this result reveals an in-depth consideration of this factor by all the categories of respondents. The result of the correlation analysis above revealed a very strong relationship between the supervisors, craftsmen and management staff on the ranking of the motivational factors enhancing construction workers productivity.

CONCLUSION

This study critically appraised the motivation as a management strategy for improving productivity in construction projects. The study suggests that most important motivation factor for workers is provision of good working environment which will give the workers a comfortable working atmosphere and will boost their performance. Based on the findings of this research it is concluded motivation factors is an inducement for higher productivity and it should be accorded a right of place by supervisors, management staff and craftsmen's in building construction in order to achieve higher productivity, which will lead to greater contribution to the nation's Gross Domestic Output and also improves the workers performance and general wellbeing. The study therefore recommends that better reward system should be implemented which includes increase in good salary; good work environment, bonus and recognition by the authority. This will definitely motivate and increase their performance of the workers.

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INFLUENCE OF MATERIALS PRICE FLUCTUATION ON COST PERFORMANCE OF BUILDING CONTRACTORS IN ABUJA, NIGERIA

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ABSTRACT

The rate of fluctuation claims by contractors on prices of materials is alarming. This leads to disputes in most building projects and usually affects the cost, time and even quality performance of building projects. Fluctuation in cost building materials poses a significant threat to both the building sector and people aspiring to own houses. The study assessed influence of materials price fluctuation on performance of building contractors in Abuja, Nigeria by examining the causative factors, effects on performance of building contractors and the impact of materials price fluctuation claims on cost performance of building project. The study adopted a survey design approach using quantitative data. Data were collected through well-structured questionnaire administered on 189 respondents including small, medium and large-scale registered building contractors within Abuja using random sampling method; also 23 archival data on material price fluctuation claims on completed building projects in the study area were obtained. The collected data were analysed using Percentages, Relative Important Index (RII), Mean Item Score (MIS) and Pearson Correlation Moment. Result reveals that the main factors responsible for material Price fluctuations are; Exchange rate, Cost of transportation, Inflation of building materials, Cost of energy (electricity, gas). The study also revealed that the major effect of materials price fluctuation on performance of contractors are; cash flow problem of the projects, contractors' loss of profit, delay in project completion, increase in construction cost and poor quality of project outputs. The results further indicate that materials price fluctuation claim has a direct correlation with total project cost with a significant level (p value) of 0.01. It is recommended that drastic steps should be taken by Government to stabilise exchange rate, reduce cost of energy, regulate cost of production and transportation, and contractors should also have appropriate planning, maintain current information, payments within stipulated time and understanding of project requirement.

Keywords: Building materials, Projects, Fluctuation, Price and Contractors' performance.

INTRODUCTION

Building materials play a vital role in the construction industry as they are those materials put together in erecting buildings, materials account for between 50 to 60% of the total construction input, it constitutes the largest single input in building construction (Adedeji, 2012). The primary problems of the construction sector can be classified into two main categories. The first is related to the consequences of integrated planning and implementability, the second problem is related to deficiencies and market price fluctuation of the inputs required for the construction (Mishra and Magar, 2017).

Fluctuations in the costs of building materials in today's unstable market makes difficult to execute construction projects due to significant losses of anticipated profits (Ayeni, 2013). Nega (2008) opine that increase in costs of construction is caused by fluctuation in the cost of building materials, an increase which has a significant impact on overall budgeted cost of construction. Nega (2008) also stressed that construction cost has been the most significant consideration for the execution

of any construction project. Cost of building materials has been one of the factors prohibiting successful housing delivery in Nigeria, housing deliveries have resulted in client and contractor disputes, litigations and project abandonment and cost and time overrun (Odeh, 2002).

The prevailing unpredictable price fluctuations of materials, labour and equipment and less satisfactory practice of compensation are the major hindrances in the growth of the Nigerian construction industry; thus, the situation makes the construction contractors sustain most of the suffering and losses that could result therein (Naveen, 2015). The problems affecting Nigerian contractors and consultants were researched by Ofori (2012) and found that challenges are the same as those noted generally in reports on construction industries in other third world countries. The challenges identified by Ofori (2012) as particularly influencing the performance of Nigerian contractors include lack of ability to obtain adequate working capital, fluctuation in the cost of materials, insufficient organisation, inadequate engineering competence and poor workmanship. Other challenges include an extremely unstable business environment characterised by high inflationary trends, poor organization practices, weak organization structures (Dansoh, 2015). Difficulties in accessing project finance also affect the performance of Nigerian contractors (Badu *et al.*, 2012).

Contractor's performance can be assessed by the level of cost, time and quality of projects delivered to clients. Performance of construction firms in such a situation is essential in order to ensure quality and guarantee acceptable standards. Therefore, it is important to be familiar with the method leading to evaluate the performance of the building contractors (Iwaro and Mwasha, 2012).

In order to minimise the adverse effects of material price fluctuation on contractors Zewdu (2015) opine that the following areas have to be taken very seriously i.e. Update control information continually with current prices, indices, and trends. Vulink, Hampson and Mohammed (2014), recommend the following which includes: Contractors should be committed to undertake the project activities on time avoiding delays, closely scrutinize payment schedules, the time gap from contract agreement to commencement should be minimised, and reduce costs through improved material and financial management techniques. Eshofonie (2008) suggested that contractors, consultants, owners and regulatory bodies should work together to improve the compensation system. Eshofonie (2008) also suggest that the stability in naira exchange rate by Government should be reinforced as instability in the naira will lead to instability in material prices and subsequently affect construction prospect.

The research examined the possible factors, consequential effect of materials price fluctuation on performance of building contractors and determines the impact of materials price fluctuation claims on cost performance of building projects in Abuja, Nigeria.

FACTORS RESPONSIBLE FOR BUILDING MATERIALS PRICE FLUCTUATION

The factors responsible for fluctuations in the cost of building materials have been categorized as economic related factors, building production related factors, stakeholders' related factors and external factors (Mojekwu *et al.*, 2010).

Demand and Supply

There may be surplus supply of materials that are not all taken up at a particular time and vice versa, by so doing fluctuation threatens the prices of these materials. With a rise in demand; the price factors will dramatically increase due to the high volume of materials needed to meet the demand. This trend is directly proportional to the cost of building project under construction (Onyechi, 2010).

Energy costs

According to Oyediran (2016), energy costs have an effect on the production and transportation processes of most construction materials, the prices of electricity bills, petrol, gasoline, coal, renewables and other fuels change quickly, and are acute data points for industry professionals and citizens alike.

Raw materials and input costs

Raw materials costs along with other factors such as gas, oil and energy are the key causes of fluctuation in the prices of building materials such as cement, water proofing and roof members. The cost that goes into production will have effect on the price and quality of the product (Zewdu, 2015).

Inflation

Inflation is the general skyward trend of prices of services and goods within an economy; it is basically a measure of how the prices of goods and services increase over time, the principle behind inflation and how it affects building material prices according to Rakhra and Wilson (2017) is that there is a time lag between an increase in inflation and the effective resulting increase in building material prices.

Crude oil prices

Crude oil is the base for lots of products. These include transportation fuels such as diesel, gasoline and jet fuel; they also include fuel oils used for electricity generation and heating. Crude oil prices measure the spot price of various barrels of oil. Anderson (2011) noted that the global crude oil price is the main driver behind the instability of some building materials such as PVC, which is a polymer whose raw production material is crude oil.

Exchange rates

The exchange rate between two currencies is the amount for which one currency is exchanged for the other, and is used in determining the strength of one currency to another. The degree to which building material prices are affected by exchange rate movements depend on the types and quantities of materials being imported by a country at a specific time, the need to import the raw materials used in the production of building materials locally, and on whether local materials (such as timber, copper and steel) are internationally traded commodities (Karana *et al.*, 2010)

Import duty

Import duty is put in place to shield local producers from clients trying to outsource cheaper goods from abroad. Import duty on materials have been noted to affect the construction industry and

building material prices in countries such as Malaysia, Nigeria, India, Uganda, Kenya and Oman by raising the prices of good imported due to imbalance in export and import rate (Hamsawi, 2011).

Interest rate

The high interest rate of banks and the unpredictability in the foreign exchange market result in serious depletion of a nation's foreign exchange resources, severely affecting the industry with import dependence of about 60% of its raw materials (Jagboro and Owoeye, 2004). However, Oladipo (2012) opined that across the nation, many construction, housing and profitable real estate projects have either been abandoned half way or put on hold because of the scarcity of capital or because of the sky rocketing cost of borrowing. Aside from the increase in the cost of borrowing, high interest rate also causes reduction in spending as people are more inclined to save. Central Bank of Nigeria interest rate as at April, 2018 was 14%.

Currency devaluation

Thomas and Martin (2004) identified the major causes of fluctuation in the cost of building project as materials price increase which they pointed out “devaluation of naira” to be the major cause and suggested price control as an obvious solution in controlling it.

Ordering and delivering process

According to Briscoe (2015), the manner in which the ordering and delivery of materials are done on site contributes to the problems of fluctuation in the cost of building projects. Ideally, site managers will require materials to arrive on site just when they are needed and in required quantity to avoid wastage in one hand and shortages on the other hand.

Human factors

According to Ihuah *et al.* (2015), human factors refer to environmental, organisational, job factors and individual characteristics, which influence behaviour at work in a way which can affect health and safety". This definition includes three interrelated aspects that can lead to material price fluctuation that must be considered: the job, the individual and the organisation:

Design changes

Design change is connected to additional work, due to the absence of comprehensive briefing on the economic, functional and technical requirements of the project by the clients (Mansfield *et al.*, 2014). Abdul-Rahman (2015) emphasized that design change orders resulting in additional work can account for as much as 50% of project cost overrun. Furthermore, additional work is a significant factor contributing to price fluctuation and schedule delays in construction project

Material wastage

Wainwright (2005) in his book “Variation and Final Account Procedure” as he identified wastage of materials as one of the causes of building materials fluctuation in the construction industry. According to Nagapan *et al.* (2012) the majority of waste generated during construction is materials waste, primarily as a result of the use of un-reusable materials, leftovers and debris.

Unfortunately, this material waste amounts about 9% of the weight of materials purchased (Azis *et al.*, 2013).

Supplier default

The results of the study by Nega (2008) revealed that fraudulent practices by suppliers was the second significant factor responsible for fluctuation in construction cost as perceived by construction professionals interviewed. Supplier unable to deliver due to market condition or fraudulent practices result in delay of construction, increase in cost and subsequently use of substandard materials.

Transportation

Sinclair and Mulford (2012) noted that increased material cost is primarily due to increased transport charges. Furthermore, transport and freight costs have been identified as the factors responsible for building material price fluctuation in African countries such as Nigeria, Uganda, and Kenya (Mathews, 2009).

Planning

Eshofonie (2008) noted that planning is one of the most important factors affecting the cost of building materials. Contractors should utilise all resources in effective ways. Proper scheduling is essential in project resource utilisation, as the reverse, inadequate planning, will increase the project cost, suggesting that where there is no effective contractor scheduling and planning on site there will be construction project delays.

Market stockpile

Naveen (2015) pointed out that market stockpile is one of the major causes of fluctuating prices of materials; He attributed the fear of fluctuation to the reserves of materials and reluctance to send large quantities to the market despite surging prices that offer huge opportunity making the price go higher. As the materials are stockpiled, it increases its scarcity causing inflating prices for the available ones.

Force majeure

Force majeure otherwise known as 'Acts of God' is a term that covers a range of events, including revolution, war, riot, earthquake, landslide, fire, political and economic instability and other such risks (Nega, 2008). Where it occurs, it will result in significant fluctuation in the cost of building materials especially when reconstruction comes to mind.

Weather conditions

Weather changes contribute an enormous challenge to global warming emission of CO₂ by buildings under in use and under construction, while building materials are a significant component of any building project, climate change indirectly or directly will also have an effect on the price and use of building materials during or before building construction (Ofeogbu, 2017).

Government policies

According to Mansfield *et al.* (2014), governments may also invoke their powers to initiate or halt projects on social, political and environmental grounds which will eventually lead to fluctuation in materials. No construction work happens in a single space; rather it is subject to a group of powers from regulatory control to political intervention.

EFFECTS OF MATERIAL PRICE FLUCTUATION ON CONTRACTORS' PERFORMANCE

According to Willis (2013), every project is a dream until it is completed and to that extent, the phenomenon of fluctuation will continue to be a dreaded but inevitable incursion into most project plans. Willis (2013) further states that fluctuation is fallout of inflation which is a global economic problem that has defied all theories and measures meant to curb it. In fact, experience has shown that some clients had abandoned their projects due to staggering increase in the cost caused by fluctuation or variation or both. Escalation in contract sums can emanate from several sources including fluctuations. According to Windapo and Cattell (2013), substantial growth in the construction industry is subject to price stability in materials costs as these have increased at faster rates than the expected. Client and project contractors have been facing serious issues to maintain steady cost projection on construction projects (Akanni *et al.*, 2014). Akanni *et al.* (2014), in their study of the implications of the rising cost of building materials in Nigeria, determined fluctuation in construction costs as the most significant effect of increase in the cost building materials. This is in agreement with Windapo and Cattell (2013) who found out that on the key issue affecting the development of the construction industry in South Africa that increase in costs of building materials was a significant factor affecting development of the construction industry. Abiola (2011) noted the consequences of inflation and fluctuation in construction cost to include project abandonment, increase in construction cost, and extension of project completion time, use of substandard materials and decrease in revenue of the construction firm. Nwuba (2004), while agreeing with Abiola (2011) stated that the cost of construction which resulted from the material price fluctuation combined with other economic problems to give rise to the abandonment of much ongoing project development and aborting of many development proposals.

Price fluctuation can have effect on contractors, clients/owners and the project itself. The major effects of price fluctuation on contractors, if not well compensated, according to Abdo (2010) are profit loss of contractors, cash flow (project financing) problem of the projects, delay in project completion, poor quality of project outputs, bad contractor reputation (negative review), hindered adequate implementation of innovation by the contractor.

Increase in project abandonment

Project abandonment is the unplanned suspension of the progress of work especially at the execution stage such as the refusal or failure to complete a contract after practical completion time (Nwachukwu, 2016). Numerous construction projects are temporarily or even permanently abandoned, and according to Nwachukwu (2016), the predominance of many uncompleted and abandoned projects resulted from finance related crises and material related factors. Fluctuation and high cost of building materials are major factors that lead to uncompleted and sub-standard buildings and this has a significant effect on the industry for delivery of housing (Makinen, 2010). Also, an upward review of contract sum leads to conflicts between contractors and clients, likely

leading to cases of abandonment where investments are tied down, since such project will not be put to use at the expected time.

Cash flow problem of the projects

When contractor does not have enough capital to be able to pay its liability. Cash flow problems and shortage of working capital can in extreme circumstances push efficient and profitable firms into liquidation. It is also possible that a firm is pulled into insolvency by the failure of another firm. This “domino theory” may apply if a client becomes insolvent owing large sums of money to the contractor, or if a main contractor fails owing cash to one or more regular subcontractors (Lowe, 2017).

Contractual disputes between the parties

In the face of materials price fluctuation, contractual disputes may arise in many forms, for instance, from the supply of defective goods or services because of changes in price. They prove a time consuming and costly distraction in project execution. According to Udeh (2011), contractual disputes can quickly turn into protracted, costly and unpleasant litigation. They generally do long-term damage to the relationships of all involved and add to the overall costs of the contract.

High rate of contractors’ fraudulent practices

Contractor fraud refers to illegal business practices committed by individual contractors or contracting firms hired to construct, renovate, repair or rebuild residential properties. Azhar, Farooqui and Ahmed (2008) noticed that common contractor frauds as material price fluctuate include; asking for a substantial upfront cash advance, leaving out key project details / low-ball offers and selling of materials.

Low volume of construction product

Output of the construction industry in Nigeria is quite low when compared with the construction industry in many developed countries. Ganiyu (2016) stated that the Nigerian construction industry is faced with a number of threats, primarily affecting its contractors’ performance in sustainable housing delivery. Similarly, according to a study by Windapo *et al.* (2013) in Nigeria, millions of middle- and low-income families are being priced out of the market for home ownership due to the unpredicted price of building materials. The observations from these studies were due to the increase in the cost of building materials.

Poor quality of workmanship

According to Lam *et al.* (2010), output of quality buildings and structures is one of the attributes of a developed construction industry. Lam *et al.* (2010) further claimed that there were records of conflicts between clients and building contractors over review in contract sums, so to avoid conflicts and still be in the business, some contractors fell back upon substandard or insufficient materials for construction projects, an action which contributed to cases of building collapse. Undeniably, workmanship plays an important role in project quality (Iwaro and Mwashia, 2012).

Unemployment of construction workers

Construction industry workers are extremely varied, as the industry is comprised of a wide range of both skilled and unskilled workers (Akanni *et al.*, 2014). Ayodele and Alabi (2010) found that fluctuation in the cost of building material is killing the construction industry as many contractors are unable to accurately forecast expected profit on the project, a situation that has contributed to laying-off of workers and closure of firms in some extreme cases. Oladipo and Oni (2012) supported this notion by stating that macro-economic indicators have an effect on the cost of building materials which has contributed to unemployment.

RESEARCH METHODOLOGY

The study adopted a survey design approach using quantitative data. Data were collected through well-structured questionnaire administered to respondents and archival data were also collected. The population consisted of 250 registered small, medium and large building contractors in Abuja gotten from the Corporate Affairs Commission (CAC directory, 2020). The population was subjected to Krejcie and Morgan Table for determining sample size at 5% limit of error and at 95% confidence level. This was reduced to 152, which is the minimum sample size for this research. A total of 170 questionnaires were retrieved from 189 distributed, 162 were found valid along with 23 archival data from building contractors that keep record of fluctuation claims due to materials price fluctuations. The 162 represents an effective response rate of 95.29% and this was considered suitable for analysis.

A simple random sampling technique was adopted by assigning a consecutive number to the population (1-250), then Pseudo Random Number Generator (PRNG) was used to generate a sequence of numbers in order to allow each set of data an equal chance of being selected within the population. The collected data were analysed with the aid of MS Excel to the Percentile, Relative Important Index (RII), Mean Item Score (MIS) and Pearson Correlation Moment. Opinions of the respondent and the archival data are presented in Tables 1-4.

RESULTS AND DISCUSSION

This section presents and discusses the results of this study.

Demographic information of the respondents

Result in Table 1 shows the characteristics of the respondents. From the table, it shows that the highest number of respondents' years of experience is between 11-15 years (30.2%) followed by 6-10 years (24.7%). The highest value of executed projects handled by most of the respondents was from 51 to 100 Million (27.8%). This indicates that most of the respondents have handled construction projects involving significant sums. Majority of the respondents are holders of Bachelor's Degree with 24.1% followed by 19.8% of them holding Master's Degree. In terms of professional membership, 80% of the respondents are members of their professional bodies while only 14.8% of the entire population are none members. As a result, respondents in this study are associated with impressive academic backgrounds and experience; hence their response to the research questions can be relied upon.

Table 1: Demographic information of the respondents

Category	Classification	Frequency	Percentage
Years of experience	1-5	24	14.8
	6-10	40	24.7
	11-15	49	30.2
	16-20	26	16.0
	Above 20	23	14.1
	Total	162	100.0
Value of Executed Project	1-10 Million	35	21.6
	11-50 Million	40	24.7
	51- 100 Million	45	27.8
	101- Above	42	26.0
	Total	162	100.0
Academic qualification	OND	18	11.1
	HND	30	18.5
	PGD	28	17.3
	B.Sc./B.Tech.	39	24.1
	M.Sc./M.Tech.	32	19.8
	PHD	15	9.3
	Total	162	100.0
Professional Qualification	MNIA	35	21.6
	MNIOB	31	19.1
	MNSE	36	22.2
	MNIQS	36	22.2
	None	24	14.8
	Total	162	100.0

Source: Researcher's field survey (2020)

Factors Responsible for Material Price Fluctuations in Building Construction Projects

Table 2 indicates that exchange rate, cost of transportation, inflation of building materials and cost of energy (fuel, electricity, gas) with RII values of 0.95, 0.93, 0.92 and 0.91 respectively are ranked as the top four important factors responsible for material price fluctuations in building construction projects.

Table 2: Factors Responsible for Material Price Fluctuations in Building Construction Projects

S/N	Material Price Fluctuations Factors	RII	RANK
1	Exchange rate of currency	0.95	1
2	Cost of transportation	0.93	2
3	Inflation of building materials	0.92	3
4	Cost of energy (electricity, gas)	0.91	4
5	Government policies on materials	0.86	5
6	High import duty rates on materials	0.81	6
7	Raw materials and input costs of building materials production	0.80	7
8	Increasing interest rate	0.80	8
9	Political instability of the nation	0.77	9
10	Rapid devaluation of national currency	0.77	10
11	level of supply and demand	0.77	11

12	Unstable crude oil prices	0.76	12
13	Ordering and delivering process of building materials	0.75	13
14	Suppliers default to make materials available at the needed time	0.75	14
15	Availability of substitute product	0.74	15
16	Ineffective planning	0.72	16
17	Market stockpile of needed materials	0.71	17
18	Human factors	0.71	18
19	Frequent design changes	0.71	19
20	Frequent weather condition change	0.61	20
21	Force majeure (An act of God)	0.56	21
22	Material wastage on site	0.53	22

Source: Researcher's field survey (2020)

Consequential effects of material price fluctuation in project performance of contractors

It is evident from Table 3 that cash flow problem of the projects was ranked as the most consequential effect of material price fluctuation in project performance of contractors with MIS value of 4.70, this was followed by contractors' loss of profit with MIS value of 4.63, delay in project completion 4.61, increase in construction cost 4.54 and poor quality of project outputs 4.51 were all ranked as the most consequential effects often experienced by the building contractors in the course of material price fluctuations in projects.

However, a close look at the result in Table 3 shows that all the identified 24 effects of building materials price fluctuation had an average MIS value of 4.08. This implies that to a considerable extent all the 24 effects have high tendency to affect contractors' performance in building construction in Abuja.

Table 3: Consequential Effects of Material Price Fluctuation in Project Performance of Contractors

Consequential effects	MIS	Rnk	Effects
Cash flow (project financing) problem of the projects	4.70	1	Very high effect
Profit loss of contractors	4.63	2	Very high effect
Delay in project completion	4.61	3	Very high effect
increase in construction cost	4.54	4	Very high effect
Poor quality of project outputs	4.51	5	Very high effect
Use of substandard materials for construction	4.48	6	High effect
Building collapses due to the use less quality of materials	4.45	7	High effect
Contractual disputes between the parties	4.43	8	High effect
Bankruptcy of contractor	4.41	9	High effect
Decrease in revenue of the construction firm	4.32	10	High effect
Low volume of construction product	4.27	11	High effect
Project abandonment	4.25	12	High effect
High rate of contractors' fraudulent practices	4.23	13	High effect
Improper construction methods applied by contractor	4.11	14	High effect
Completion at the expense of other projects	4.01	15	High effect
Unemployment of construction workers	3.87	16	High effect
Bad reputation of contractor	3.80	17	High effect
Contractors ineffectiveness	3.64	18	High effect
Conflict between client and contractors	3.63	19	High effect

Affect client expectation's on quality of project delivery	3.43	20	Moderate effect
Stress on contractors	3.41	21	Moderate effect
Increase in the cost of repair	3.41	22	Moderate effect
Hindered adequate implementation of innovation	3.39	23	Moderate effect
Affect the aesthetics value of building product	3.22	24	Moderate effect
Source: Researcher's field survey (2020)		Ave. 4.08	

Impact of Materials Price Fluctuation Claims on Cost Performance of Building Projects

Table 4 shows that there is a very strong positive relationship between materials price fluctuation claim and total project cost (p value 0.01). This implies that constant fluctuation claims due to materials prices will lead to a corresponding fluctuation in the final project cost.

Moreover, the percentage impact of fluctuation claims to total project cost ranges from 0.52% to a maximum of 8.55% with an average of 3.85%

Table 4: Impact of Materials Price Fluctuation Claims on Cost Performance of Building Projects

Project No	Initial project cost (₹)	Final project cost (₹)	Material Fluctuation claims (₹)	Percentage Contribution
1	130,610,025.63	155,625,000.00	8,088,001	5.20
2	48,255,650.00	66,755,548.22	4,200,020	6.29
3	35,000,000.00	40,045,850.00	2,000,000	4.99
4	43,658,214.24	60,174,286.00	3555624.00	5.91
5	21,988,797.60	23,904,805.11	500555.25	2.09
6	213,648,783.60	250,000000	6,080,073	2.43
7	276,931,365.20	301,500467	3,120,000	1.03
8	87,300,000.00	116,100,000.00	5,168,000	4.45
9	1,380,000,000.00	1,500,000,000.00	36,280,021	2.42
10	22,226,680.20	28,226,365.55	1,680,000	5.95
11	19,233,000.00	31,325,225.21	2,200,009	7.02
12	100,000,000.00	145,000,000.00	8,320,000	5.74
13	500,000,550.00	523,700,000.00	12,004,540	2.29
14	1,600,800,000.00	1,790,000,400.25	28,000,605	1.56
15	740,090,000.00	760,000,350.42	18,550,000	2.44
16	31255988.00	42,732,000.00	1,480,000	3.46
17	92,000,000.00	100,300,272.00	520,000	0.52
18	40,977,574.08	46,099,770.84	2,355,087.4	5.11
19	46,083,600.00	51,844,050.00	1,500,000	2.89
20	45,512,288.00	49,201,324.00	1,800,300	3.66
21	14,200,000.00	19,800,000.00	1,254,000	6.33
22	20,100,000.00	25,789,000.00	268,000	1.04
23	6,785,230.00	8,991,694.40	397,163.7	4.42
24	87,377,000.00	106,136,000.00	2,560,000	2.41
25	142,000,000.00	150,125,200.25	6,800,000	4.53
26	60300500.00	82500054.25	2025000.22	2.45
27	23,746,966.38	30,275,961.20	2589000.00	8.55
28	30123548.58	32,495,459.50	850000.00	2.62

Source: Researcher's field survey (2020)

CONCLUSION AND RECOMMENDATIONS

This research assesses the influence of materials price fluctuation on cost performance of building contractors in Abuja, Nigeria with a view to minimising the resultant effects on contractors. Based on the findings, the study concludes that the main factors responsible for material price fluctuations are; Exchange rate, Cost of transportation, Inflation of building materials, Cost of energy (electricity, gas). The major effect of materials price fluctuation on performance of building contractors are; cash flow problem of the projects, contractors' loss of profit, delay in project completion, increase in construction cost and poor quality of project outputs. The study also revealed that a positive relationship exists between materials fluctuation claims and final project cost in the zone. However, in order to provide lasting solutions and bring about steady building material prices and avoid circumstances of constant price fluctuation, it is recommended that drastic steps should be taken by Government to stabilise naira exchange rate, reduce cost of energy, and reduce cost of production and transportation of building materials. Furthermore, contractors should have appropriate planning, maintain current information, payments within stipulated time and understanding of project requirement.

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ASSESSING THE WILLINGNESS OF QUANTITY SURVEYORS TO PAY FOR 5D BIM

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ABSTRACT

5D Building Information Modelling (5D BIM) is a derivative of the building information modelling (BIM) for the cost management of construction projects. As professionals primarily responsible for the cost management of infrastructure projects, the adoption of 5D BIM among Quantity Surveyors is very low in the Nigerian construction industry and elsewhere. The main problem relates to the lack of sound economic basis to decide whether to adopt 5D BIM for cost management of construction projects. There is an ongoing larger study investigating the willingness of Quantity Surveyors to pay for 5D BIM. The paper employs the willingness to pay (WTP) technique in the research process to establish an economic basis of Quantity Surveyors' decision to adopt 5D BIM. The paper utilizes ideas from the field of psychology and quantity surveying profession in eliciting Quantity Surveyor's willingness to pay for 5D BIM. The paper will serve as a theoretical framework for grounding future research, especially the investigation of the willingness of Quantity Surveyors to pay for 5D BIM in the Nigerian construction industry also in theory it will advance decision-making in the field of psychology for the construction industry professionals most importantly quantity surveyors and to the Academics it will be a reference material for future research.

Keywords: 5D BIM, Behavioural Economics, Cost Management, Quantity Surveyors, Willingness to pay (WTP).

INTRODUCTION

Automating in the construction industry and in the era of Industry 4.0, 5D BIM has emerged as a technological application for effective cost management works (Harrison & Thurnell, 2015).

5D BIM is an essential process used for cost management function of construction project. According to Aouad *et al.* (2014), 5D BIM facilitates cost-benefit analysis and cash flow management of construction projects, quantity take-off and extraction of quantities from 3D models (Harrison & Thurnell, 2015), while Smith (2016) attributes 5D BIM as an important models that gives quantity surveyors opportunities to provide knowledge and expertise functions to their client and other construction professionals

5D BIM provides better understanding of construction cost and also ensures clash within a design are detected in more details so as to ensure conflict-free construction on-site (Davidson, 2009). According to Barnes and Davies (2015), 5D BIM provides early estimation that ensures all project participant are adequately informed about the project cost before commencement.

Similar to other technology application such as virtual reality (VR) and augmented reality (AR) gadgets, adopting 5D BIM and similar technological applications, including VR and AR gadgets for construction procurement, is often dependent on whether they are economically beneficial. This can be conceived as whether the benefits of adopting such technological applications outweigh their costs (Lu *et al.* 2014; Shin *et al.* 2018). To this end, professionals or professional organizations in construction need a basis of a decision to determine whether the adoption of technological applications are economically beneficial to their profession. Investment appraisal techniques such as return on investment (ROI) and cost-benefit analysis (CBA) can be found in the literature for evaluating whether the adoption of BIM is a sound economic decision for the adopters in the construction industry (Lee *et al.* 2012). As a derivative of BIM but with much lesser social-economic justification for adoption, there is no such study employing appraisal techniques to develop a sound economic basis for adopting 5D BIM for cost management of construction works by quantity surveyors. As such, lack of an economic decision basis for adopting 5D BIM may however be of direct detriment to quantity surveyors adopting 5D BIM for cost management functions. This can lead to the inability of quantity surveyors to determine the economic value-added of 5D BIM to construction projects (Harrison & Thurnell, 2015).

Buyers' reactions to price of product and services is a measure of their judgment to buy or not to buy (MarineLeGall, 2009). The monetary release power of a buyer to a product is its willingness to pay (Lusk & Hudson, 2004). According to Hellum (2015), WTP is a tool used in comparing buyers alternative to a product. In behavioural economics, the reaction of buyers to the prices of products and services is their willingness to pay (WTP). WTP is therefore, an economic decision-making basis for ascertaining the maximum price a buyer accepts to pay for a given quantity of goods or service. MarineLeGall (2009) defines WTP as the maximum price the consumer accepts to pay or the upper limit of the acceptability margin. Also, Hellum (2015) observes WTP as an economic decision-making basis which helps users decide the choice of an item when comparing or considering purchasing an item for use. WTP has been previously used to evaluate the economic decisions in construction in previous research. Zhang *et al.* (2018) used WTP to evaluate the decision of construction professionals to pay for green building in China. Also Kyung *et al.* (2012) used WTP to evaluate hoteliers' willingness to pay an extra premium for green hotel initiative in the United States of America. From previous studies, adopting 5D BIM is an enormous problem for quantity surveyors (Mayouf *et al.*, 2019). In this paper, the big research problem is lack of sound economic basis for quantity surveyors to decide whether to adopt 5D BIM for cost management of construction projects or not. In an attempt to address this problem, a Master degree project is being undertaken using WTP techniques to assess quantity surveyors WTP for 5D BIM, the WTP technique is proposed to be employed as a research process in establishing an economic decision basis for quantity surveyors to adopt 5D BIM. The research process only is presented in this paper. It will become a framework for employing WTP technique in behavioural economics for BIM research in the field of Quantity surveying.

LITERATURE REVIEW

BIM and 5D BIM

BIM is the geometric and non-geometric representation of building into a digitalized recognized format using reliable shared knowledge. Sebastian (2011) defines BIM as an integrated model in which all process and product information are combined, stored, elaborated and interactively distributed to all relevant building actors. Similarly, Abubakar *et al.* (2014) view BIM as the development and use of computer model to simulate design construction and operation of a facility using rich data and parametric digital representation of the facility through stakeholders collaboration.

5D BIM is a new tool where a digital building model is created and identified by different properties and specifications to support the process of cost estimating and pricing (Stanley & Thurnell, 2014). Also Moses (2018) define 5D BIM as the linking of the fifth dimension to the 3D BIM to ensure extracting of non-graphical data and model attributes to generate cost information and material quantities within a level 2 environment.

According to Barnes and Davies (2015), 5D BIM provides the platform for digital construction information which allows contractors, employers and other project team members to generate accurate cost and essential estimating information with model element attributes like the size of the projects, area and productivity projections of the design.

5D BIM in Quantity Surveying

Stanley and Thurnell (2014) observed that quantity surveyors are the major beneficiary of 5D BIM because it helps them perform tasks such as quantity take-offs, estimation and cost management in a collaborative project environment. Also Harrison and Thurnell (2015) affirm the findings of Stanley and Thurnell 2014, and Mitchel (nd) on the benefits of 5D BIM. The studies reveal that 5D BIM provides numerous benefits to quantity surveyors over the traditional methods mainly through increased efficiency, better cost planning, initial concept estimates, elemental cost benchmarking, quantity take-off and bidding. Other benefits are; pricing of bill of quantities, as-built cost data and facilities management, change orders, variation and payments, visualization, improved value management services to the client and rapid identification of design changes. Also with the use of 5D BIM. Soleen *et al.* (2017) identify improvements in projects productivity through adequate communication, computerized quantities take-off and cost calculations, and cost savings in operation cost of a project as an advantage of 5D BIM to the traditional quantity surveying functions. Similarly Muzyimwe (2011) highlights that 5D BIM raises the value of quantity surveyors services by offering them ability to envision, simulate and explore the impact of different design and construction scenarios through the integration of cost data, quantities and project within a BIM model. Also Smith (2016) summarizes that 5D BIM allows quantity surveyors to spend more time in providing knowledge and expertise to the project team as the time taken to generate quantities is significantly reduced through automation with the aid of 5D BIM model. However, despite the benefits of 5D BIM, the adoption level is low with 14% (Stanley & Thurnell, 2014) among quantity surveyors. Barriers such as difficulty in understanding 5D BIM work flow, missing information on 3D BIM model produced by designers (Mayouf *et*

al., 2019), lack of government support (Harrison & Thurnell, 2015), lack of software compatibility, lack of protocol for coding objects within BIM model (Stanley & Thurnell, 2014), lack of demand by the client for BIM use, high initial cost for BIM system setup and lack of guidance from BIM expert to construct a piece of information enriched BIM model (Kim, *et al.*, 2016), the scale of culture change required/lack of flexibility and lack of supply chain buy-in (Eadie, *et al.*, 2013). Also, findings from Stanley and Thurnell (2014) suggest that 7-10% of construction professionals sometimes use 5D BIM for automations, with vast majority believing that 5D BIM makes the traditional QS's redundant.

Economic Decision Techniques for Adopting BIM

There are very few studies on establishing the economic basis for adopting BIM. These studies are identified in Table 1. It could be observed that the studies employed different techniques for establishing an economic basis for adopting BIM. These techniques are mainly the return on investment(ROI) and cost-benefit analysis (CBA) which are based on the principle of investment appraisal. The shortcoming of ROI is that a design must be devoid of errors to ensure optimal benefit (Lee *et al.*, 2012). The shortcoming of CBA is that BIM must be used all through the planning, designing and construction stage which might be expensive (Shin *et al.*, 2018). As suggested previously, the 5D BIM is a derivative of BIM which quantity surveyors employ for cost management of construction works. Despite this, there is no study establishing an economic basis of decision for adopting 5D BIM by quantity surveyors for cost management of construction works. In the next sections, the research seeking to fill the gap above is described.

Table 1: Summary of the literature of economic basis for adopting BIM

Literature sources/authors	Title of publication	Name of techniques and descriptions	Remarks and limitations
Lee, G., Park, H. K., & Won, J. (2012). D3 City project—Economic impact of BIM-assisted design validation. <i>Automation in Construction</i> , 22, 577-586.	D3 City project — Economic impact of BIM-assisted design validation	ROI was used to evaluate the economic impact of BIM based on the avoidance costs of rework due to design errors in a case study project	• The use of ROI could only be optimized if design is properly done, and error-free • ROI also rely on past available and futuristic data for its computation
Walasek, D., & Barszcz, A. (2017). Analysis of the adoption rate of Building Information Modeling (BIM) and its return on investment (ROI) <i>Procedia Engineering</i> 172, 1227-1234	Analysis of the adoption rate of Building Information Modeling (BIM) and its return on investment (ROI)	ROI was used to emphasis the benefit of adopting BIM in project by the design team	• The awareness of ROI will increase if clients are willing to pay professionals who are using BIM. • Increase in cost for the client due to extra payment demands by construction professional, will negatively affect the ROI
Shin, M.H., Lee, H.K., & Kim, H.Y, (2018) Benefit-Cost Analysis of Building Information Modeling (BIM) in a Railway Site-Sustainability (10) 1-10	Benefit-Cost Analysis of Building Information Modeling (BIM) in a Railway Site	CBA was used to evaluate the economic impact of using BIM through out a project, from the planning, designing and construction phase of a railway	• Project delay and rework could be eliminated if BIM is used through out the project. • CBA requires complete information data in order to identify flaws in a project.
Lu, W., Fung, A., Peng, Y., Liang, C., & Rowlinson, S, (2014) Cost-Benefit analysis of Building Information Modeling Implementation in building projects through demystification of time-effort distribution curves. <i>Building and Environment</i> (82) 317-327	Cost-Benefit analysis of Building Information Modeling Implementation in building projects through demystification of time-effort distribution curves.	CBA was used to evaluate the economic impact of using BIM on the project through demystification of time-effort distribution curves to ascertain the monetary implication of using BIM and non-BIM usage	• CBA ensures benefit only in a project • CBA could only be used if there is available existing data. Unavailability of data sometimes lead to cost being underestimated or exaggerated

Proposed Research: Willingness to Pay (WTP) for 5D BIM

The proposed investigation on the willingness of quantity surveyors to pay for 5D BIM was borne out of the need to establish an economic basis of decision for adopting 5D BIM for cost management of construction works.

Transitioning towards the digital mode of service delivery to improve client satisfaction has been challenging for quantity surveyors (Muhammad *et al.*, 2017). At the same time, the BIM technological application and the derivatives have become available to quantity surveyors and allied professionals to automate their service delivery. Particularly, the 5D BIM, aids quantity surveyors to automate services such as cost management, quantity take-off and project planning faster (Stanley & Thurnell, 2014). Therefore, increasing the adoption of 5D BIM among quantity surveyors is important to improve quantity surveying services (Eadie *et al.*, 2013).

PRESENTING OF THE RESEARCH PROCESS

Willingness To Pay (WTP) Technique

The willingness to pay (WTP) technique is proposed to establish an economic basis of decision for adopting 5D BIM for cost management of construction works. Basically, the (WTP) is define as the maximum price a given consumer accepts to pay for a product or service. It comprises of important features (income level, preference, taste, alternatives e.t.c) that can help individual and companies to ascertain certain information needed before a product is introduced or bought so that the maximum amount that can yield satisfaction can be known (MarineLeGall, 2009).

Generally, the broader objectives of the study are to: identify 5D BIM features, ascertain the willingness to pay of quantity surveyors for 5D BIM features, understand the price range quantity surveyors will be willing to pay for each 5D BIM features and identify factors that affect quantity surveyor's willingness to pay. However, for the purpose of this research process a framework is proposed to assess the willingness of QS to pay for 5D BIM features. As illustrated in Figure 1. There are four stages after identifying the research objectives. The research process employs the WTP technique as follows.

Stage 1: Selecting an appropriate model

After identifying the research objectives, an appropriate research model must be chosen in other to dissect the objectives into measurable items. Probit model is proposed to be employed for this study which was adopted by Xian (2012) to assess why rural households choose not to participate in the open and optional village development fund in the poverty-stricken areas of china. Similarly, Maximum likelihood method is also being employed as adopted by Vandermersch and Mathijs, (2004) to assess consumer willingness to pay for domestic milk in Belgium. relative importance index was chosen as the best model in answering the research objectives. A probit model is a regression tool used to elicit an individual choice. This model calculates the maximum price an individual can pay for an item, it thus comprises of the demography, price and decision to pay or not of quantity surveyors for 5D BIM features. The maximum likelihood model thus elicits the likely WTP of the respondent in consideration of wide range of characteristic, ranging from the respondent demographic information, choice and other available characteristics so as to elicit the overall WTP of the respondents.

The relative importance index (RII) will be employed to elicit respondent decision according to their hierarchy of choice for 5D BIM features and factors influencing QS WTP decisions, which in turn affects the behavioral tendencies of QS to choose whether to pay for an item or not.

Stage 2: Operationalizing the selected model

The relative importance index (RII) equation used by Tam et al. (2004); Holt (2014), will be employed. The equation is presented below

Equation 1:
$$RII = \frac{\sum W}{A \times N}$$

Relative importance index will be used to answer objective one (1), to identify 5D BIM features and four (4), factors influencing QS WTP, this model thus characterize: W= represents the rating given to each factor by the quantity surveyors, A=represent highest weight and N= represents the total number of samples.

Probit model equation, mean $WTP = (a + (\sum (\beta_1 * X_a)) / \beta_2) * -1$ (Gaddum, 1933)

Probit model will be employed to answer objective three (3), to know the price quantity surveyors are willing to pay for each 5D BIM features, this model thus characterize: X^a = Mean value of the X variables, β = A vector of observed corresponding estimated variables, α = Generic constant. Maximum likelihood method used by Hosmer and Lemeshow (1989) will be employed. The equation is presented below

$$WTP = (\beta_1 + \beta_2 Bid + B3 characteristic + \varepsilon)$$

The maximum likelihood (ML) estimation will be employed, as it is the general model of estimation to predict a dichotomous dependent variable based on explanatory variables. ML estimation yields values for the unknown parameters by maximizing the probability of obtaining the observed set of data. ML will answer objective two (2) to know QS WTP for 5D BIM, this model thus characterizes: β =A vector of observed corresponding estimated variables, Bid= QS observed response Characteristics =Demographic information, ε = error variables

Stage 3: Identifying data required

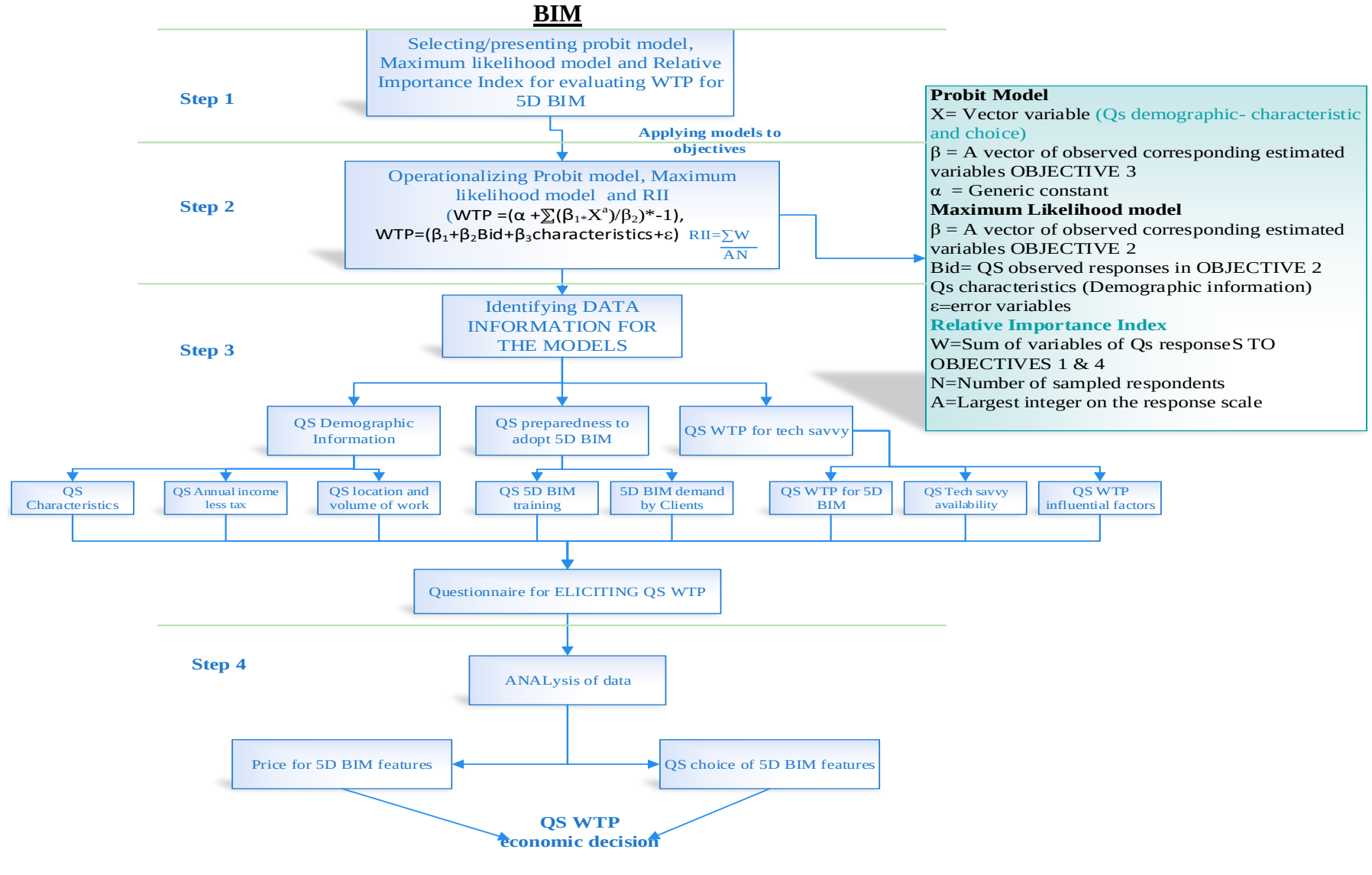
This step is essential because data required to elicit QS WTP needs to be identified and ascertained. Quantitative data would be obtained from quantity surveyors using questionnaire. The respondents in this study are quantity surveyors (academia and practitioners) who carry out their services in lagos state Nigeria, this is imperative because lagos is the technological hub of Nigeria (Ameh & Osegbo, 2011). The questionnaire for collecting data from the respondents is divided into three phases: Phase 1 generally infer the demographic information of the respondents, which include their characteristics, annual income and location of business. Phase 2 characterize the preparedness of QS to adopt 5D BIM which include their training and demand by client to use it for execution of project. Phase 3 characterize the respondents ICT skills, availability and usage of ICT tools in carrying out its functions and also availability of training for new ICT skills and tools. These three phases are the key components of the questionnaire to be used in eliciting the respondents WTP for 5D BIM features.

Stage 4: Analysis of data

After collating the data, statistical package for social sciences (SPSS) and Microsoft Excel will be employed to analyse the data. SPSS will be employed to analyse objective 1 and 4 using relative importance index, however, objective 1 will be ranked using a likert scale 5-0 with scale 5 to mean very high extent, and scale 0 to mean very low extent. Very high extent ranking will reveal that respondents prefers the features as to very low extent showing no preference, like wise objective 4

will be ranked using a likert scale 5-0 to 5 meaning strongly agree and 0 to mean strongly disagree. Strongly agree will reveal factors influencing respondent WTP while strongly disagree shows no influence. For objective 2 and 3 SPSS and Microsoft Excel will be employed, coefficient of the variables will be generated using SPSS, while aggregating to determine WTP price and WTP will be employed using Microsoft Excel. General screening of data will be done to check for mistakes, improper answering and antecedent's requirement on the questionnaire. Thereafter the mean price of respondents WTP will show the range QS are willing to pay for 5D BIM features.

Fig 1: ILLUSTRATION OF THE WILLINGNESS OF QUANTITY SURVEYORS TO PAY FOR 5D



CONCLUSION

Quantity surveyors need an economic basis to make sound decisions on whether to adopt 5D BIM for cost management services in construction. Therefore, larger research investigation on the willingness of quantity surveyors to pay for 5D BIM and borne out of the need to establish an economic basis of decision for adopting 5D BIM for cost management of construction works was proposed. This paper presents the research process only. The literature review focused on the uses of BIM and 5D BIM in quantity surveying and also identifying the shortcomings in the existing techniques for establishing economic basis for adopting BIM. Following the review, the larger research on the willingness of quantity surveyors to pay for 5D BIM was introduced and the summary comprised the aim, research problem, significance and scope of the investigation. Finally, the research process was presented, firstly by describing the willingness to pay (WTP) technique and the relevance to the research subject. Secondly, the stages involved in the research process employing the WTP technique were explained and illustrated in logical order. The research process is presented and will be employed to achieve the aim in the larger investigation. The illustration of the process is expected to become a framework for employing WTP technique in behavioural economics for BIM research in the field of quantity surveying.

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PRIORITIZING EVALUATION CRITERIA FOR CONTRACTOR SELECTION IN NIGERIA

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ABSTRACT

Public procurement process in Nigeria is laden with obvious loopholes, among several challenges. With the insistence on the lowest most responsive tender criterion, contractors have continually exploited the tender evaluation and the selection process in spite of their deficiencies in qualification and relevant resources. Based on a review of the subsisting evaluation method in Nigeria, this paper aimed at prioritizing contractor selection criteria on construction projects. A sample size of 200 was computed. With the aid of relative importance index (RII) and severity index (I) of data obtained from 119 (59.5%) valid questionnaire drawn from Architecture and Engineering professionals was analyzed. The result shows that ‘proper planning’, ‘credit worthiness’, ‘transition plans’, ‘plant and equipment holdings’, ‘financial stability’, ‘past performance’, and ‘quality’ are the most important factors that are prioritized in contractor’s selection, according to the clients and consultants. Inadvertently, the probability of success in tendering will be high if contractors are selected through the application of multi-criteria methods like the qualification-based or Best Values selection. This study reveals that proper planning, Credit Worthiness, Transition plan, Plant and equipment holdings and financial stability of the contractors are the top five priority criteria for bid evaluation and contractor’s selection in Nigeria. Although the study is situated in Nigeria, the generalizability of the method and results obtained, require caution because of the peculiarities in procurement laws at the different levels of government.

Keywords: Contractor Selection, Evaluation, Tender, Public Procurement, Selection Criteria, Nigeria.

INTRODUCTION

Contractor selection impacts on project outcomes, justifying the quantum of researches on improving the process (Bochenek, 2014). In developing countries like Nigeria, the public procurement is faced with challenges like contractor’s under performance as a result of lack of qualification and resources (Acheamfour, Kissi, & Adjei-Kumi, 2019; Tomczak & Jaśkowski, 2018). Inappropriate contractor selection criteria adopted by the employers in the procurement of civil and building works result in persistent cost and time overruns and compromised quality (Holt, 2010). Contractors exploit the loopholes in the existing tender evaluation processes, engaging in opportunistic behaviors (Ogunsina, Ogunsemi, & Awodele, 2013). This practice, if left unchecked, is capable of denting the image of Nigeria in the Benchmarking of Public procurement of 180 countries around the world (IBRD, 2017).

Importance of Contractor Selection on Construction Projects

Globally, the major factors that impede on the successful completion of construction projects are; bid evaluation and contractor’s prequalification encountered by the construction industries (Ochrana & Hrnčířová, 2015). These factors vary depending on the culture, environment, processes, and organization of the construction industry. According to Holt (2010), the mismanagement of the tendering process; with the lowest bid criterion, lead to failure or delay in the completion of construction projects. However, many construction industries in developing

countries are still using the lowest bid selection methods for awarding construction contracts (Acheamfour et al., 2019; Grega, Orviska, Nemec, & Lawson, 2019; Nguyen, Lines, & Tran, 2018; Ochрана & Hrnčířová, 2015). The construction industries of developing economies are underperforming in projects despite research on several solutions to the overarching challenge of selecting the most suitable contractor for the construction of building and civil engineering works. The underperformance of the public procurement process is attributed to the procurement personnel's resistance to change and continuous application of the lowest bid selection (Alptekin & Alptekin, 2017; Oo & Yan, 2018) as aptly supported by the extant procurement laws. Adebisi, Ojo, & Alao (2018) averred that the successful completion of construction project is directly impacted by the selection of a suitable constructor. Other researchers (Dissanayake, 2017; Osei-Kyei et al., 2018) concur that competent contractors are very necessary all-through the project lifecycle.

Procurement research are situated (De Clerck & Demeulemeester, 2016; Lenderink, Halman & Voordijk, 2019; Mickovski, Black & Smith, 2014), largely because of country-specific peculiarities and variance in the tender evaluation and selection process. Bid evaluation and contractor selection depend on differing decision criteria which are based on selection criteria (Hatush & Skitmore, 1997a; Semaan & Salem, 2017; Singh & Tiong, 2006), selection techniques (Arroyo, Ballard & Tommelein, 2014; Arroyo, Fuenzalida, Albert, & Hallowell, 2016; Haapasalo, Aapaoja, Björkman, & Matinheikki, 2015; Schöttle & Arroyo, 2017), multi-criteria decision making (Ben-Arieh & Easton, 2007; Sharma, 2015; Taylan, Kabli, Porcel & Herrera-Viedma, 2017; Topcu, 2004) and procurement routes (Dissanayake, 2017; Kumaraswamy & Dissanayaka, 2001). Even where similar procurement laws apply, like in the EU, procurement performance of respective countries differ in terms of the selection process employed in the evaluation of bids (Flynn, 2018). Notable factors that are relevant in assessing contractors include: the overall national interest, project packaging, invitation, prequalification, shortlisting and bid evaluation (Acheamfour *et al.*, 2019). It has therefore become necessary to articulate the relevance of factors influencing the contractor's selection in tendering. The results of which will guide contractors in prioritizing their focus. The outcome of this paper will possibly influence policy makers in the drive to amending the subsisting laws on contractor selection in Nigeria.

The Nigerian Public Procurement Act (PPA, 2007) recommends the selection of the "lowest most responsive bid" criterion by public procuring entities. Other criteria include experience, past performance, personnel, financial position, plant and equipment, and management capability. In spite of the adherence to the low-bid consideration, procurement stakeholders acknowledge persistent flaws in the contractor selection process, bid evaluation, and the procurement system. According to Mahmood (2010), 80% of construction projects in Pakistan are delayed, and only 20% were completed within schedule and cost. The delays are largely caused by contractors; through inadequate experience, improper planning, and poor site management. Adebisi *et al.* (2018) averred that poor contractor selection leads to adverse project performance; including cost and time overruns resulting in disputes between clients and contractors, the extreme case of which is the failure in projects. It is evident that there are specific issues in Nigeria that are associated with selecting an appropriate contractor during the bidding process in award of construction projects (Bagaya & Song, 2016). Some of the delays are also attributable to project consultants who also play key roles in selecting the most suitable contractor during the bidding process (Omar,

2012). Drawing from the general factors obtained from the literature, it is necessary to evaluate which of them are most essential in choosing from amongst contractors. It is therefore necessary to prioritize the criteria used for contractor selection and bid evaluation in the Nigerian public procurement system. This study recounts and examines contractor selection and bid evaluation criteria through an in-depth review of literature as well as the criteria prescribed in the procurement laws and other relevant factors that may influence the procuring entities' decision on bid evaluation in contractor selection.

Seminal works on contractor selection (Holt, Olomolaiye & Harris, 1995; Jennings, Holt, Jennings & Holt, 1998; Wong, Holt, & Harris, 2001) have identified qualification requirements using quantitative model for choosing contractors. Holt *et al.* (1995) showed that choosing a contractor has to be based on the value for money, rather than automatically selecting the lowest bidder as the primary aim of the process is to identify the optimum tender and not the lowest bidder. Most clients have varied methods of quantifying the criteria, while others resort to a subjective assessment of contractors based on the information solely provided by them. Anecdotal evidences in Nigeria reveal that some procuring entities do not have uniform selection criteria for selecting contractors. The tradition of selecting contractors based on the lowest most responsive bid makes the lowest price a dominant requirement in project award (BPP, 2011; PPA, 2007).

CONTRACTOR SELECTION CRITERIA

Many researchers (Darvish, Yasaei & Saeedi, 2009; Hatush & Skitmore, 1997; Topcu, 2004) have identified the main criteria for prequalification and bid evaluation; including financial soundness, management and technical ability, experience and performance of the contractor, availability of resources, quality management, and health and safety management. Chen, Manley, Lewis, Helfer, & Widen (2018) and Fong & Choi (2000) also identify more criteria, as universally accepted for the selection of contractors and bid evaluation including; primary financial capability, technical capability, team management, and health and safety track record of the contractor.

Other popular criteria reported by several studies for contractor evaluation and selection include financial stability, technical qualification and capacity, knowledge of technical personnel, experience, management capacity, relationship with others and past performance, reputation, and health and safety (Acheamfour *et al.*, 2019; Cheaitou *et al.*, 2018; Lines & Feng, 2016; Nguyen *et al.*, 2018; Xia *et al.*, 2013) More reliable choice of Best Values (BV) selection has compelled many researchers (Ahmed, Gharaibeh, & Damjanovic, 2012; Gransberg & Shane, 2015; Hasnain *et al.*, 2017; Taylor, Yang, Wang, Wang & Ma, 2015) to deemphasize sole price-based selection by identifying qualification-based selection as better alternatives to the traditional price-based selection of contractors. More to the financial criteria, researchers have introduced additional criteria including physical and human resources (Cheng, Wang & Sun, 2012; Kusumarukmi & Adi, 2019; Rhee, Oh & Yu, 2016), time (Minchin, Li, Issa, & Vargas, 2013; Safa, Yee, Rayside, & Haas, 2016; Tabish & Jha, 2018; Taylan *et al.*, 2017; Wambugu, 2014), quality (Adenuga, 2013; Basu, 2014; Jelodar, Yiu & Wilkinson, 2016; Singh & Tiong, 2005; Yasamis, Arditi, & Mohammadi, 2002), risk (Al-Sobie, Arditi & Polat, 2005; Alofi, Kashiwagi & Kashiwagi, 2017; Asgari, Awwad, Kandil & Odeh, 2016; Cattell, Bowen & Kaka, 2010; Cheng *et al.*, 2012; Farooq, Thaheem & Arshad, 2018; Gajjar, Kashiwagi, Sullivan & Kashiwagi, 2016), and past relationships with clients and other contractors (Ahmed, El-adaway, Coatney, & Eid, 2016; Hatush & Skitmore,

1997b; Kadefors, Björlingsson & Karlsson, 2007). Table 1 lists some contractor selection criteria as identified in literature.

METHODOLOGY

A quantitative method was adopted for this paper by surveying a sample of Architecture and Engineering Construction personnel drawn from the public sector client as well as consultants who are engaged in the prequalification and evaluation of bids and subsequent selection of contractors for various construction projects in Nigeria. Using the Krejcie & Morgan, (1970) Table, a sample size of 200 was obtained and considered to be a purposively meaningful representation of the population (Chisala, 2017; Schweitzer, Hofmann, & Meinheit, 2019). 250 questionnaires were randomly distributed amongst registered construction consultants and clients' representatives. The questionnaire was made up of three segments. The first section collects demographics of the respondents; Employer organization, experience, job title, General perception on construction contract procurement processes in Nigeria and the effectiveness of the Nigerian Public procurement act. The second segment listed out 28 sub-criteria; loaded in five (5) major criteria that influence the tender evaluation and the contractor selection decision.

Table 1 Contractor Selection Criteria from Literature

Main Selection Criteria	ContractorPalaneeswaran & Kumaraswamy (2001)	Hatush & Skitmore (1997)	Holt <i>et al.</i> (1995)	Holt, Olomolaiye, & Harris (1994)	Topcu (2004)	El-Agha (2013)	Cheng <i>et al.</i> (2012)	Alia, Bohari, Skitmore, Xia, & Teo (2017)
Financial stability	√	√		√	√		√	
Background of company	√	√			√		√	
Technical capacity	√	√		√		√		
Cost	√	√	√	√	√		√	
Performance					√	√		
Standard of quality	√	√	√		√	√	√	
Occupational health and safety	√	√			√		√	
Time performance	√	√	√	√	√	√		
Management capability					√		√	
Failed contract					√	√		
Progress of work					√			
Human resource management		√					√	
Level of technology					√	√		
Relationship with client	√	√		√		√	√	
Relationship with sub-contractors					√	√		
Fraudulent activity					√		√	
Competitiveness	√						√	√
Green Practices								
Sustainable Practices								√

22 selection criteria were extracted through the review of literature as summarized in Table 1, while 5 of the sub-criteria were added through a focus group discussion with experts who attended a conference organized by the Bureau for Public procurement in Nigeria.

Five-point Likert scale: (1) least important, (2) slightly important, (3) important, (4) very important, and (5) extremely important, was adopted to evaluate the severity of each sub-criterion for evaluation of tenders and contractor selection. The third segment of the questionnaire, spells out the items identified as relevant considerations on a successfully completion of a construction project in Nigeria. Participants were asked to identify the threshold of the issue, by indicating its rating (severity) from a choice of low, medium, and high. Participants were also asked to tick(✓) the type of tender evaluation criteria that is considered to be the maximum weight in selecting a contractor on a three-point Likert scale (low, medium and high)

Data Analysis and Results

131 questionnaires were filled by the respondents, out of which 12 were not complete responses and therefore were removed from further analysis. Therefore, 119 questionnaires were accepted for analysis. The criterion that influence the exclusion of incomplete response was relevant in finding the pattern of answering most of the questions. Four (4) randomly identified sub-criteria (4, 11, 18, and 26) were treated for quality checks and their responses obtained were cross-checked to verify their degree of accuracy. A response was eliminated where responses to all the four sub-criteria were found different from most of the other responses. By the elimination method applied, the consistency of the responses were kept in check (Dong, Lepri, Pianesi & Pentland, 2010; Saaty, 2008).

Test of Normality on Data

This paper hypothesizes to test the normality of collected data that:

H₀: The sampled population is normally distributed.

H₁: The sampled population is not normally distributed

The Kolmogorov-Smirnov (K-S) test for normality was conducted using SPSS in order to prove the validity or otherwise of the hypotheses, t. The test result is shown in Table 2. The population for the study is normally distributed as the K-S statistic values and the significance values are greater than 0.05 (Sig. > 0.05).

The significance value must be greater than 0.05 in a normal distribution, t (Creswell, 2014; Creswell & Creswell, 2018). It implies that the evidence to reject the claims that the sampled population is normally distributed is not sufficient. Hence, the Alternative hypothesis H₁ is rejected and Null hypothesis H₀ is accepted in this study.

Reliability and Validity of Research Data

According to Kothari (2004), a measure that analyzes whether items in a survey questionnaire are reliable to provide consistent results after respective testing in variable environments is referred to as ‘reliability’. Cronbach’s Alpha test was conducted and value for the complete dataset was evaluated as 0.857 ranging between $0.9 \geq \alpha \geq 0.8$. Consequently, the data is adjudged to be ‘acceptable’ or ‘fit’ for subsequent analysis (Sijtsma, 2016). On the other criteria in the questionnaire, respondents were asked about their individual and organizational experience,

severity indexes, preferred procurement method, and questions associated to contracts type and procurements. The Cronbach's Alpha value for the variables is computed as 0.842, indicating that the collected data is reliable and all items retain a fair internal consistency for the investigation.

Table 2: K-S Test Results for Normality of Data on Response of AEC Professionals

Category of Main Criterion	Sub-Criterion	Kolmogorov Smirnov ¹		Shapiro-Wilk	
		Statistic d _f	Significance	Statistic d _f	Significance
Financial Soundness	Financial Stability	.235	112.342	.265	113.090
	Estimated Costs	.233	112..233	.297	113.121
	Banking Arrangements	.261	112.121	.361	113.232
	Satisfactory Settlement	.241	112.433	.261	113.133
	Credit Worthiness	.320	112.123	.300	113.131
	Salary Satisfaction	.398	112.135	.298	113.544
Technical Ability	Past Experience	.328	112.150	.228	113.245
	Capability with Projects	.228	112.231	.228	113.365
	Plant & Equipment Holdings	.388	112.566	.288	113.242
	Quality Assurance	.599	112.566	.299	113.222
	Labor force Retention	.223	112.755	.253	113.128
	Proper Planning	.291	112.234	.292	113.433
	Method of Execution	.322	112.233	.241	113.245
	Environmental Sustainability	.286	112.240	.288	113.263
	Green Practices*	.218	112.020	.299	113.266
	Sustainable Practices*	.233	112.101	.253	113.274
	Past Performance & Quality	.235	112.167	.292	113.256
	Organization and Management Capabilities	.222	112.250	.241	113.266
Managerial Capability	Methodology of Managing Sub-contractors	.212	112.266	.250	113.264
	Risk Management	.255	112.128	.250	113.363
	Accident Rates	.268	112.112	.261	113.246
	Transition Plan	.322	112.221	.322	113.356
	Past Failures	.227	112.112	.227	113.378
	Attention to staff Welfare & Safety	.297	112.112	.297	113.463
Health & Safety	Health & Safety Procedures	.278	112.544	.278	113.633
	Accident Rate	.406	112.356	.406	113.257
	Management Safety Accountability	.332	112.232	.332	113.256
	Methodology of Managing Sub-contractors	.279	112.134	.279	113.232
Reputation	Length of Time in Business	.324	112.123	.324	113.244
	Past Client-Contractor Relationship	.296	112.129	.296	113.456
	Political Considerations	.311	112.677	.311	113.356
	Current Reputation	.267	112.344	.267	113.375
	Compatibility with Project	.286	112.234	.286	113.786
	Behavior with Staff	.283	112.233	.283	113.357
	Level of Technology	.266	112.122	.266	113.364

¹Lilliefors' Significance Correlation

Procurement (Contract) Vs Respondents' Experience and Evaluation Method

A key question asked the respondents was about the type of procurement (contract) offered to contractors in the last five to ten years. The responses as shown in Table 3 indicate that mostly traditional contracts were awarded in the Pakistani construction industry, with 59 respondents indicating this choice on their questionnaire. Design and Build procurement method was adopted by 28 respondents, while the remaining 32 respondents indicated that Turnkey procurement contracts were widely used in the industry over the last ten years.

Table 3 Procurement Type (Contract) Versus Respondents' Experience

Respondents' Experience	Procurement Contract			Total
	Design Bid-Build (DBB)	Design and Build (DB)	Collaborative Projects	
6-10 years	3	7	1	11
11-15 years	5	7	1	13
16-20 years	51	14	30	95
Total	59	28	32	119

Respondents were also asked to indicate which method of evaluation they believe to be the most effective in selecting the best contractor. The answers are tabulated in Table 4. According to 61 respondents, the multi-criteria method of evaluation provides the clients with the best value from a contractor. On the other hand, 58 respondents indicated that the single-step criterion of the lowest bid price was the best method to evaluate a contractor. Likewise, 41 participants showed a preference for the multi-criteria method while awarding contracts through the traditional procurement method. This is followed by 32 respondents who preferred the single criterion of contractor evaluation while awarding contracts through the Turnkey procurement method.

Table 4 Type of Procurement Versus Method of Evaluation Used by Respondent

Evaluation Method	Procurement Contract			Total
	Design Bid-Build (DBB)	Design and Build (DB)	Collaborative Projects	
Sole Price Criterion	12	6	7	25
Multi-Criteria evaluation	47	22	25	94
Total	59	28	32	119

Results of Relative Importance Index (RII)

The financial soundness was the first category for which RII was calculated. Kothari (2004) argued that RII is relevant in establishing the contributions of specific variables to an entire system or a phenomenon. The empirical confirmation of the factors that contribute to the implementation and preferences in evaluating a tender and selecting a particular contractor was carried out with the aid of RII as calculated using Equation 1. Where:

W is the weight given to each factor by the respondents (Ranging from 1 to 5)

A is the highest weight (i.e. 5 in this study) and;

N is the total number of respondents.

$$\text{Relative Importance Index (RII)} = \frac{(\sum w)}{(A * N)} \quad \dots\dots \text{Equation 1}$$

All the sub-criteria were ranked using RII values. Based on Table 5, RII of the “credit worthiness” of a contractor was calculated as 0.86, making it the most important main criterion for the contractor selection and bids evaluation. The ‘financial stability of contractor’, with RII value of 0.84, was identified as the second most important criterion. At the third rank, two criteria ‘banking

arrangements and bonds’ and ‘satisfactory settlement of final accounts on past projects’, with RII of 0.82 each, are placed.

Table 5 RII on Sound Financial Status Criterion

S/No	Question	Factor	RII	Rank
1	SFS5	Credit Worthiness	0.89	1
2	SFS1	Financial Stability of the Contractor	0.82	2
3	SFS3	Banking Arrangements and Bonds	0.81	3
4	SFS4	Satisfactory Settlement of Final Accounts on Past Construction Projects	0.78	4
5	SFS2	Estimated Cost of Projects/Tender Price	0.77	5
6	SFS6	Employee's Satisfaction in terms of Salary (Monthly)	0.77	6

The next category of the questions pertains to the factors influencing the contractor’s technical ability. From Table 6, the top three factors impacting the technical ability of contractors include ‘proper planning’ (RII=0.848), ‘plant and equipment holding’ (RII=0.837), and ‘quality assurance’ (RII=0.828). It should be noted that ‘past experience of contractors’, was ranked 7th with RII of 0.813 while ‘compatibility of the project’ was ranked 8th with RII of 0.802. These findings provide a better insight into what clients and consultants should consider when selecting contractors for a construction project.

Table 6 RII on Technical Ability (TAB) Criterion

S/No	Question	Factor	RII	Rank
1	TAB7	Proper Planning	0.848	1
2	TAB2	Plant and Equipment Holdings	0.837	2
3	TAB5	Quality Assurance	0.828	3
4	TAB6	Labour Force Retention	0.822	4
5	TAB3	Permanent Work Force (Staff)	0.817	5
6	TAB8	Method of Execution	0.816	6
7	TAB1	Past Experience	0.813	7
8	TAB4	Compatibility with the Project	0.802	8

Management capability is the third category, analyzed for contractor selection. The responses obtained are summarized in Table 7. ‘Transition plan’ was ranked first with RII value of 0.864. It was followed by ‘Past Performance and Quality’ (0.833). Ranking of these sub-criteria gives a better idea as to which of the variables are more significant.

Table 7 RII on Management Capability (MCB) Criterion

S/No	Question	Factor	RII	Rank
1	MCB5	Transition Plan	0.864	1
2	MCB1	Past Performance and Quality	0.833	2
3	MCB2	Organization and Management Capabilities	0.832	3
4	MCB3	Methodology of Managing Sub-Contractor	0.825	4

The fourth category of health and safety has become an important criterion for the selection of contractors. Many researchers (Acheamfour *et al.*, 2019; Hasnain *et al.*, 2017; Welch, Russell, Weinstock & Betit, 2015) have reiterated the immense importance of health and safety requirements in contractor selection. This is particularly relevant, with the emphasis currently placed on health and safety issues by most professional organizations in Nigeria. The responses are summarized in Table 8. The most important factor for the selection of contractors, based on health and safety, is determined by Occupation, Safety & Health Act, OSHA accident rates (accident rates)' with RII value of 0.811. It was followed by 'health and safety procedures' (RII=0.810), 'management safety accountability' (RII=0.804), and 'attention to site welfare and safety' (RII=0.783).

Table 8 Relative Importance Indices (RII) for Health and Safety (HSF) Criterion

S/No	Question	Factor	RII	Rank
1	HSF3	Accident Rate	0.811	1
2	HSF2	Health and Safety Procedures	0.810	2
3	HSF4	Management Safety Accountability	0.804	3
4	HSF1	Attention to Site Welfare and Safety	0.783	4

The last category analysed for RII values was the reputation of contractors. This category had five variables that needed to be analysed in order to understand the importance of each factor. Table 9 provides the results of RII analysis. The factor 'Past Client-Contractor Relationship' was considered to be the most important with RII value of 0.827. Other factors, in descending order, are ranked as: 'Behaviour with Staff' (RII=0.822), 'past failures (incomplete projects)' (RII=0.817), 'Length of time in Business' (RII=0.815), and 'Current Reputation in Market' (RII=0.805).

Table 9 RII for Reputation (RPT) Criterion

S/No	Question	Factor	RII	Rank
1	RPT3	Past Client-Contractor Relationship	0.827	1
2	RPT5	Behaviour with Staff	0.822	2
3	RPT2	Past Failures (Incomplete Projects)	0.817	3
4	RPT1	Length of time in Business	0.815	4
5	RPT4	Current Reputation in Market	0.805	5

Severity Index

In addition to the RII, many academics in the built-environment research recommend the application of a 'Severity Index' score that can be used to analyze the responses based on their severity score (Idrus, Sodangi, & Amran, 2011). Therefore, this study's results further examine the severity index, computed to assess the frequency of responses.

According to Idrus et al. (2011), in order to determine the severity of factors, severity index is computed thus:

$$\text{Severity Index (I)} = \frac{(\sum ai.xi)}{5(\sum xi)} \times 100\% \quad \text{..... Equation 2}$$

Where;

xi is the frequency of responses for i in which i is one of the Likert scale responses (i.e. 1, 2, 3, 4 and 5).

ai is the constant expressing the weight assigned to the i^{th} response (for $i = 1, 2, 3, 4, 5$, value of ai is 0, 1, 2, 3, 4).

The Severity Index helps in prioritizing all the criteria considered in this study. The criteria with the highest severity index (5) are ranked as the topmost criteria. The criteria that obtain the least severity index (%) are ranked as the lowest. This was determined by evaluating the five-point Likert scale to relative importance indices for each of the criteria using Equation 2.

Table 10 shows the result of the severity index as visually displayed in Figure 3 with the results of selection criteria that are applied in contractor selection by the procurement personnel as well as the consultants. ‘Proper planning’ is the topmost-ranked criterion for contractor selection with a severity index of 94%. Proper planning is a sub-criterion for ‘technical ability’ in which it ranked 0.87 on the Relative Importance Index. The next most important sub-criteria are ‘satisfactory settlement’. Then, ‘behaviour with staff’ and ‘financial stability’ were ranked as the second most important selection criteria with severity index of 86% each. Both client personnel and the consultants concur that these requirements are equally important in selecting the most appropriate contractor in public procurement. The next significant sub-criterion is ‘Organization and Management Capabilities’ with a value of 84%.



Figure 1 Severity Indices (In %) of Contractors Selection Criteria

Discussion of the Results

A thorough review of literature and the analysis of empirical data has shown a prioritized criterion for tender evaluation and contractor selection in the Nigerian public procurement. It has shown that ‘proper planning’ is the most significant criterion for contractor selection, according to AEC

professionals in Nigeria with severity index of 94%. The significant sub-criteria related to proper planning are ‘meeting with schedules’, ‘managerial capability of the contractor’, ‘programme of work’, and ‘capability with past projects. The results are inconsistent with some researches around the world; Malaysia (Idrus *et al.*, 2011), Burkina Faso and Pakistan (Bagaya & Song, 2016), Gaza Strip (El-Agha, 2013), and The Autonomous Region of Cantabria (San-Cristóbal, 2012) where ‘Proper planning’ was a top-ranked criterion for contractor selection with a severity index of 88%. Next most important sub-criteria are in Bagya & Song (2016) and Idrus *et al.* (2016); credit worthiness’ and ‘transition plan’ each with severity index of 87% each. Similarly, the AEC personnel concur that the criteria were equally important in selecting the most appropriate contractor in public procurement. The next significant sub-criterion was ‘plant and equipment holding’ with a severity index of 86%.

Proper planning is a compound term that entails the navigation of the contractor within the complex construction terrain of Nigeria. Its ranking as the topmost criteria in this study shows that the AEC procurement personnel in Nigeria expect contractors to show sufficient plan to handle risks associated with construction project all-through the construction project development process. In Nigeria, public projects are reputed to be highly risky in terms of clients’ commitment to the terms of contract (Idiake *et al.*, 2015).

Table 10 Severity Index and Ranking of Criteria for Selection

Criteria for Selecting Main Contractor	$a_1 \times x_1$	$a_2 \times x_2$	$a_3 \times x_3$	$a_4 \times x_4$	$a_5 \times x_5$	$\sum(a_i \times x_i)$	$5 \sum x_i$	Severity Index (%)	Rank
Proper Planning	0	0	24	88	600	712	750	0.90	1
Credit Worthiness	0	8	30	80	580	698	750	0.87	2
Transition Plan	0	22	57	80	500	659	750	0.69	7
Plant & Equipment Holdings	0	50	15	40	550	655	750	0.76	4
Financial Stability	0	14	120	12	500	646	750	0.75	5
Past Performance & Quality	0	32	60	72	480	644	750	0.67	11
Management Capabilities	9	12	63	116	425	625	750	0.66	12
Quality Assurance	5	32	69	56	460	622	750	0.42	23
Behavior with Staff	0	8	57	316	240	621	750	0.57	17
Methodology of Managing Sub-contractors	5	32	69	56	460	622	750	0.82	3
Past Failures	0	8	57	316	240	621	750	0.71	6
Banking Arrangements	0	28	129	44	410	611	750	0.53	17
Labor force Retention	0	54	30	168	355	607	750	0.62	14
Accident Rates	0	52	42	172	335	601	750	0.45	21
Past Client-Contractor Relationship	8	58	51	40	430	587	750	0.52	19
Risk Management	0	46	84	156	300	586	750	0.68	10
Salary Satisfaction	0	46	84	156	300	586	750	0.51	20
Permanent Workforce	0	54	30	168	355	607	750	0.46	22
Level of Technology	0	52	42	172	335	601	750	0.41	24
Method of Execution	8	58	51	40	430	587	750	0.35	24
Political Considerations	0	46	84	156	300	586	750	0.28	28
Current Reputation	0	46	84	156	300	586	750	0.62	13
Satisfactory Settlement	0	8	57	316	240	621	750	0.34	25
Past Experience	0	28	129	44	410	611	750	0.61	15
Management Safety Accountability	0	54	30	168	355	607	750	0.35	24
Health & Safety Procedures	0	52	42	172	335	601	750	0.29	27
Compatibility with Project	8	58	51	40	430	587	750	0.56	18
Length of Time in Business	0	46	84	156	300	586	750	0.59	16
Attention to staff Welfare & Safety	8	58	51	40	430	587	750	0.50	20
Estimated Costs	0	46	84	156	300	586	750	0.32	26

Source: Survey, 2020

CONCLUSIONS

This paper prioritized contractor selection criteria according to clients as well as consultants in Nigeria for construction projects. The sensitivity of contractor selection decision cannot be overemphasized. The support for Best Values selection, according to the study findings shows that construction professionals involved in public procurement recognize the immense importance of qualification-based selection criteria for the selection of contractors in public procurement. This is concluded based on the ranking of the finance-related criteria by the clients and the consultants. The study is limited in that the study group were not differentiated on the basis of their participation in federal, state or local government projects. In order to obtain a more specific results, a similar study should encompass practitioners and client representatives engaged in Federal government organization and projects in order to minimize complexities attendant to disparity in the procurement laws between local, state and the federal levels of government.

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EFFECT OF SUPERVISION ON CONSTRUCTION PROJECT DELIVERY IN ABUJA, NIGERIA

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ABSTRACT

The role of the industry in the achievement of projects that are economically, socially and environmentally sustainable cannot be over-emphasized. It is therefore necessary for the construction industry to focus on the improvement of supervision of its operatives in construction project delivery. This study therefore, examined the effect of quality supervision of construction operatives on project delivery in Abuja, Nigeria. A survey research design method using the quantitative approach was adopted for the study. The population for this study comprises construction professionals that involves in the execution of building projects in Federal Capital Development Authority (FCDA) and Efab Properties Limited in Abuja. The population size for the study was 70. Since the population size was less than 200, a census of the total members of the population (70) structured questionnaires were administered among construction professionals while 57 were retrieved at 81% returned rate. Descriptive method of data analysis was adopted using Mean Item Score (MIS). The findings from the study revealed that proper manpower management, material handling and transport waste management, and design interpretation with MIS value of 4.66, 4.64 and 4.59 respectively are the most effective factors that lead to quality supervision. The study concluded that construction firms should spend more time and resources in improving its manpower management, material handling and transport waste management, and design interpretation. Thus, the study recommended that construction industry should focus on the training and improvement of its operatives, since the poor manpower management is identified as the effective factor of quality supervision.

Keywords: Manpower, Training, Operative, Supervision, Project, Delivery.

INTRODUCTION

The construction industry an important component of every economy as it plays a significant role in the economy of developing countries (Kheni, 2008). The industry occupies a dynamic spot in the economy of every country because of its imperative influence to the progression of development (Oyewobi, 2011). This industry by nature, is said to have peculiar problems and special requirements. The quality of site supervision has a major influence on the overall performance and efficiency of construction project. Inadequate supervision is believed to be one of the major causes of poor project delivery. Alwi, Keith, and Sherif (2001) also argue that the quality of site supervision in any country is directly related to the supervisor's level of experience gained through formal training. There has been enough evidence to show that most of the constructions done in Nigeria are done without proper supervision at construction site. It has also been observed that government concentrates in issuing the documents and collecting the required fees or the reward as the case may be instead of monitoring procedures (Madu, 2005). Projects are used in all economic and non-economic fields as mean of organizing the activity, aiming the achievement of desired objectives (Beleiu *et al.*, 2019).

Thompson and Gilbert (2011) defined supervision as a process of watching over. Some of problems confronting project supervision in the recent time which has to do with the discrepancies between the design and construction process when construction operatives are at the centre of it

all because of their inconsistent knowledge application and skills during building production process. Windapo (2012) identified critical working conditions; commitment of all project contributors; prearrangement of site layout; inadequate top management support and indeterminacy of project team as the major factors affecting supervision of project. He also emphasized that where projects failures occur due to scarce skilled or experienced tradesmen. Construction labour requires highly skills in accordance with level of the competencies, the type of work, and role complexity (Windapo, 2012). According to Ahmad, Sutrisno, Muhamad and Suparji (2017), professionalism of both experts and skilled workers is one of the key to effective and successful implementation of building and civil engineering construction project.

A lot of researchers have worked on supervision in the construction industry with regard to the various aspects of construction and came up with different views and opinion. Gidado (2016) worked on the “resultant effect of poor supervision in building project in Nigeria”. He opined that construction activities, tasks in every project phase are only achievable by adhering to the project documents and by extension adequate supervision. Gidado (2016) also reveal supervision has a positive influence on project quality delivery and he recommended that there is need for further study to identify, assess and examine other resultant effects of other factors affecting the quality of building projects especially the ultimate collapses in the Nigeria’s construction Industry. Ahmad *et al.* (2017) worked on “enhancing the competitiveness of skilled construction workers through collaborative education and training” opined that the competence profile of construction workers is low. Ogundipe, Olaniran, Ajoa, and Ogunbayo (2018) assessed the impact of quality supervision on construction operatives project delivery in Nigeria. They postulated that though skilled operatives are knowledgeable in their area of specialisation but adequate supervision on application of materials and other components of building would help them to correct quite numbers of error before it’s escalated into exorbitant damages on sites. According to Ogundipe *et al.* (2018), quality of a project is not a luxury but a critical implementation of the project plans with adequate supervision to ensure project success. Adenuga (2013) believed that every party to projects has suitable roles to perform if quality service delivery must be attained. Ogunde, Eseoh, Joshua, Bamidele, Amusa and Ogunde (2017) opined that the most prominent factors that affect project delivery were inadequate managerial skills, poor project planning and unavailability of funds.

None of the above cited studies researched specifically on the effect of quality supervision of construction operative on project delivery in Abuja, Nigeria. This is the gap this research intends to fill. This study is centred on the effect of quality supervision of construction operatives on project delivery in Abuja, Nigeria with the view of improving project delivery in Nigeria.

LITERATURE REVIEW

Construction Industry

The construction industry often acts as a catalyst to stimulate the growth of a nation’s economy (Ali and Rahmat, 2010). Construction industry all over the world is often perceived to be the life wire of its respective economy as it cuts across all aspects of human activities (Ayangade, 2009). The Nigeria construction industry is not an exception to this.

Construction Project Supervision in Nigeria

Nnadi (2018) identified poor construction quality to be a major cause of building collapse in Nigeria. Thompson and Gilbert (2011) defined supervision as the process of overseeing and watching over a work or set of activity. Nnadi (2018) also agree that weak foundation, usages of substandard materials and promotion of quackery among construction operatives. Supervision is a method for invigorating, controlling, enhancing, reviving, empowering and regulating group of workmen with the expectation of seeking collaboration among them for the successful execution of their supervision tasks. Nigeria is one of the fast-developing countries in the world with large number of people engaged in construction projects. However, the workers are skilled and unskilled. The success of completing any construction project depends heavily on the quality of supervision. Naturally, the quality of supervision is dependent upon the supervisor's skill. A supervisor is usually given authority and responsibility for planning and execution of the work. Supervisors are managers, whose major activities focus on leading, coordinating and directing the work of others to achieve group goals. (Shinde, Gupta and Desai, 2014). In addition, they argue that a successful supervisor has to deal with several skills such as management skills, human relation skills and skills in leadership, motivation, and communication and organization behaviour. Nnadi (2018) postulated at every stage of construction, there is a need for expertise supervision and monitoring to reduce risk during construction processes.

A successful project is very much depending on the construction professionals to act as an effective manager (Omran and Hussin, 2009). Zulu and Chileshe (2008) observed that majority of local contractors 'poor performance has negative implications in competing with other contractors. Jarkas and Radosavijevic (2013) outlined factors that affect productivity and workers motivation as delay payment, lack of a financial motivation, rework, change in design at construction stage, overcrowding, quality level of drawings, inexperience supervisors, setting wrong target and materials shortage on site. Supervision a collective problem solving medium and as such is one of the most effective tools of ensuring project success. Afolabi, Emeghe, Oyeyipo and Ojelabi (2016) noticed that Nigerian Artisans cut corners and carry out hasty construction in meeting their daily target that makes contractors to depend on migrant craftsmen. Joshua, Olusola, Ogunde, Amusan, Ede, and Tunji-Olayeni (2017) maintained that lack of knowledge on application of cement are responsible for low standard of concrete produced on sites in Lagos State, Nigeria. Construction supervision must be gear towards ensuring high quality standard of work and the processes engaged in carrying them out by the parties involved. Ogundipe *et al.* (2018) reported that supervisor/workmen ratio on sites remained one of the ignored factors responsible for low safety practices. In Nigerian construction industry, supervision has been a major concern that could limit quality performance of construction projects. Construction industry is labour-intensive, which involves human effort and performance. Construction is a key sector of the national economy for the countries all around the world, as traditionally it took up a big portion in nation's total employment and its significant contribution to a nation's revenue as a whole. However, until today construction industries are still facing a number of problems, such as low productivity, poor safety and poor quality of work (Attar, 2013). Supervision is continuous and involves participatory process as against the traditional supervisory visits which concentrate on fault finding instead of solving problem that could hinder quality performance. The periodic site visits offer little guidance to improve productivity where site workers are left undirected, with little or no milestones that could help measure their productivity level before the next supervisory visit. Motivation and

optimizing workers could be hard to come by in such situation. Fagbenle, Ogunde and Owolabi (2011) emphasizes that contractors need to detect the attributes of their operatives in enhancing their service delivery. Jha and Iyer (2006) noticed that competent project managers would engage his past experience to contribute positively to successful delivery of projects. Because other success factors- (support of top management; supervision and report from parties to project; communication within project teams and clients could be harnessed to their advantages is the process of ensuring that the project is built in accordance with the requirements of the contract documents, approved plans, specifications, building codes, building code standards and applicable local codes and ordinances.

Heravitorbati, Coffey, Trigunasyah, and Sagharforoush (2011) described quality and success in construction projects as the fulfilment of expectation of project participants. In Nigeria, it is generally believed that poor construction supervision, corruption, weak building regulation, poor structural design, defective construction, use of low-quality materials, hasty construction, shallow foundation and poor workmanship are the common causes of most building failures. Madu (2005) identified causes of building failure as due to natural occurrences such as earthquakes, tornadoes, flood, etc. According to him others include factors such as omission, carelessness, leading to use of deficient structural drawings, absence of proper supervision of projects, alteration of approved drawings, use of substandard materials, corruption in the Nigerian system, building without approved drawings and translocation of building plans to different sites. This may also be in form of illegal alteration to approved drawings. This practice if not properly controlled could spell danger years after the buildings are in use (Chendo and Obi, 2015).

Structural failure in buildings, in broad terms comes in various forms and degrees of severity; the worst of it is structure collapse. Deterioration or decay especially of vigour or usefulness of a building can be categorized as a failure of some sort but a total loss of bearing strength resulting in a sudden breakdown, physical depletion and/or falling apart is termed a collapse. Among these causal factors are greed, incompetence, corruption, poor planning, poor enforcement of building codes, inadequate public awareness and education, and limited financial and technical resources (Falobi, 2009). In the developing countries, majority of the indigenous construction firms depend mainly on conventional methods of construction (Alwi, Keith, and Sherif, 2001). Thus, demand supervision of operatives and their activities by the supervisors in the various units. They also believed that the construction industry attracts different participants working together to perform one tasks or the other that are interdependent and each of the operatives' inputs are required in meeting clients' satisfaction in all ramification. Hackman, Acheampong, Agyekum and Ayarkwa (2015) identified unfavourable working conditions, commitment of all project participants, and arrangement of site layout, inadequate top management support and indecisiveness of project team as the major factors affecting supervision of projects. This syndrome has caused serious damage to the industry in all manners, thereby resorting into repeated delays and cost overruns. On the other hands, problems that affect operative's service delivery have to do with construction process and materials procurement as established in (Sholanke, Fagbenle, Aderonmu, and Ajagbe, 2015). They further maintained that application of low quality of building materials and poor design contributed to buildings collapse being experienced from time to time in developing nations. Ogunde *et al.* (2017), believed that construction projects could experience low quality of finished job, project elongation, disputes, delay payment and poor project delivery due to shortage of skilled

workers. Ogundipe (2017) argued that lack of safety knowledge of workers during their apprenticeship could negatively impact their skills and response to safety practices on sites. Meanwhile dimension tolerance is another major problem affecting the procurement and performance of building materials, because materials such as blocks, bricks, reinforcement bars, plumbing pipes and prefab concrete vary in lengths, diameters, strength and sizes (Joshua and Ajao, 2018).

Strategies for Improving Project Delivery

Quality supervision is nothing but how well a supervisor utilizes available resources (men and material) effectively and efficiently, all project managers agree that the effectiveness of supervisor's efforts is judged by how well they manage every activity during the construction phase (Shinde *et al.*, 2014). The measure to improve quality supervision in construction project cannot be over emphasizes (Sugiharto, Kieth and Sherit, 2001). He also optioned that it is the supervisor's job to make use of all resources available efficiently. Shinde *et al.* (2014), identified various measure such as training of supervisors, material management, inspection, and stacking and storage for improving site supervision. Khyomesh *et al.* (2011) defined material management as a process that coordinates planning, assessing the requirement, sourcing, purchasing, conveying, storing and monitoring of materials, minimalizing the waste and optimizing the profitability by reducing cost of material.

According to Shinde *et al.* (2014), the purpose of training a supervisor is to improved self-confidence, to improve work efficiency, to develop motivational skills, to develop leadership skills, to improve operational efficiency and encouraging continuous development. Shinde *et al.* (2014), postulated that a supervisor must be familiar with all the activities that are carried out on site, must be able to plan, organize, lead, monitor and motivate and control. They also must have basic technical skills. According Sugiharto *et al.* (2001), a supervisor must understand site drawings, understand quality specifications, attends site meetings, responsible for planning and allocating labour and job/task, read and write report. He is also organizing site storage, controlling and checking each job/task being taken in projects, discussing problems with foremen and labourers. Chika and Chijioke (2013) postulated that quality and effective supervision has to with guiding, advising, encouraging, refreshing, motivating and ascertaining the stated goals of the Organisation. Raji and Firas (2011) opined that quality management and supervision of work means checking and judging construction site work against the required specification and standards, before, during and after completion of the work. Alwi *et al.* (2001) affirmed that success in completing site activities, right from the beginning to the end, relies heavily on the quality of supervision. Naturally, the quality of supervision is dependent upon the supervisor's skill. A supervisor is usually given authority and responsibility for planning and controlling the work of a group by close contact (Alwi *et al.*, 2001). According to Gidado (2016), a supervisor must be willing to deliver high quality building materials to site in required quantities coupled with strict supervision of workmen by the Site Supervisor. Gidado (2016) agreed that adequate supervision leads to quality job but comes with additional cost for the effective supervision called cost of quality. David and Sunday (2015) agreed that in putting in place measure that improve supervision, a good process for recording time within each segment of projects, using Timesheets to record and monitor the time spent by staff on a particular shift; quickly Identify measure and resolve time management issues that relates to the project and keep your Project Plan up-to-date at all times.

Construction site congestion lowers the rate of productivity as identified by (Aduagyei, and Ruwanpura, 2008). According to Beleiu, Crisan, and Nistor (2019), projects are used in all economic and non-economic fields as mean of organizing the activity, aiming the achievement of desired objectives. Davis (2014) studies project management success in literature from 1970s to present, classifying the evolution of success factors into decades. According to this study, approaches of success factors evolved from focusing on the operation level of a project in 1970s to embracing a stakeholder focused approached after 2000s (Davis, 2014). In accordance with her previous discovery, Davis (2014) adopted the following themes in order to describe the success factors of projects. The themes are: cooperation, communication, timing, identifying agreeing objectives, stakeholder satisfaction, acceptance and use of final products, and cost budget.

METHODOLOGY

Survey research design method using quantitative research approach was adopted. Data was collected using well-structured questionnaire and analyzed using descriptive method of analysis. Sekaran and Bougie (2009), defined study population as the general population from whom the expected data to discover answers to your exploration question is acquired. The population for this study comprises construction professionals that involves in the execution of building projects in Federal Capital Development Authority (FCDA) and Efab Properties Limited in Abuja. The population size for the study is 70. The sampling frame for this study is comprised of Quantity Surveyors, Builders, Engineers and Architects. According to Ali *et al.* (2010), a sample size larger than 30 and less than 500 are recommended appropriate for a most research study. Sample size is a representative number or group from the general research population (Sekaran and Bougie, 2009). Since the population size was less than 200, a census of the total members of the population (70) structured questionnaires were administered among construction professionals while 57 were retrieved at 81% returned rate. The questionnaire was designed in a 5-point Likert's scale format. It was broken down into five sections. The first section addressed the profile of the respondents while the other sections addressed the objectives respectively. Data analysis involves making sense out of the numerical values obtained through the data collection process (Morenikeji, 2007). All the data collected for this research were analyzed using descriptive method, which was similar to that used by (Anifowose, Lawal and Umoru, 2014). The use of Mean Item Score (MIS) was adopted to identify and assess the factor of quality supervision, identify and assess the factors of construction project delivery, determine the effect of quality supervision measure on construction project delivery and to examine the strategies for improving project delivery.

DATA ANALYSIS AND DISCUSSION

The profile of respondents was presented in this section. This section also gives the presentation of results of data collected from the analysis carried out. The data collected from the field were analysed using descriptive statistics, Mean Item Score (MIS) and presented in form of Figures and Tables.

Demographic Characteristics of Respondents

This section shows the demographic characteristics of respondents that contributed to the research. Highlight of the respondents' demographics are given in figure 1 – 5.

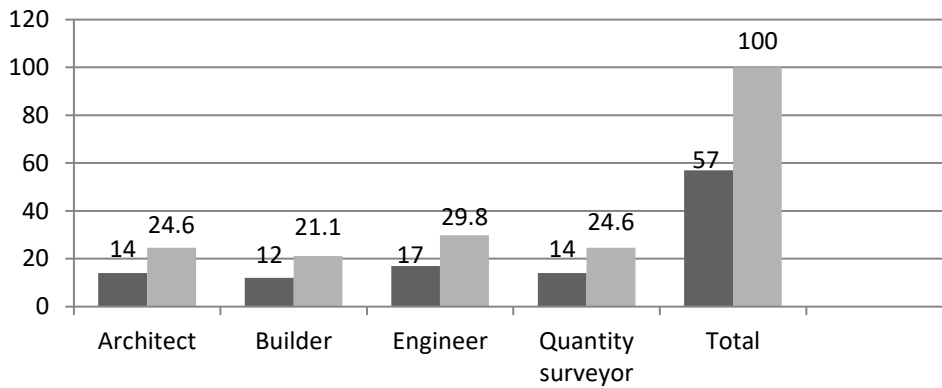


Figure 1: Profession of the Respondents

Figure 1 present the profession of the respondent. The largest contributors to this research were engineers with frequency of 17 having 29.8%, followed by Architects with frequency of 14 having 24.6% and Quantity Surveyors with frequency of 14 having 24.6% respectively, next are Builders with frequency of 12 having 21.1%. This signifies that the key professional's responds to the study more which makes the information obtained more reliable.

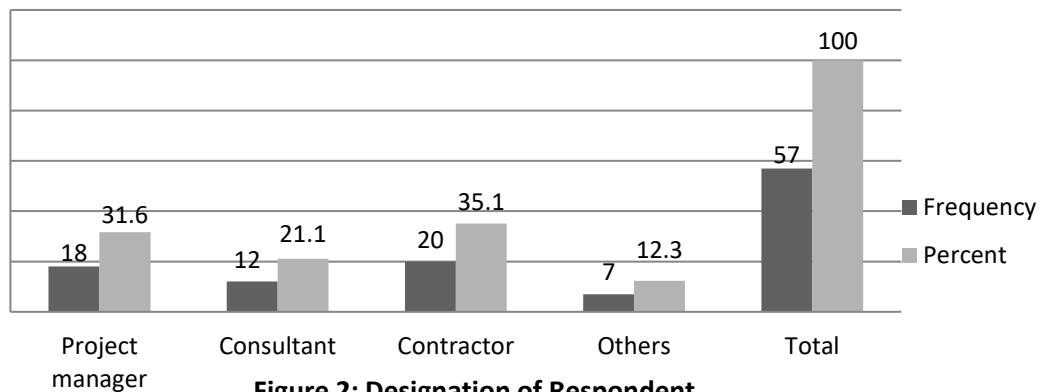


Figure 2: Designation of Respondent

Figure 2 shows the designation of respondent's in the construction industry, in which are project managers, consultant, contractor and others have frequency of 18 with 31.6%, 12 with 21.1%, 20 with 35.1% and 7 with 12.3 percentage contribution respectively. This signifies that more than average of respondents has been involved in building construction project which makes information obtained more reliable.

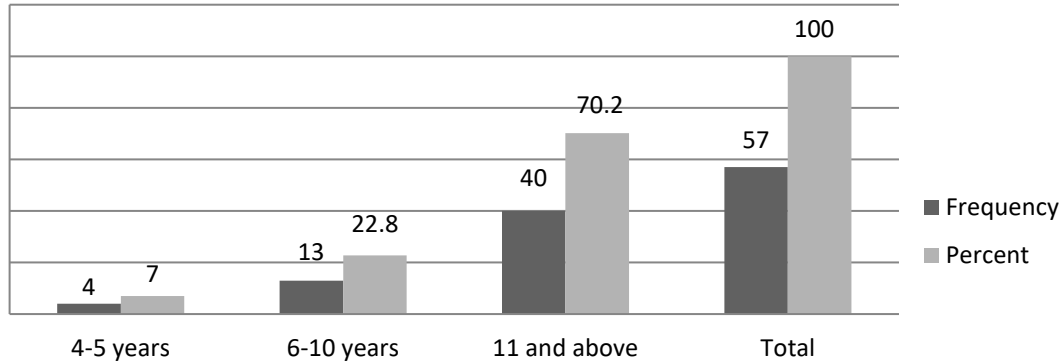


Figure 3: Years of Experience

Figure 3 shows the years of respondent's experience in which, 4 – 5 years, 6 – 10 years and 11 years and above have frequency of 4 with 7.7%, 13 with 22.8% and 40 with 70.2% percentage contribution respectively. This asserts that information obtained from the research is reliable and rich considering respondents experience over the year.

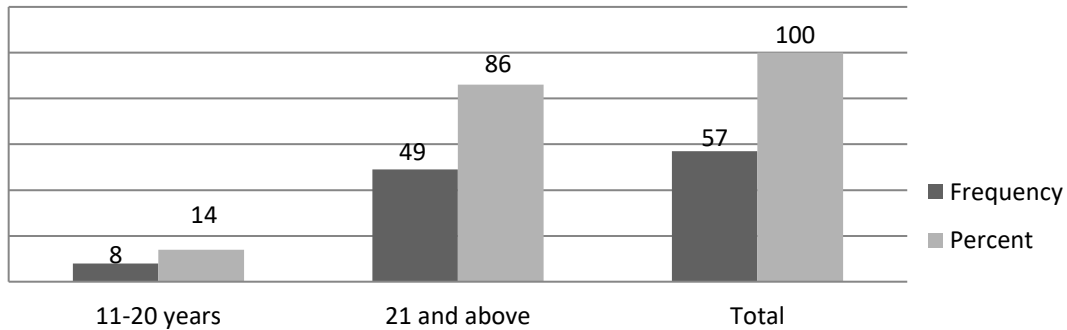


Figure 4: Project Executed In Last Five Years

Figure 4 present the number of projects executed by the respondent over the years in which 11-20 years, and 21 years and above have frequency of 8 with 14%, 49 with 86%, percentage respectively. This asserts that information obtained from the research is reliable and rich considering respondents project executions over the years.

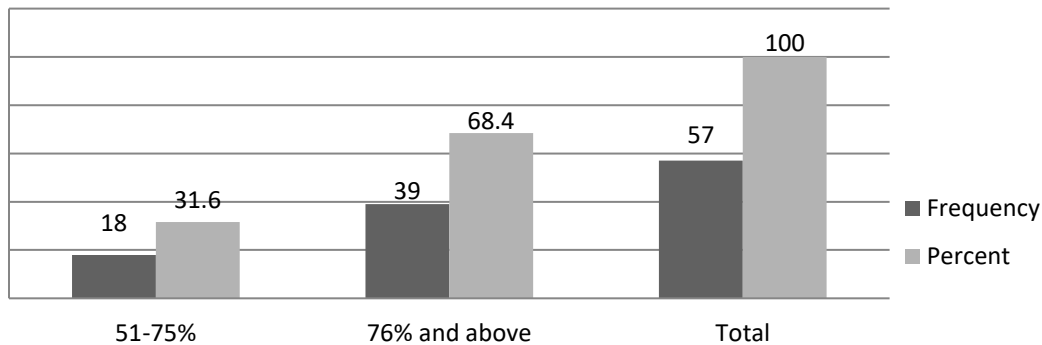


Figure 5: Percentage Of Quality Supervision

Figure 5 shows the percentage of quality supervision of operatives which ranges from 51-75% 76%and above have frequency of 18 with 31.6% and 39with 68.4% percentage contribution respectively. This asserts that information obtained from the research is reliable and rich considering respondents experience over the year.

Factors of Quality Supervision

Nineteen (19) basic factors of quality supervision were identified through literature review and were ranked according to their importance using Mean Item score (MIS). The rate of response and the MIS score are shown in Table 1.

Table 1: Factors of quality supervision

S/No.	Factors	MIS	Rank	Decision
1	proper manpower management	4.66	1st	very effective
2	material handling and transport waste management	4.64	2nd	very effective
3	proper design interpretation	4.59	3rd	very effective
4	Checking the trade mark of the construction product	4.57	4th	very effective
5	check the grade of materials	4.57	4th	very effective
6	material estimation, budgeting, planning and programming	4.57	4th	very effective
7	supervise quality assurance	4.57	4th	very effective
8	scheduling purchasing and procurement	4.56	8th	very effective
9	supervise specification alignment	4.49	9th	Effective
10	proper communication among parties involved	4.47	10th	Effective
11	material storage and warehousing	4.43	11th	Effective
12	strict supervision on labour	4.42	12th	Effective
13	education and training of operatives	4.42	12th	Effective
14	inventory control	4.36	14th	Effective
15	check the batching date and transportation date	4.33	15th	Effective
16	carry out price comparison	4.26	16 th	Effective
17	supervise testing of material	4.24	17 th	Effective
18	product and component supervision	4.21	18 th	Effective
19	supervise dimension tolerance	4.17	19 th	Effective
Average		4.45		Effective

Table 1 revealed nineteen (19) basic factors which affect quality supervision with mean important score between 4.66 and 4.17. The result indicates that “proper manpower management” was

ranked first (1st) having the most effective on factors that affect quality supervision an MIS score of 4.66, followed by “material handling and transport waste management was ranked second (2nd) with MIS score 4.64, next was “proper design interpretation” which was ranked third (3rd) with an MIS score of 4.59, “checking the trade mark of the construction product”, “material estimating, budgeting, planning and programming,” “check the grade of materials “and “supervise quality assurance” were all ranked forth (4th) with an MIS score of 4.57, the order was followed by “scheduling, purchasing and procurement” was ranked eighth (8th) with an MIS score of 4.56, while the least on the table of ranking was “supervise dimension tolerance” with an MIS score of 4.17.

Factors Influencing the Rate of Project Delivery

The Factors that influences the rate of project delivery was assessed with a likers scale of 1-5; mean item score (MIS) was used to analyze the data collected. The rate of response and the MIS score as they are categorized into five (5) related factors as shown in Table 2.

Table 2: Factors influencing the rate of project delivery

S/No.	Factors	MIS	Rank	Decision
1	design development	4.80	1st	very effective
2	material procurement	4.59	2nd	very effective
3	lack of qualified craftsmen	4.57	3rd	very effective
4	defective work or construction mistakes	4.47	4th	Effective
5	financial process difficulty or money disbursement	4.43	5th	Effective
6	excessive changes in quantities and changes in specification, drawings approval	4.40	6th	Effective
7	inadequate work scheduling	4.40	6th	Effective
8	incomplete document	4.36	8th	Effective
9	failure or damage to structure	4.36	8th	Effective
10	design error or incomplete supply of drawings	4.35	10th	Effective
11	inspections from local authority, consultants or clients	4.35	10th	Effective
12	different site condition	4.35	10th	Effective
13	equipment non availability	4.35	10th	Effective
14	inadequate planning	4.35	10th	Effective
15	sub surface soil condition	4.31	15th	Effective
16	labour injuries during construction process	4.29	16th	Effective
17	material/ fabrication delay	4.29	16th	Effective
18	decision during development stage or changes in drawing	4.28	18th	Effective
19	poor subcontractor performance	4.26	19th	Effective
20	poor supervision of material and labour	4.26	19th	Effective
Average		4.39		Effective

As illustrated in Table 2, the result indicates that in terms of factors that influence the rate of project delivery, the “Design development” was ranked first (1st) as the major factor that influence the rate of project delivery with an MIS score of 4.80. “Material procurement” came second (2nd) with an MIS score of 4.59 followed by “Lack of qualify craftsmen” which was ranked third (3rd) with an MIS score of 4.57, while “Poor subcontractor performance” and “poor supervision of material and labour” were the least on the list of ranking with an MIS of 4.26.

The Strategies for Improving Project Delivery

The strategies for improving project delivery was assessed with a likers scale of 1-5; mean item score (MIS) was used to analyse the data collected. The rate of response and the MIS score as they are categorized into five (5) related factors as shown in Table 3.

Table 3: Strategies for Improving Project Delivery

S/No.	Factors	MIS	Rank	Decision
1	improved Organisation	4.82	1 st	very effective
2	coordinated planning of job	4.66	2 nd	very effective
3	workers motivation like financial incentive and holiday	4.50	3 rd	Effective
4	reducing the amount of deflective work	4.50	3 rd	Effective
5	paying attention to details of the current best practices in the industry	4.49	5 th	Effective
6	timely provision of materials	4.45	6 th	Effective
7	reducing the construction process risk	4.38	7 th	Effective
8	the effective application of workers skill and experience	4.35	8 th	Effective
9	improving the service to client	4.26	9 th	Effective
10	external influences such as political or cultural awareness and capability	4.21	10 th	Effective
Average		4.46		Effective

Table 3 revealed ten (10) basic strategies for improving project delivery with mean important score between 4.82 and 4.21. The result indicates that “Improved Organisation” was ranked first (1st) having a very effective on the strategies of improving project delivery with an MIS score of 4.82, followed by “coordinated planning of job ”was ranked second (2nd) with MIS score 4.66 , next was “workers motivation like financial incentive and holiday” and “reducing the amount of deflective work” were both ranked third (3rd) with an MIS score of 4.50, while “external influences such as political and cultural awareness and capacity” was the least on list of ranking with an MIS of 4.20.

DISCUSSION OF RESULTS

The first objective of this study was to identify and assess the factor of quality supervision. Nineteen factors were identified and data was collected under this objective based on material procurement supervision, material supervision and worker supervision. “Poor manpower management” was ranked first, making it the most effective factor of quality supervision. Having an MIS of 4.66 and “supervise dimension tolerance” was ranked last with an MIS of 4.45. This finding is in line with Ogundipe *et al.* (2018) who identify poor manpower management as a factor influencing quality supervision and Nnadi (2018) who postulated Promotion of quackery of is of the causes of building collapse. The second objective was to identify and assess factors of construction project delivery. The analysis reveals that “Design Development” is the most important factor influencing project delivery having an MIS of 4.80. While poor subcontractor performance and poor supervision of labour and material were ranked least with an MIS of 4.26 this finding corresponds with Idowu *et al.* (2016) who identified design development as a factor that causes delay in project delivery. The third of objective was to provide strategies of improving project delivery. Ten (10) strategies were identified. The most effective strategy improving project delivery was “Improved Organisation” with an MIS of 4.82 and the last was “external influences

such as political and cultural awareness and capacity” with an MIS of 4.20. This finding is in line with the findings of Davis (2014), that communication and improved Organisation among stakeholder of construction industry improves project delivery.

Summary of Findings

The analyses carried out in this study revealed the following:

- i. The most effective factor of quality supervision is manpower management (MIS=4.66) and Dimension tolerance was ineffective with an (MIS=4.45)
- ii. Design development is the most influencing factors of project delivery
- iii. The most effective strategy for improving project delivery is an improved organisation while external influences such as political and cultural awareness and capacity (MIS=4.20)

CONCLUSION

This research was carried out to understand the effect of quality supervision of construction operatives on project delivery in Abuja. In order to do so, the study examines the effect of quality supervision factors of construction operatives on construction project with the view to improved project delivery. To achieve this aim, data was collected from various construction firm in Abuja through a well-structured questionnaire. Retrieved data was analyzed through the use of descriptive statistics. The finding from the data analysis carried out led to the following conclusions.

- i. The most important factors of quality supervision are poor manpower management, material handling and transport waste management and proper design interpretation
- ii. The design development is the most important factors that influences the rate of project delivery.
- iii. The most important strategy is improved Organisation.

Recommendations

The finding of this study led to the following recommendations:

- i. Construction industry should focus on the training and improvement of its operatives, since poor manpower management is identified as the effective factor of quality supervision.
- ii. More time and skill should be dedicated to design development in order to produces quality working drawings (architectural design, structural design, electrical and mechanical design) and specification.
- iii. More strategies for improving project delivery should be identified and assess

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ASSESSING CHANGE ORDER CAUSES IN THE PRE-CONSTRUCTION AND CONSTRUCTION PHASE OF CONSTRUCTION PROJECTS

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ABSTRACT

Change order has been seen to affect several construction projects and almost every construction project suffers change order. The need for carrying out studies on the causes of change orders cannot be overemphasized, as several changes occur in construction project and sometime causes an adjustment in the contract sum or contract time. Nevertheless, when change order occur performance of projects momentarily affected. Change orders often have a serious impact on the quality, time and cost. Eventually it results in disputes, delays, and dissatisfactions among stakeholders and ultimately results in failures of projects. Hence, despite few studies on the causes of change order, little research has established how change orders affect construction projects both from the preconstruction and construction phase of construction projects. As such, this study aimed at assessing the causes of change order in the preconstruction and construction phases of construction projects. A quantitative research approach was adopted for this study. A well-Structured Questionnaire was self-administered to registered Architects, Quantity Surveyors, Civil Engineers and Builders. The questionnaire sought the perception of respondents on how these causes affect construction projects both in the preconstruction and construction phases. Data was analysed using Mean, Standard Deviation, Frequency, Percentage, ANOVA and an Independent T-test. The result of the study was presented in tables. The result reveals that the most critical causes of change order in preconstruction phase is “Poor working drawing details” and the top most critical factor of change order in construction phase is “Design modification by owner”. It is concluded that the consultant usually does several mistakes in the planning and designing stage which later on results in change orders from having poor working drawing details. However, clients need to efficiently work during the planning and designing phase and further properly monitor the project during execution to avoid these orders.

Keywords: Change Order, Construction Industry, Construction Project, Pre-Construction, Construction Phase.

INTRODUCTION

The construction industry has always been predominant in economic development especially in developed countries. Construction industry being one of the potential industries in a country's economy, plays significant role in economic stability and growth of a country (Ali *et al.*, 2019). The Nigerian construction industry has contributed to the economy by enabling the procurement of goods and services to the provision of buildings and other infrastructure, providing employment opportunities to its labour force while contributing immensely to the Gross Domestic Product (GDP) of the country. Despite adding to the Gross Domestic Product (GDP) of the country, according to Ayangade (2009), the Nigerian construction industry is yet to measure up to those of the western world like the UK and Australia due to its developing nature.

Researchers have always looked into evaluating the causes of change orders and its effects without giving detail to construction participants as to help them understand which comes during pre-

construction and construction phase, as these two phases' matters a lot considerably and most researches have concentrated more on the construction phase of construction projects (Ali *et al.*, 2019). This research is aimed at a detailed look into the causes of change orders on a construction project and considers both pre-construction and construction phase of construction projects in Nigeria as there has been no research to assess change order causes in both preconstruction and construction phase of construction projects.

LITERATURE REVIEW

The Nigerian construction industry has been seen to face some challenges which contribute to the level the industry is at presently. Major risk factors have been found out to fatally affect the success of construction projects, which will eventually have a serious impact on its quality, time and cost (Santoso *et al.*, 2003; Moon *et al.*, 2016). Construction projects always involve complex, integral processes which are easy to experience change. Umar *et al.* (2016) and previous studies has shown that change is one of the major risk factors which have been found out to affect the success of projects. Change orders have been found out to be one of the most common causes of disputes, delays and dissatisfaction among stakeholders and this ultimately results in failure of projects (Assaf *et al.*, 2006; Ali *et al.*, 2019). Change orders often raises negative feeling among parties involved in a construction project, and this affects the relationship between the client, contractor and consultants i.e. Quantity Surveyors, Architects and Engineers (Alaryan *et al.*, 2014).

Change orders have been defined by various researchers, Abitha *et al.* (2018) defined change order as a written order to the contractor, signed by the owner, and issued after award of the contract, implying a change in the work or an adjustment in the contract sum or the contract time. Zawawi *et al.* (2010) defined change order as a work that is added to or removed from the original scope of work which alters the original contract sum and completion period. According to Osman *et al.* (2009), change order is seen as any deviation from a well-defined scope of work and schedule while Parker (2011) described change as work, process or methods that deviate from the initial scope or to modify the design, done in the form of "adding", "deleting", or "replacement" (Ndiokubbbwayo and Haupt, 2009).

Change orders on sites are very common in construction projects, because even the best plans are subject to changes during the construction phase and sometimes results to claims (Thomas and Napolitan, 1995). According to Ayodele and Alabi (2011), change orders causes an interruption in work flow, as it requires more additional of both paper and practical work, most change orders issued during contract execution have negative effect on project cost and completion time and in worst case scenarios could eventually culminate in the abandonment of the construction project and raises disputes among the parties involved in the project which are very common in developing countries. The assessment of change orders attribute carried out in Pakistan concluded that mistakes in specification and Design modification by owner/clients are the most common causes of change orders in the Pakistan construction industry.

This research sought to assess the root causes of change orders in construction projects in Nigeria. These causes will be divided into two categories i.e. pre-construction and construction stage and will be beneficial to clients, consultants and contractors, helping to provide knowledge on the

causes that lead to issues with regards to change orders and to reduce their occurrences in future projects as its occurrence is characterized by cost overrun and time overrun also due to delay cause by change. Cost and time overrun is a very common problem in the Nigerian construction industry and one of the major risk factors which cause these overruns is change orders (Aibinu and Jagboro, 2002).

Causes of Change order in the Pre-Construction Phase of Construction Projects

Change orders in construction often have serious impacts on performance of the project. Ijaola *et al.* (2012) identified that the additional works from client and design modification are the major causes of change order in both Nigeria and Oman. The most important effects of change order are claims and disputes among the parties in Nigeria while “delay in the project completion date and cost overruns” were the most important effects in Oman notifying contractor as the most benefiting parties in change order. Another study was conducted by Alaryan *et al.* (2014) in Kuwait construction projects and identified the major causes of change order by conducting a questionnaire survey among construction related parties such as owners, contractors and consultants. The most critical five causes of change orders were identified as: change of plans by owner, change of project scope by owner, problems on site, errors and omission in design, poor working drawing details. Hence, the following factors were identified at preconstruction phase by different studies which were further subjected to analysis.

Table 1: Identified causes for preconstruction phase

S/N	Preconstruction Phase	Source
1	Mistake in specification	(Ali <i>et al.</i> , 2019)
2	Mistake in design	(Jaydeep <i>et al.</i> , 2015; Oladiran <i>et al.</i> , 2018; Umar <i>et al.</i> , 2016; Alnuaimi <i>et al.</i> , 2014; Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
3	Lack of experience in selecting construction team by client	(Alnuaimi <i>et al.</i> , 2014; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
4	Improper scheduling by client	(Ali <i>et al.</i> , 2019)
5	Insufficient use of value engineering	(Umar <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
6	Poor working drawing details	(Jaydeep <i>et al.</i> , 2015; Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
7	Flexible nature of client in safety	(Senouci <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)

Causes of Change order in the Construction Phase of Construction Projects

Construction phase is most important phase of project delivery. Maximum resources are utilized in this phase therefore most of change order occurs in construction phase. Nevertheless, the identified factors at construction phase for the assessment of the causes of change order are;

Table 2: Identified causes for construction phase

Construction Phase	Source
Design modification by client	(Alnuaimi <i>et al.</i> , 2014; Umar <i>et al.</i> , 2016; Ijaola <i>et al.</i> , 2012; Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
Design modification by consultant	(Umar <i>et al.</i> , 2016; Senouci <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018)
Change in scope at later stage	(Jaydeep <i>et al.</i> , 2015; Umar <i>et al.</i> , 2016; Senouci <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
Delays in payment by client	(Ali <i>et al.</i> , 2019)
Lack of communication between parties	(Alnuaimi <i>et al.</i> , 2014; Shalaby <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
Contractor financial issues	(Jaydeep <i>et al.</i> , 2015; Umar <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
Additional work from owner side	(Ijaola <i>et al.</i> , 2012; Ali <i>et al.</i> , 2019)
Safety rules and regulation are not followed by contractor	(Ali <i>et al.</i> , 2019)
Construction delays by contractor	(Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
Poor site management by contractor	(Ali <i>et al.</i> , 2019)
Delay in material delivery by supplier	(Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
Delay of project schedule	(Senouci <i>et al.</i> , 2016; Ali <i>et al.</i> , 2019)
Design complexity	(Senouci <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
On site changing in material specification	(Oladiran <i>et al.</i> , 2018; Shalaby <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
Late decision making by client/ contractor	(Ali <i>et al.</i> , 2019; Alnuaimi <i>et al.</i> , 2014)
Defective workmanship	(Jaydeep <i>et al.</i> , 2015; Oladiran <i>et al.</i> , 2018)
Ineffective supervision by client/consultant	(Ali <i>et al.</i> , 2019; Alnuaimi <i>et al.</i> , 2014)
Bad relationship with supplier by contractor	(Ali <i>et al.</i> , 2019)
Severe weather conditions on job site	(Jaydeep <i>et al.</i> , 2015; Umar <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
Owners financial problem	(Jaydeep <i>et al.</i> , 2015; Umar <i>et al.</i> , 2016)
Change in project schedule	(Jaydeep <i>et al.</i> , 2015; Oladiran <i>et al.</i> , 2018)
Unavailability of skilled labour/material	(Jaydeep <i>et al.</i> , 2015; Umar <i>et al.</i> , 2016; Senouci <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018; Ali <i>et al.</i> , 2019)
Differing site conditions	(Umar <i>et al.</i> , 2016; Senouci <i>et al.</i> , 2016)
Materials or workmanship not complying with specification	(Umar <i>et al.</i> , 2016)
New government regulations	(Umar <i>et al.</i> , 2016)
Technology change	(Alnuaimi <i>et al.</i> , 2014; Senouci <i>et al.</i> , 2016; Umar <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018)
Natural growth of project was not anticipated at design phase	(Ijaola <i>et al.</i> , 2012; Alnuaimi <i>et al.</i> , 2014; Oladiran <i>et al.</i> , 2018)
Conflict between contract document	(Umar <i>et al.</i> , 2016; Oladiran <i>et al.</i> , 2018;)
Contractor not involved at design phase	(Oladiran <i>et al.</i> , 2018)

RESEARCH METHODOLOGY

A good research design should have amongst other features, the ability to generate data that is capable of establishing facts, refuting or validating a prior expectation or hypothesis if any. For this reason, the types of data required for the pursuit of this research are in two categories which include: Primary data and Secondary data. Secondary data were sourced from secondary sources, through the review of relevant literatures which were beneficial to this research, while the Primary

data were sourced through the use of a well-structured closed-ended questionnaire, administered to consultants, including Quantity Surveyors, Architects, Engineers and Builders to obtain relevant information to fulfil the objectives of this study.

The questionnaire was divided into two sections. Section A, which deals with the general information of the respondents, the following questions: Role of Respondent, Registration status with professional body, Academic qualification, and Years of experience.

Section B seeks to find information about the level to which listed factors, contributes to causing change order both in the preconstruction and construction phase of construction projects. A scale of five (5) was adopted for the questionnaire where, 1-Very Low, 2-Low, 3-Moderate, 4-High and 5-Very High. A population consists of all the items in a field of enquiry (Kazdin, 2003). The target population for this study includes all registered Architects, Quantity Surveyors, Engineers and Builders in Nigeria. In order to obtain a list of all registered members listed in the professions above, a search through their respective registration bodies was conducted and Table 1. shows the summary of all the professions and the registered member for each, as well as the source.

Table 3: Summary of total population.

S/N	PROFESSIONALS	TOTAL POPULATION	SOURCE
1	ARCHITECTS	5,023	ARCON (2017)
2	QUANTITY SURVEYORS	3,588	QSRBN (2019)
3	ENGINEERS	2,285	COREN (2018)
4	BUILDERS	1,997	CORBON (2017)
GRAND TOTAL		12,893	

Source: Online Survey, 2019

Therefore, the sample frame for this research consists of 12,893 professionals. To identify the sample size for this study, Slovin (1960) sample formula was used; the sample size of the population studied was 388. The data received through the questionnaires was analyzed with the aid of the SPSS (Statistical Package for Social Sciences), using descriptive statistic to find out how listed factors contributes to change order in the Nigerian construction industry. These results were presented in tables and analysed using mean scores. Average Index Value (AI) was used to rank this selected causes of change order. Inferential statistics (ANOVA) was used to compare responses between the different professions surveyed.

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

This section contains the presentation and discussion of data obtained from the field survey. The nature of data collected and pattern adopted in the review of literature necessitated the analysis. A descriptive statistical technique was used for the analysis, which includes measure of central tendency and measure of dispersion. The findings would consequently help in making suggestions which would further help in drawing a vivacious conclusion as well as recommendations.

Results on Change Order Causes in Preconstruction Phase

In Table 4.1 seven causes of change orders which occur during preconstruction phase of construction projects were identified from the review of relevant literature and listed out, in which

respondents were asked to rate on a scale of 1-5 as to the extent to which they believe these causes contributes to change order in the preconstruction phase of construction projects.

Table 4.1: Respondents perception on the causes of change order in preconstruction phase

S/N	Causes of change order in preconstruction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Poor working drawing details	0	8	49	69	36	3.82	0.83	1
2	Insufficient use of value engineering	1	17	44	63	37	3.73	0.95	2
3	Mistake in design	6	14	47	62	33	3.63	1.02	3
4	Lack of experience in selecting construction team by client	15	43	43	41	20	3.05	1.18	4
5	Mistake in specification	18	47	49	30	18	2.90	1.17	5
6	Improper scheduling by client	20	49	59	30	4	2.69	0.99	6
7	Flexible nature of client in safety	36	77	43	6	0	2.12	0.79	7

Source: Field survey, 2019

The results on the table shows that ‘Poor working drawings’ ranked first with a mean of 3.82 and standard deviation of 0.83 contributes more to causing change order than any other causes of change order in the preconstruction phase as assessed by all the respondents that were surveyed. This is followed by ‘Insufficient use of value engineering’ ranked second with a mean score of 3.72 and standard deviation of 0.95, ‘Mistake in design’ ranked third with a mean score of 3.63 and standard deviation of 1.02, ‘Lack of experience in selecting construction team by client’ ranked fourth with a mean score of 3.05 and a standard deviation of 1.18, ‘Mistake in specification’ ranked fifth with a mean score of 2.90 and standard deviation of 1.17, ‘Improper scheduling by client’ ranked sixth with a mean score of 2.69 and standard deviation of 0.99, and ‘Flexible nature of client in safety’ ranked seventh with a mean score of 2.12 and a standard deviation of 0.79 consecutively.

Table 4.2: Architects perception on change order causes in preconstruction phase

S/N	Causes of change order in preconstruction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Mistake in design	1	4	12	15	11	3.72	1.03	1
2	Insufficient use of value engineering	0	7	11	16	9	3.63	1.00	2
3	Poor working drawing details	0	5	18	12	8	3.53	0.94	3
4	Lack of experience in selecting construction team by client	3	9	12	14	5	3.21	1.13	4
5	Improper scheduling by client	7	10	17	8	1	2.67	1.04	5
6	Mistake in specification	5	18	11	6	3	2.63	1.09	6
7	Flexible nature of client in safety	10	18	11	4	0	2.21	0.91	7

SOURCE: Field Survey, 2019

The table shows that ‘Mistake in design’ ranked first with a mean score of 3.72 and standard deviation of 1.03 contributes more to change order during the preconstruction phase of construction projects. This is followed by ‘Insufficient use of value engineering’ ranked second with a mean score of 3.63 and standard deviation of 1.00, ‘Poor working drawing details’ ranked third with a mean score of 3.53 and standard deviation of 0.94, ‘Lack of experience in selecting construction team by client’ ranked fourth with a mean score of 3.21 and standard deviation of 1.13, ‘Improper scheduling by client’ ranked fifth with a mean score of 2.67 and a standard deviation of 1.04, ‘Mistake in specification’ ranked sixth with a mean score of 2.63 and a standard deviation of 1.09, and ‘Flexible nature of client in safety’ ranked seventh with a mean score of 2.21 and a standard deviation of 0.91 consecutively.

Table 4.3: Quantity Surveyors perception on change order causes in preconstruction phase

Table 4.3 shows Quantity Surveyors assessment of change order causes that occurred during preconstruction Phase.

S/N	Causes of change order in preconstruction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Insufficient use of value engineering	0	2	13	19	14	3.94	0.86	1
2	Poor working drawing details	0	1	15	22	10	3.85	0.77	2
3	Mistake in design	2	6	14	19	7	3.48	1.03	3
4	Mistake in specification	3	12	12	13	8	3.23	1.19	4
5	Lack of experience in selecting construction team by client	4	16	12	11	5	2.94	1.16	5
6	Improper scheduling by client	6	17	17	7	1	2.58	0.96	6
7	Flexible nature of client in safety	10	27	11	0	0	2.02	0.67	7

Source: Field survey, 2019

Table 4.3 shows that ‘Insufficient use of value engineering’ ranked first with a mean score of 3.94 and a standard deviation of 0.86 contributes more to change order during the preconstruction phase of construction projects. This is followed by ‘Poor working drawing details’ ranked second with a mean score of 3.85 and standard deviation of 0.77, ‘Mistake in design’ ranked third with a mean score of 3.48 and standard deviation of 1.03, ‘Mistake in specification’ ranked fourth with a mean score of 3.23 and standard deviation of 1.19, ‘Lack of experience in selecting construction team by client’ ranked fifth with a mean score of 2.94 and standard deviation of 1.16, ‘Improper scheduling by client’ ranked sixth with a mean score of 2.58 and standard deviation of 0.96, and ‘Flexible nature of client in safety’ ranked seventh with a mean score of 2.02 and standard deviation of 0.67 consecutively.

Table 4.4: Engineers perception on change order causes in preconstruction phase

S/N	Causes of change order in preconstruction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Poor working drawing details	0	1	7	20	11	4.05	0.76	1
2	Insufficient use of value engineering	1	6	12	13	7	3.49	1.05	2
3	Mistake in design	3	4	13	12	7	3.41	1.14	3
4	Lack of experience in selecting construction team by client	3	9	11	10	6	3.18	1.19	4
5	Mistake in specification	4	8	15	8	4	3.00	1.12	5
6	Improper scheduling by client	4	12	15	8	0	2.69	0.92	6
7	Flexible nature of client in safety	8	17	12	2	0	2.21	0.83	7

Source: Field survey, 2019

Table 4.4 shows that ‘Poor working drawing details’ ranked first with a mean score of 4.05 and standard deviation of 0.76 contributes more to change order during the preconstruction phase of construction projects. This is followed by ‘Insufficient use of value engineering’ ranked second with a mean score of 3.49 and standard deviation of 1.05, ‘Mistake in design’ ranked third with a mean score of 3.41 and standard deviation of 1.14, ‘Lack of experience in selecting construction team by client’ ranked fourth with a mean score of 3.18 and standard deviation of 1.19, ‘Mistake in specification’ ranked fifth with a mean score of 3.00 and standard deviation of 1.12, ‘Improper scheduling by client’ ranked sixth with a mean score of 2.69 and standard deviation of 0.92, and ‘Flexible nature of client in safety’ ranked seventh with a mean score of 2.21 and standard deviation of 0.83 consecutively.

Table 4.5: Builders perception on change order causes in preconstruction phase

S/N	Causes of change order in preconstruction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Mistake in design	0	0	8	16	8	4.00	0.72	1
2	Poor working drawing details	0	1	9	15	7	3.88	0.79	2
3	Insufficient use of value engineering	0	2	8	15	7	3.84	0.85	3
4	Lack of experience in selecting construction team by client	5	9	8	6	4	2.84	1.27	4
5	Improper scheduling by client	3	10	10	7	2	2.84	1.08	4
6	Mistake in specification	6	9	11	3	3	2.63	1.19	6
7	Flexible nature of client in safety	8	15	9	0	0	2.03	0.74	7

Source: Field survey, 2019

The table shows that ‘Mistake in design’ ranked first with a mean score of 4.00 and a standard deviation of 0.72 contributes more to change order during the preconstruction phase of construction projects. This is followed by ‘Poor working drawing details’ ranked second with a

mean score of 3.88 and a standard deviation of 0.79, 'Insufficient use of value engineering' ranked third with a mean score of 3.84 and a standard deviation of 0.85, 'Lack of experience in selecting construction team by client' and 'Improper scheduling by client' ranked fourth with a joint mean score of 2.84 and a standard deviation of 1.27 and 1.02 respectively, 'Mistake in specification' ranked sixth with a mean score of 2.63 and a standard deviation of 1.19, and 'Flexible nature of client in safety' ranked seventh with a mean score of 2.03 and a standard deviation of 0.74 consecutively.

Table 4.6: ANOVA

Table 4.6 shows the details of the analysis of variance ANOVA statistics revealed the significant difference among the four categories of respondents (Architects, Quantity Surveyors, Engineers and Builders), in preconstruction phase.

Table 4.6 shows the details of the analysis of variance ANOVA

<i>Source of Variation</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Between Groups	0.021	3	0.007	0.016	0.997
Within Groups	10.494	24	0.437		
Total	10.515	27			

A statistical test was conducted with the use of the One-way ANOVA to check if there is any significant difference between the responses from the four various professions surveyed (Architects, Quantity Surveyors, Engineers and Builders). The result of the ANOVA in Table 4.6 revealed that the sig. value is 0.997 which is greater than 0.05, this means there is no significance difference between the opinion of the various professions that were surveyed.

Change Order Causes in Construction Phase

In Table 4.7, Twenty-Nine causes of change orders which occur during construction phase of construction projects were identified from the review of relevant literature, in which respondents were asked to rate on a scale of 1-5 as to the extent to which they believe these causes contributes to change order in the construction phase. Where 1 represent Very Low 2 represent Low, 3 represent Moderate, 4 represent High and 5 represent Very High.

Table 4.7: Respondents perception on change order causes in construction phase

S/N	Causes of change order in construction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Design modification by client	0	3	26	71	62	4.19	0.77	1
2	Change in scope at later stage	0	1	31	81	49	4.10	0.72	2
3	Design complexity	0	11	40	50	61	3.99	0.95	3
4	Owners financial problem	0	6	42	71	43	3.93	0.82	4
5	Design modification by consultant	0	3	49	72	38	3.90	0.78	5

6	Conflict between contract document	0	8	48	62	44	3.88	0.87	6
7	Change in project schedule	0	2	50	80	30	3.85	0.72	7
8	Ineffective supervision by client	0	13	48	71	30	3.73	0.86	8
9	Contractor not involved at design phase	2	22	38	70	30	3.64	0.98	9
10	Defective workmanship	1	12	60	70	19	3.58	0.82	10
11	Delay in material delivery by supplier	9	14	49	64	26	3.52	1.04	11
12	Additional work from owner side	0	17	70	61	14	3.44	0.80	12
13	Differing site conditions	2	24	59	58	19	3.42	0.92	13
14	Materials or workmanship not complying with specification	2	26	58	61	15	3.38	0.91	14
15	New government regulations	3	28	78	42	11	3.19	0.87	15
16	Lack of communication between parties	7	38	58	41	18	3.15	1.04	16
17	Technology change	4	41	65	37	15	3.11	0.97	17
18	Delay of project schedule	8	35	61	48	10	3.10	0.98	18
19	Natural growth of project was not anticipated at design phase	2	39	70	43	8	3.10	0.87	18
20	Late decision making by contractor	8	35	67	43	9	3.06	0.95	20
21	On site changing in material specification	11	39	55	47	10	3.04	1.03	21
22	Poor site management by contractor	7	55	70	25	5	2.79	0.87	22
23	Safety rules and regulation are not followed by contractor	22	45	62	22	11	2.72	1.08	23
24	Bad relationship with supplier by contractor	18	52	59	28	5	2.69	0.99	24
25	Delays in payment by client	18	61	51	29	3	2.62	0.97	25
26	Unavailability of skilled labour/material	14	69	62	17	0	2.51	0.80	26
27	Severe weather conditions on job site	26	65	49	21	1	2.42	0.93	27
28	Contractor financial issues	31	70	39	19	3	2.34	0.98	28
29	Construction delays by contractor	28	67	52	15	0	2.33	0.87	29

Source: Field survey, 2019

The results on the table shows that ‘Design modification by client’ ranked first with a mean of 4.19 and a standard deviation of 0.77 contributes more to causing change order than any other causes of change order in the construction phase as assessed by all the respondents that were surveyed. This is followed by ‘Change in scope at later stage’ with a mean score of 4.10 and a standard deviation of 0.72 ranked second, ranked third is ‘Design complexity’ with a mean score of 3.99 and a standard deviation of 0.95, ranked fourth is ‘Owners financial problem’ with a mean score of 3.93 and a standard deviation of 0.82 and ranked fifth is ‘Design modification by consultant’ with a mean score of 3.90 and a standard deviation of 0.78. In the bottom five are ‘Delays in payment by client’ ranked twenty fifth with a mean score of 2.62 and a standard deviation of 0.97, followed by ‘Unavailability of skilled labour/material’ ranked twenty sixth with

a mean score of 2.51 and a standard deviation of 0.80, ranked twenty seventh is ‘Severe weather conditions on job site’ with a mean score of 2.42 and a standard deviation of 0.93, ranked twenty eight is ‘Contractor financial issues’ with a mean score of 2.34 and a standard deviation of 0.98 and ranked twenty ninth is ‘Construction delays by contractor’ with a mean score of 2.33 and a standard deviation of 0.87.

Table 4.8: Architects perception on change order causes in construction phase

S/N	Causes of change order in construction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Design modification by client	0	2	6	16	19	4.21	0.86	1
2	Design complexity	0	1	10	17	15	4.07	0.83	2
3	Change in project schedule	0	0	11	21	11	4.00	0.72	3
4	Change in scope at later stage	0	0	11	22	10	3.98	0.71	4
5	Design modification by consultant	0	1	14	17	11	3.88	0.82	5
6	Conflict between contract document	0	2	14	17	10	3.81	0.85	6
7	Owners financial problem	0	2	14	19	8	3.77	0.81	7
8	Defective workmanship	0	1	16	21	5	3.70	0.71	8
9	Ineffective supervision by client	0	3	16	16	8	3.67	0.87	9
10	Contractor not involved at design phase	1	7	8	19	8	3.60	1.05	10
11	Materials or workmanship not complying with specification	0	6	13	19	5	3.53	0.88	11
12	Additional work from owner side	4	20	15	4	0	3.44	0.80	12
13	Delay in material delivery by supplier	4	2	13	19	5	3.44	1.08	12
14	Technology change	0	8	17	14	4	3.33	0.89	14
15	New government regulations	1	6	19	13	4	3.30	0.91	15
16	Differing site conditions	0	9	17	14	3	3.26	0.88	16
17	Delay of project schedule	4	8	10	17	4	3.21	1.15	17
18	Natural growth of project was not anticipated at design phase	0	11	19	11	2	3.09	0.84	18
19	Late decision making by contractor	1	11	20	10	1	2.98	0.83	19
20	On site changing in material specification	3	12	15	12	1	2.91	0.97	20
21	Safety rules and regulation are not followed by contractor	6	9	16	10	2	2.84	1.09	21
22	Contractor financial issues	3	20	9	8	3	2.72	1.08	22
23	Lack of communication between parties	4	13	20	6	0	2.65	0.84	23
24	Bad relationship with supplier by contractor	5	17	15	6	0	2.51	0.88	24
25	Severe weather conditions on job site	6	16	15	6	0	2.49	0.91	25
26	Poor site management by contractor	3	20	17	3	0	2.47	0.74	26

27	Delays in payment by client	8	18	9	7	1	2.42	1.05	27
28	Unavailability of skilled labour/material	5	20	14	4	0	2.40	0.82	28
29	Construction delays by contractor	8	17	15	3	0	2.30	0.86	29

Source: Field survey, 2019

Table 4.8 shows that ‘Design modification by client’ ranked first with a mean of 4.21 and a standard deviation of 0.86 contributes more to causing change order than any other causes of change order in the construction phase as assessed by all the Architects that were surveyed. This is followed by ‘Design complexity’ with a mean score of 4.07 and a standard deviation of 0.83 ranked second, ranked third is ‘Change in project schedule’ with a mean score of 4.00 and a standard deviation of 0.72, ranked fourth is ‘Change in scope at later stage’ with a mean score of 3.98 and a standard deviation of 0.71 and ranked fifth is ‘Design modification by consultant’ with a mean score of 3.88 and a standard deviation of 0.82. In the bottom five are ‘Severe weather conditions on job site’ ranked twenty fifth with a mean score of 2.49 and a standard deviation of 0.91, followed by ‘Poor site management by contractor’ ranked twenty sixth with a mean score of 2.47 and a standard deviation of 0.74, ranked twenty seventh is ‘Delays in payment by client’ with a mean score of 2.42 and a standard deviation of 1.05, ranked twenty eight is ‘Unavailability of skilled labour/material’ with a mean score of 2.40 and a standard deviation of 0.82 and ranked twenty ninth is ‘Construction delays by contractor’ with a mean score of 2.30 and a standard deviation of 0.86.

Table 4.9: Quantity Surveyors perception on change order causes in construction phase

S/N	Causes of change order in construction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Change in scope at later stage	0	0	7	25	16	4.19	0.67	1
2	Design modification by client	0	0	10	22	16	4.13	0.73	2
3	Contractor not involved at design phase	0	1	10	27	10	3.96	0.71	3
4	Design complexity	0	4	12	16	16	3.92	0.96	4
5	Owners financial problem	0	2	13	21	12	3.90	0.83	5
6	Change in project schedule	0	2	14	21	11	3.85	0.83	6
7	Conflict between contract document	0	2	16	19	11	3.81	0.84	7
8	Ineffective supervision by client	0	3	14	24	7	3.73	0.79	8
9	Design modification by consultant	0	1	21	20	6	3.65	0.73	9
10	Defective workmanship	0	4	15	23	6	3.65	0.81	9
11	Differing site conditions	1	3	15	22	7	3.65	0.89	9
12	Lack of communication between parties	0	7	14	17	10	3.63	0.98	12
13	Delay in material delivery by supplier	3	7	13	17	8	3.42	1.13	13
14	Materials or workmanship not complying with specification	0	8	16	20	4	3.42	0.87	13
15	Natural growth of project was not anticipated at design phase	0	7	22	14	5	3.35	0.86	15

16	Additional work from owner side	8	21	15	4	0	3.31	0.85	16
17	New government regulations	0	10	24	10	4	3.17	0.86	17
18	On site changing in material specification	3	8	19	15	3	3.15	0.99	18
19	Late decision making by contractor	4	9	16	14	5	3.15	1.11	18
20	Delays in payment by client	2	15	19	10	2	2.90	0.93	20
21	Bad relationship with supplier by contractor	4	13	18	11	2	2.88	1.00	21
22	Poor site management by contractor	3	13	22	8	2	2.85	0.92	22
23	Delay of project schedule	3	16	21	8	0	2.71	0.82	23
24	Technology change	4	16	19	8	1	2.71	0.92	23
25	Unavailability of skilled labour/material	2	19	21	6	0	2.65	0.76	25
26	Safety rules and regulation are not followed by contractor	8	16	18	3	3	2.52	1.05	26
27	Construction delays by contractor	7	19	17	5	0	2.42	0.87	27
28	Severe weather conditions on job site	11	18	15	4	0	2.25	0.91	28
29	Contractor financial issues	12	24	11	1	0	2.02	0.76	29

Source: Field survey, 2019

The table shows that ‘Change in scope at later stage’ ranked first with a mean of 4.19 and a standard deviation of 0.67 contributes more to causing change order than any other causes of change order in the construction phase as assessed by all the Quantity Surveyors that were surveyed. This is followed by ‘Design modification by client’ with a mean score of 4.13 and a standard deviation of 0.73 ranked second, ranked third is ‘Contractor not involved at design phase’ with a mean score of 3.96 and a standard deviation of 0.71, ranked fourth is ‘Design complexity’ with a mean score of 3.92 and a standard deviation of 0.96 and ranked fifth is ‘Owners financial problem’ with a mean score of 3.90 and a standard deviation of 0.83. In the bottom five are ‘Unavailability of skilled labour/material’ ranked twenty fifth with a mean score of 2.65 and a standard deviation of 0.76, followed by ‘Safety rules and regulation are not followed by contractor’ ranked twenty sixth with a mean score of 2.52 and a standard deviation of 1.05, ranked twenty seventh is ‘Construction delays by contractor’ with a mean score of 2.42 and a standard deviation of 0.87, ranked twenty eight is ‘Severe weather conditions on job site’ with a mean score of 2.25 and a standard deviation of 0.91 and ranked twenty ninth is ‘Contractor financial issues’ with a mean score of 2.02 and a standard deviation of 0.76.

Table 4.10: Engineers perception on change order causes in construction phase

S/N	Causes of change order in construction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Design modification by client	0	1	5	17	16	4.23	0.78	1
2	Design modification by consultant	0	0	7	20	12	4.13	0.70	2
3	Owners financial problem	0	1	9	15	14	4.08	0.84	3
4	Change in scope at later stage	0	1	8	18	12	4.05	0.79	4
5	Design complexity	0	3	10	9	17	4.03	1.01	5
6	Conflict between contract document	0	2	10	14	13	3.97	0.90	6
7	Ineffective supervision by client	0	3	8	18	10	3.90	0.88	7
8	Change in project schedule	0	0	14	21	4	3.74	0.64	8
9	Delay in material delivery by supplier	1	3	13	14	8	3.64	0.99	9
10	Additional work from owner side	0	3	19	15	2	3.41	0.72	10
11	Differing site conditions	1	6	13	14	5	3.41	0.99	10
12	Delay of project schedule	1	5	15	14	4	3.38	0.94	12
13	Defective workmanship	1	4	16	15	3	3.38	0.88	12
14	New government regulations	0	4	22	11	2	3.28	0.72	14
15	Contractor not involved at design phase	1	8	13	13	4	3.28	1.00	14
16	Safety rules and regulation are not followed by contractor	2	7	18	8	4	3.13	1.01	16
17	Natural growth of project was not anticipated at design phase	1	9	16	12	1	3.08	0.87	17
18	Materials or workmanship not complying with specification	2	9	16	9	3	3.05	1.00	18
19	Technology change	0	12	17	6	4	3.05	0.94	18
20	Lack of communication between parties	3	11	12	10	3	2.97	1.09	20
21	Late decision making by contractor	3	8	17	9	2	2.97	0.99	20
22	Poor site management by contractor	0	14	16	8	1	2.90	0.82	22
23	On site changing in material specification	4	13	10	8	4	2.87	1.17	23
24	Unavailability of skilled labour/material	1	17	14	7	0	2.69	0.80	24
25	Severe weather conditions on job site	6	14	10	8	1	2.59	1.07	25
26	Bad relationship with supplier by contractor	7	13	14	5	0	2.44	0.94	26
27	Delays in payment by client	6	17	11	5	0	2.38	0.91	27
28	Contractor financial issues	9	12	13	5	0	2.36	0.99	28
29	Construction delays by contractor	8	17	11	3	0	2.23	0.87	29

Source: Field survey, 2019

The table shows that ‘Design modification by client’ ranked first with a mean of 4.23 and a standard deviation of 0.78 contributes more to causing change order than any other causes of change order in the construction phase as assessed by all the Engineers that were surveyed. This is followed by ‘Design modification by consultant’ with a mean score of 4.13 and a standard deviation of 0.70 ranked second, ranked third is ‘Owners financial problem’ with a mean score of 4.08 and a standard deviation of 0.84, ranked fourth is ‘Change in scope at later stage’ with a mean score of 4.05 and a standard deviation of 0.79 and ranked fifth is ‘Design complexity’ with a mean score of 4.03 and a standard deviation of 1.01. In the bottom five are ‘Severe weather conditions on job site’ ranked twenty fifth with a mean score of 2.59 and a standard deviation of 1.07,

followed by ‘Bad relationship with supplier by contractor’ ranked twenty sixth with a mean score of 2.44 and a standard deviation of 0.94, ranked twenty seventh is ‘Delays in payment by client’ with a mean score of 2.38 and a standard deviation of 0.91, ranked twenty eight is ‘Contractor financial issues’ with a mean score of 2.36 and a standard deviation of 0.99 and ranked twenty ninth is ‘Construction delays by contractor’ with a mean score of 2.23 and a standard deviation of 0.87.

Table 4.11: Builders perception on change order causes in construction phase

S/N	Causes of change order in construction phases	Frequencies					Mean	SD	Rank
		1	2	3	4	5			
1	Design modification by client	0	0	5	16	11	4.19	0.69	1
2	Change in scope at later stage	0	0	5	16	11	4.19	0.69	1
3	Owners financial problem	0	1	6	16	9	4.03	0.78	3
4	Design modification by consultant	0	1	7	15	9	4.00	0.80	4
5	Design complexity	0	3	8	8	13	3.97	1.03	5
6	Conflict between contract document	0	2	8	12	10	3.94	0.91	6
7	Change in project schedule	0	0	11	17	4	3.78	0.66	7
8	Additional work from owner side	0	2	10	16	4	3.69	0.78	8
9	Contractor not involved at design phase	0	6	7	11	8	3.66	1.07	9
10	Delay in material delivery by supplier	1	2	10	14	5	3.63	0.94	10
11	Ineffective supervision by client	0	4	10	13	5	3.59	0.91	11
12	Defective workmanship	0	3	13	11	5	3.56	0.88	12
13	Materials or workmanship not complying with specification	0	3	13	13	3	3.50	0.80	13
14	Technology change	0	5	12	9	6	3.50	0.98	13
15	Lack of communication between parties	0	7	12	8	5	3.34	1.00	15
16	Differing site conditions	0	6	14	8	4	3.31	0.93	16
17	On site changing in material specification	1	6	11	12	2	3.25	0.95	17
18	Delay of project schedule	0	6	15	9	2	3.22	0.83	18
19	Late decision making by contractor	0	7	14	10	1	3.16	0.81	19
20	Poor site management by contractor	1	8	15	6	2	3.00	0.92	20
21	Bad relationship with supplier by contractor	2	9	12	6	3	2.97	1.06	21
22	New government regulations	2	8	13	8	1	2.94	0.95	22
23	Delays in payment by client	2	11	12	7	0	2.75	0.88	23
24	Natural growth of project was not anticipated at design phase	1	12	13	6	0	2.75	0.80	23
25	Safety rules and regulation are not followed by contractor	6	13	10	1	2	2.38	1.04	25
26	Construction delays by contractor	5	14	9	4	0	2.38	0.91	25
27	Severe weather conditions on job site	3	17	9	3	0	2.38	0.79	25
28	Contractor financial issues	7	14	6	5	0	2.28	0.99	28
29	Unavailability of skilled labour/material	6	13	13	0	0	2.22	0.75	29

Source: Field survey, 2019

The table shows that ‘Design modification by client’ and ‘Change in scope at later stage’ jointly ranked first with a mean of 4.19 and a standard deviation of 0.69 contributes more to causing change order than any other causes of change order in the construction phase as assessed by all the Builders that were surveyed. This is followed by ‘Owners financial problem’ with a mean score of 4.03 and a standard deviation of 0.78 ranked third, ranked fourth is ‘Design modification by consultant’ with a mean score of 4.00 and a standard deviation of 0.80, and ranked fifth is ‘Design complexity’ with a mean score of 3.97 and a standard deviation of 1.03. In the bottom five are ‘Safety rules and regulation are not followed by contractor’, ‘Construction delays by contractor’ and ‘Severe weather conditions on job site’ jointly ranked twenty fifth with a mean score of 2.38 and a standard deviation of 1.04, 0.91 and 0.79 respectively, followed by ‘Contractor financial issues’ ranked twenty eight with mean score of 2.28 and a standard deviation of 0.99 and ranked twenty ninth is ‘Unavailability of skilled labour/material’ with a mean score of 2.22 and a standard deviation of 0.75.

Table 4.12 shows the details of the analysis of variance ANOVA statistics revealed the significant difference among the four categories of respondents (Architects, Quantity Surveyors, Engineers and Builders), in construction phase.

Table 4.12: ANOVA

<i>Source of Variation</i>	<i>Sum of Squares</i>	<i>Df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Between Groups	0.045	3	0.015	0.043	0.988
Within Groups	38.797	112	0.346		
Total	38.842	115			

A statistical test was conducted with the use of the One-way ANOVA to check if there is any significant difference between the responses from the four various professions surveyed. The result of the ANOVA in Table 4.14 revealed that the sig. value is 0.988 which is greater than 0.05, this means there is no significant difference between the opinion of the various professions that were surveyed.

4.2 Results on between independent sample T – Test between factors in preconstruction and construction phase

Table 4.13 shows the group statistics result of the independent sample T-test between the factors in the preconstruction phase and the factors in the construction phase. The test shows that the factors of the preconstruction phase, contributes more to change order having a higher mean than that of the construction phase.

Table 4.13: T-TEST

Labels	N	Mean	Std. Deviation	Std. Error Mean
Groups Preconstruction	7	3.134	0.627	0.237
Construction	29	3.266	0.558	0.104

The Table 4.14 shows the significant level difference of the phases. The results show the Sig (2-tailed) to be 0.587 and 0.623, showing that there is no significant difference in both phases.

Table 4.14: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Groups	Equal variances assumed	.093	.762	-.549	34	.587	-.132	.240	-.620	.356
	Equal variances not assumed			-.510	8.44	.623	-.132	.259	-.723	.459

DISCUSSION OF RESULTS

A construction projects is a series of several phases starting from the inception of project which normally involves the creativity and innovative ideas by the owner. The preconstruction phase thus ends up typically with inclusion of planning and design phase, thus, several changes are expected from owner side. This phase involves many variations from the owner side and mainly occurs due to the several reasons listed in the tables above.

From the analysis of data, the most critical cause of change order in preconstruction phase is “Poor working drawing details”. Typically, owner involves the designer to prepare the working drawings, as mentioned earlier, this is a very early stage of project delivery thus mainly involves a lot of mistakes as the details of the drawings are usually poor at this stage. Thus, this reason is very common in developing countries like Nigeria. The research by Keane, Patrick, Begum, and Ross (2010) agrees with these findings as various causes of change order through study are such as mistakes and modifications, ambiguous poor design, poor working and drawing details, poor coordination, and variation in specifications by owner. Also, the most critical five causes of change

orders were identified as: change of plans by owner, change of project scope by owner, problems on site, errors and omission in design, poor working drawing details (Alaryan and Alia, 2014). From the analysis of data in the construction phase, it can be seen that the top most critical factor of change order is “Design modification by owner”. Second top most cause is “change in scope at later stage”. Changes in project scope do cause delays and sometimes cause failure of projects. Therefore, it is necessary that project should be such that its scope will remain for long time. But it does not happen most of time, as mentioned the change in scope is very common in Nigeria as in Pakistan due to financial cut-off and other reasons. Another critical cause is “Owners financial problem”, project execution needs resources and resources come from budget. When client fails to have timely payment then it will cause delays in project time. These delays are sometimes so seriously that contractor could not complete the work and at later stage require change orders from the clients. Almost in all developing countries the finance is a basic issue facing the public clients. When the departments are out of budget such delays usually occur. This finding agrees with Alnuaimi *et al.* (2009) who concluded that the major cause of change orders on most construction projects was modifying the original scope or design, this is followed by change in specifications, change in design by the consultant, change in financial/economic conditions. Another study was carried out indicated that financial difficulties of contractor and construction delays by other contractors previously are important factors of change order (Pourrostan, Towhid, Ismail, and Mahmood, 2011).

On the other hand, the contractor has to meet the project deadlines, thus end results are contractor demands for the change orders. There is thus direct link of timely payment and the change order. The project owner must carefully tackle these issues by reserving the funds for the intended projects which they wish to have at exact time with stipulated cost and imagined best quality. In similar way, “Design modification by consultant” is another important cause of change order. Similar to the major root cause, “Design modification by owner” when errors and mistakes are done by the designer, the consultants want their early remedy but it usually affects the construction seriously.

Ijaola *et al.* (2012) agrees with this study, as identified that the additional works from client and design modification are the major causes of change order in both Nigeria and Oman.

CONCLUSION AND RECOMMENDATIONS

This study aimed at assessing the causes of change order in both the pre-construction and construction phase of construction projects in Nigeria. The objectives were to identify the change order causes in the preconstruction and construction phase and to assess these factors in the two phases in accordance with professional’s perception, the study thereafter concludes critical factors in both phases after subjecting these factors to analysis. From the results of critical factors of preconstruction, it is concluded that the consultant usually does several mistakes in the planning and designing stage which later on results in change orders from having poor working drawing details. The appointment of consultants and the monitoring of activities is not properly done due to which constitutes mistakes and errors found in the design stage. Similarly, the results of

construction stage present that critical causes are due to the client. Here frequent changes by the client and delays in payment by the client significantly affects the project delays and increased cost, thus results in demand of change orders by the contractor, *thus construction clients are the part which is highly responsible for such change orders in Nigeria.*

Nevertheless, the most critical cause of change order in preconstruction phase is “Poor working drawing details”. Also, owner involves the designer to prepare the working drawings, this is a very early stage of project delivery thus mainly involves a lot of mistakes as the details of the drawings are usually poor at this stage. Thus, this reason is very common in developing countries like Nigeria. It is extremely important to consider because when the working drawings are wrongly prescribed then it will cause problems for contractors to execute at later stage and can cause many issues like delays in project which influences project cost ultimately. More so, the top most critical factor of change order in construction phase is “Design modification by owner”. Second top most cause is “change in scope at later stage”. Changes in project scope will cause delays and sometimes cause failure of projects. Therefore, it is necessary that project should be such that its scope will remain for long time.

Recommendations

- i. The clients need to efficiently work during the planning and designing phase and further properly monitor the project during execution to avoid these orders.
- ii. More attention should be paid during design phase so as to avoid having poor working drawings and mistakes in drawings which brings about change orders.
- iii. In the future this study can be extended in many directions. As this study only focused on causes of change order, further research can be carried out on the effects of change orders on projects in both phases.

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DETERMINATION OF EFFECTIVE STRATEGIES FOR TRUCK TRANSIT PARKS MANAGEMENT PRACTICE

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ABSTRACT

Road transportation, among the other modes, plays a central role in economic development. In the developing world, many cities are rapidly growing and the economic patterns of the people living in these cities is changing. These changes have necessitated the need for the Transportation Authorities in the cities around the globe to come up with plans and strategies that will efficiently and effectively provide mobility facilities. The current parking planning practices are inefficient, resulting in economically excessive parking supply, increased automobile traffic, and more dispersed destinations, contributing to various economic, social and environmental problems. This study determines effective truck transit parking strategies based on the following objectives: the identification of truck transit parking management concepts, determination of the challenges hindering effective truck transit parking management practice and establishment of effective strategies that enhance truck transit parking management practice. A total of 350 questionnaires were administered to consultants, statutory authority/development control staff, contractors, clients, commuters, drivers, and transporters among others. 203 questionnaires were returned representing 58% valid response rate and subsequently analysed using descriptive and inferential statistics with the aid statistical package for social sciences (SPSS) software. The study determines the problems hindering effective transit truck parking management practice in Kaduna metropolis to include: *facility costs: increased development and operating costs for parking facilities, environmental impacts: loss of greenspace, air pollution, parking congestion, squatter settlements* among others. The most effective parking management strategies determined consist of: *more accurate and flexible standards, overflow parking plans, parking facility design and operation* among others. Conclusively, the current truck transit parks management practice is bedeviled with some challenges which affects or hinders TTP management practice. These logistical challenges increase automobile traffic and accidents, encourage and disperse urban fringe development among others which contribute to various economic, social and environmental problems. Finally, the suitable strategies determined in this study enhance TTP management practice.

Keywords: *Truck Transit Parks, Transportation, Logistical Challenge, Parking Management Strategies*

INTRODUCTION

Road transportation, among the other modes, plays a central role in economic development. In the developing world, many cities are rapidly growing and the economic patterns of the people living in these cities is changing (Kodukula and Sharma, 2011). These changes have necessitated the need for the Transportation Authorities in the cities around the globe to come up with plans and strategies that will efficiently and effectively provide mobility facilities. Often city officials presume that the provision of more parking spaces for the citizens means meeting the mobility needs. On the contrary, every truck that is on the road needs a place to be parked: it is a key issue in almost all urban areas and beyond.

Truck transit park is one of the critical infrastructures that drives economic growth in many nations by enabling easy trade, services and manufacturing (Montgomery, 2015). While in developing economies, investment in infrastructure is vital for poverty reduction (Fay *et al.*, 2011; Nuramo &

Haupt, 2017). Parking facilities that serve multiple destinations are efficiently regulated or priced to favor higher value users (for example, delivery vehicles and customers over commuters and residents) tend to be efficiently used. Often, city officials presume that the provision of more parking spaces for the citizens means meeting the mobility needs. On the contrary, every car that is on the road needs a place to be parked: it is a key issue in almost all urban areas and some highways. In recent times, the existing parking planning practices are inefficient, resulting in economically excessive parking supply, increased automobile traffic, and more dispersed destinations, contributing to various economic, social and environmental problems (Izuwah, 2018; Litmann, 2019). There are several reasons to use management strategies that result in more efficient use of parking resources, in order to address parking problems without expanding supply. Furthermore, other challenges faced in this area are high traffic and over congestion among others (Izuwah, 2018). See Plates 1 and 2. To this end, this paper seeks to determine effective truck transit parking strategies based on the following objectives: the identification of truck transit parking management concepts, determination of the challenges hindering effective truck transit parking management practice and establishment of effective strategies that will enhance truck transit parking management practice.



Plate 1: Izuwa (Current situation of Truck Parking Management Practice in some places Nigeria). From *Infrastructure Concession Regulatory Commission, Nigeria* (2018).



Plate 2: Izuwa (Current situation of Truck Parking Management Practice in some places Nigeria). From Infrastructure *Concession Regulatory Commission*, Nigeria (2018).

LITERATURE REVIEW

Parking Management is a general term for strategies, policies and programs that encourage more efficient use of existing parking facilities, reduce parking demand and shift travel to non- Single-Occupant Vehicle (SOV) modes (Seattle Urban Mobility Plan Report, 2008; Barter 2014).

Managing parking helps to reduce the undesirable impacts of parking demand on local and regional traffic levels and the resulting impacts on community liveability and design. At the same time, smart management of parking helps to ensure access to retail businesses, provides access for visitors to regional and neighbourhood attractions and supports neighbourhood vitality. The supply of free or inexpensive parking at the final destination is a key decision factor cited for choosing to drive a personal auto rather than taking a bus, bike, walk or carpool.

Principles of Parking Management

Parking management principles can help to guide planning decision to support parking management. These are: Choice of viable options, information to motorists, sharing of parking facilities, efficient utilization of space, flexibility, prioritization, appropriate pricing, accountability, peak period management, quality (aesthetics, convenience, safety, etc.), and analysis of costs and benefits (Litmann, 2019).

Parking Management Strategies

These include: enforcement of regulations, reduce on-street time limits (e.g., 2-hours to 90 minutes, increase the number of spaces, encourage businesses to share parking, encourage use of alternative modes, develop special regulations (for the disabled, delivery/ loading areas, etc), and implement a residential parking permit program if needed to address spillover problems, as well as providing signs and maps showing motorists where they may park.

(Victoria Transport Policy Institute VTPI, 2005; Litman 2006a & Willson, 2015).

Importance of Parking Management

Parking management is important in that it results in facility cost savings, improved service quality, flexible location and design, revenue generation, reduces land consumption, supports mobility management, supports smart growth, improved walkability, supports transit, reduced stormwater management costs, water pollution and heat island effects, supports equity objectives, and more liveable communities (Litmann, 2019). See Plate 3.



Plate 3: Izuwa (Modern TTP Facility). From *Infrastructure Concession Regulatory Commission, Nigeria* (2018).

Challenges of TTP Management Practice

Some of the challenges are: parking congestion, facility costs, traffic congestion, inequity, tax costs, environmental impacts, sprawl and high rate of accidents.

Paradigm Shifts and Innovations

Parking planning is undergoing a paradigm shift, a fundamental change in how problems are perceived and solutions evaluated (Belmore, 2019; Economist, 2017). The old paradigm places a heavy burden of proof on innovation. The new paradigm recognizes that transport and land use conditions evolve, so parking planning practices need frequent adjustment. It shifts the burden of proof, allowing new approaches to be tried to test their effectiveness, or lack thereof. The old paradigm results in predict and provide planning, in which past trends are extrapolated to predict future demand, which planners try to satisfy. This often creates a self-fulfilling prophecy, since abundant parking supply increases vehicle use and sprawl, creating a cycle of increased automobile dependency, as illustrated in Figure 1.

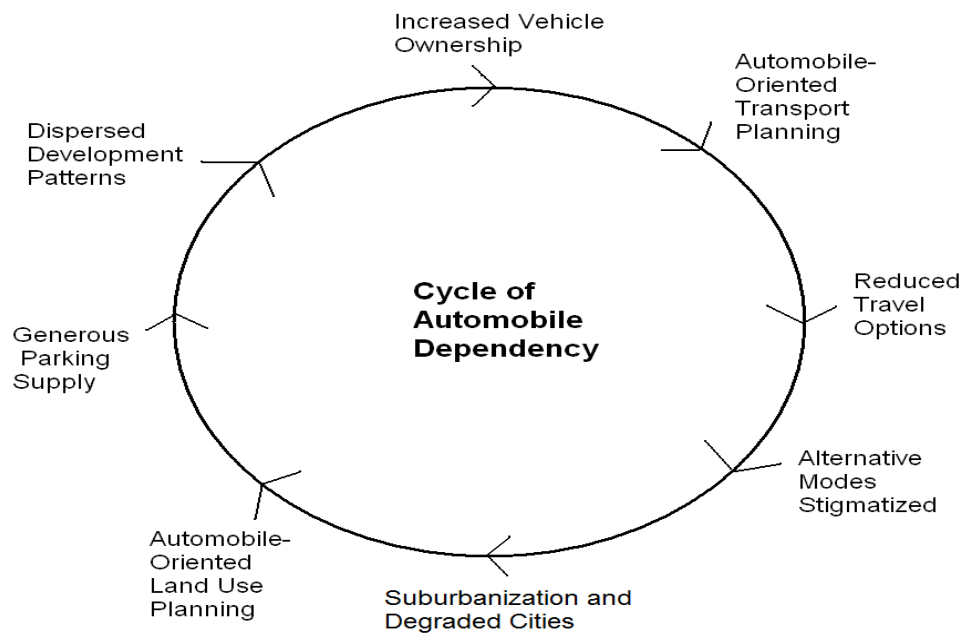


Figure 1. Cycle of Automobile Dependency: Generous parking supply is part of a cycle that leads to increased automobile dependency. Parking management can help break this cycle (Litmann, 2019).

Improve User Information and Marketing

User information refers to real-time information for travelers about parking availability, regulations and price, and about travel options, such as walking, ridesharing and transit can increase motorist satisfaction, increase parking space utilization and encourage shifts to alternative modes (Kimble, 2010). User information can be provided by signs, maps, brochures, websites, and electronic guidance systems (Poon, 2018).

Local governments can produce brochures and websites that identify the location of parking facilities. User information is one component of marketing.

Table 1 Parking Management Strategies

Strategy	Description
Strategies That Increase Parking Facility Efficiency	
Shared parking	Parking spaces serve multiple users or destinations, including sharing rather than assigning reserved spaces to users, and sharing facilities among multiple destinations.
Parking regulations	Regulations that favour higher-value uses, increase turnover and address spill over problems.
More accurate and flexible standards	Parking standards are adjusted to more accurately reflect demand in a particular situation taking into account various geographic, demographic and management factors.
Parking maximums	Establish maximum parking standards.

Remote parking	Provide off-site or urban fringe parking facilities, and encourage their use.
Smart growth	Encourage more compact, mixed, multi-modal development.
Walking and bicycling improvements	Improve walking and cycling conditions to expand the range of destinations serviced by a parking facility and reduce automobile trips.
Increase capacity of existing facilities	Increase parking supply by using otherwise wasted space, smaller stalls, car stackers and valet parking.
Strategies That Reduce Parking Demand	
Mobility management	Encourage more efficient travel including changes in mode, timing and destination.
Ridesharing, ride-hailing and transit	Improve ridesharing (car- and vanpooling), ride-hailing (such as Uber and Lyft) and public transit services, particularly in denser urban areas.
Efficient parking pricing	Charge motorists directly for using parking facilities, with efficient prices that include lower rates during off-peak periods and higher rates during peak times and locations.
Unbundle parking	Rent or sell parking facilities separately from building space.
Financial incentives	Provide financial incentives to shift mode, such as parking cash-out and transit benefits.
Improve pricing methods	Use better charging techniques to make pricing more convenient and cost effective.
Parking tax reform	Various tax policy changes that support parking management objectives.
Bicycle facilities	Provide bicycle storage and changing facilities.
Support Strategies	
Improve user information	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures and electronic communication.
Improve enforcement	Ensure that parking regulation enforcement is efficient, considerate and fair.
Transport management associations	Establish member-controlled organizations that provide transport and parking management services in a particular area.
Overflow parking plans	Establish plans to deal with periods of peak parking demand.
Address spill over problems	Use management, enforcement and pricing to address spill over problems.
Parking facility design and operation	Improved parking facility design and operations to help solve problems and achieve parking management objectives.
Contingency-based planning	Identify possible responses that can be implemented if the current parking supply turns out to be inadequate sometime in the future

Source: Seattle Urban Mobility Plan Report (2008); Litman (2019)

Gap/Outstanding issue

The current parking planning practices are inefficient, resulting in economically excessive parking supply, increased automobile traffic, and more dispersed destinations, contributing to various economic, social and environmental problems. There are many reasons to use management strategies that result in more efficient use of parking resources, in order to address parking problems without expanding supply.

RESEARCH METHODOLOGY

Research Approach, Data Collection Method, Population and Sampling

The paper adopted quantitative research approach through the use of questionnaire survey. In general, questionnaire survey helps in collecting information on facts, activities, level of knowledge, opinions, expectations and aspirations, membership of various groups, and attitudes and perceptions relevant to the study (Naoum, 1998; Siniscalco and Auriat, 1998; Russell, 2006; Enshassi *et al.*, 2010). The questionnaire survey assessed the strategies and challenges of Truck Transit Parks in Nigeria. Statistical tools were subsequently used to analysed the data to achieve the research objectives (Fellows and Liu, 1999; Hughes, 2006).

The population of this study, therefore, consists of seven (7) categories of respondents; consultants, statutory authority/development control staff, contractors, clients, commuters, drivers, and transporters that are concerned with truck transit parks design, construction, management and maintenance. Stratified random sampling was used in determining the sample size as proposed by Levy & Lemeshow (2008).

Sample

Samples were drawn from the target population based on a statistically determined, efficient sample size so as to estimate some parameters of the population. The estimated population quantities were then used to assess the prospects and challenges of Truck Transit Parks management in Nigeria.

The following table summarizes the sample allocation in this stratified random sampling:

Table 2: SAMPLE SIZES IN EACH STRATUM

Strata (Type of Respondents)	Sample size
Clients	50
Statutory authority/development control staff	50
Consultants	50
Contractors	50
Drivers	50
Transporters	50
Commuters	50
Total	350

RESULTS, ANALYSIS AND DISCUSSIONS

Survey Results

Characteristics of respondents

Type of Respondents

The frequency for the survey is as follows: 28 form the response from Statutory authority/development control staff representing 13.79%; 35(17.24%) from Clients representing; 36 (17.73%) from Consultants; 39(19.21%) from Contractors; 38 (18.71%) from Drivers; 15(7.38%) form response from Transporters; 12(5.94%) was response from Commuters. Distribution of data collection was reasonable with a response of more than 50%.

Respondents' Experience in Truck Transit Parks Management Practice:

The distribution of data collection on respondents' experience is as follows: 5-10years form 37%; 11-20years comprised of 38.56%; and 21-30years was 24.44%. Survey on respondents' experience shows that majority of them are conversant with the TTP management practice.

Determining the challenges hindering Truck Transit Parks management practice in Nigeria

The severity for each of the challenge hindering Truck Transit Parks management was determined using the criteria established and discussed earlier identified in literature. The results of the assessment are provided below.

The rating scales for mean values are as follows: 0-1.49= Not Severe (NS), 1.5-2.4= Least Severe (LS), 2.5-3.4= Fairly Severe (FS), 3.5-4.4= Severe (S), 4.5-5.00 = Very Severe (VS)

Table 3: Challenges hindering TTP management practice in Nigeria

S/No.	Challenges	Mean	Std. Deviation	Ranking	Remarks
1	Facility costs: increased development and operating costs for parking facilities	4.689	0.0576	1	VS
2	Environmental impacts: loss of greenspace, air pollution	4.606	1.2	2	VS
3	Parking congestion	4.589	0.8792	3	VS
4	Squatter settlements	4.566	1.2022	4	VS
5	Driver fatigue	4.504	0.0876	5	VS
6	Sprawl: encouraging dispersed, urban fringe development, and discouraging multi-model	4.501	0.0012	6	VS
7	Inequity: distribution of costs, including cost burdens on people who do not use parking fac	4.421	1.5188	7	S
8	Poor vehicle maintenance	3.871	0.2001	8	S
9	Spillover: problems from motorists where they are not wanted	3.772	0.0705	9	S
10	Rate of accidents	3.698	0.0303	10	S
11	Tax costs: tax burden required to subsidized parking facilities	3.5	0.4491	11	S
12	Traffic congestion	3.233	0.3079	12	FS
13	High way shoulder defacing	3.122	1.9871	13	FS

Source: Research survey (2020)

Determining the strategies enhancing Truck Transit Parks management practice

To determine the strategies enhancing Truck Transit Parks management practice, the strategies identified in literature were examined. The suitability of each of the strategy was determined using the criteria established and discussed earlier. The assessment of the strategies was done based on the respective truck transit management practice around the globe. The results of the assessment are provided below.

The rating scales for mean values are as follows: 0-1.49= Not Suitable (NS), 1.5-2.4= Least Suitable (LS), 2.5-3.4= Fairly Suitable (FS), 3.5-4.4= Suitable (S), 4.5-5.00 = Most Suitable (MS)

Table 4: Strategies enhancing TTP management practice

S/No.	Strategies	Mean	Std. Deviation	Ranking	Remarks
1	More accurate and flexible standards	4.72	0.1214	1	MS
2	Overflow parking plans	4.69	0.3308	2	MS
3	Parking facility design and operation	4.63	0.1377	2	MS
4	Ridesharing, ride-hailing and transit	4.54	1.9917	3	MS
5	Address spill over problems	4.54	0.1082	3	MS
6	Parking regulations	3.98	0.1199	4	S
7	Increase capacity of existing facilities	3.83	0.2071	5	S
8	Efficient parking pricing	3.65	0.7326	6	S
9	Unbundle parking	3.65	0.8515	7	S
10	Financial incentives	3.36	1.8214	8	FS
11	Improve pricing methods	3.33	0.0770	9	FS
12	Parking maximums	3.19	0.3592	10	FS
13	Parking tax reform	3.07	1.2202	11	FS
14	Support Strategies	3.02	0.7869	12	FS
15	Improve user information	2.97	1.2971	13	FS
16	Improve enforcement	2.88	0.1626	14	FS
17	Contingency-based planning	2.80	1.5505	15	FS
18	Transport management associations	2.69	0.4414	16	FS
19	Remote parking	2.45	0.0970	17	LS
20	Smart growth	2.45	0.0873	17	LS

Source: Research survey (2020)

Testing respondents' extent of differences on the severity of the challenges of TTP management practice in Nigeria and importance of the benefits of TTP management practice established

To test whether significant differences exist in terms of the opinions of the respondents regarding the severity or otherwise of the challenges of TTP management practice in Nigeria, and importance of TTP management practice, Analysis of Variances (ANOVA) was employed. The study assumed a normally distributed sample. The ANOVA test results was interpreted using the following:

- If P-value is 0.05 and above, this implies that there is a Significant Difference (SDf) in ranking among respondents. In a nutshell, the ranking is in disagreement
- If P-value is <0.05, this implies that there is No Significant (NDf) difference in ranking between or among respondents. In a nutshell, the ranking is in agreement

Table 5: Respondents' extent of differences on the challenges hindering TTP management practice in Nigeria established

Interpretation of P-values: Significant Difference= SDf, No Significant Difference= NDf

S/No.	Challenges	P-value	Remarks
1	Facility costs: increased development and operating costs for parking facilities	0.013211	NDf
2	Environmental impacts: loss of greenspace, air pollution	1.543421	SDf
3	Parking congestion	0.011345	NDf
4	Squatter settlements	0.767892	SDf
5	Driver fatigue	0.098763	SDf
6	Sprawl: encouraging dispersed, urban fringe development, and discouraging multi-model	0.052309	NDf
7	Inequity: distribution of costs, including cost burdens on people who do not use parking fac	1.818769	SDf
8	Poor vehicle maintenance	0.044332	NDf
9	Spillover: problems from motorists where they are not wanted	0.043219	NDf
10	Rate of accidents	0.033208	NDf
11	Tax costs: tax burden required to subsidized parking facilities	0.020765	NDf
12	Traffic congestion	0.713344	SDf
13	High way shoulder defacing	1.878799	SDf

Source: Research survey (2020)

Table 6: Respondents' extent of differences on the strategies enhancing TTP management practice established *Interpretation of P-values: Significant Difference= SDf, No Significant Difference= NDf*

S/No.	Strategies	P-value	Remarks
1	More accurate and flexible standards	0.011185	NDf
2	Overflow parking plans	0.683312	SDf
3	Parking facility design and operation	0.003302	NDf
4	Ridesharing, ride-hailing and transit	0.987328	SDf
5	Address spill over problems	0.037821	NDf
6	Parking regulations	0.046912	NDf
7	Increase capacity of existing facilities	0.010133	NDf
8	Efficient parking pricing	0.878099	NDf
9	Unbundle parking	0.612667	SDf
10	Financial incentives	0.835702	SDf
11	Improve pricing methods	0.776065	NDf
12	Parking maximums	0.393887	NDf
13	Parking tax reform	0.989776	SDf
14	Support Strategies	0.057021	SDf
15	Improve user information	0.352823	SDf
16	Improve enforcement	0.273385	SDf
17	Contingency-based planning	0.612885	SDf
18	Transport management associations	0.8357021	SDf
19	Remote parking	0.0111029	NDf
20	Smart growth	0.0333775	NDf

Source: Research survey (2020)

DISCUSSION OF FINDINGS

Challenges hindering TTP management practice in Nigeria

Table 3 show the TTP management challenges that were determined in order of their severity and they include: *facility costs: increased development and operating costs for parking facilities,*

environmental impacts: loss of greenspace, air pollution, parking congestion, squatter settlements, sprawl: encouraging dispersed, urban fringe development, and discouraging multi-model. These challenges are considered very severe and hinder or hamper TTP Management practice. This is because ratings on the severity of those challenges are within the range of 4.5 – 5.00. However, the respondents considered the remaining challenges (*traffic congestion and high way shoulder defacing*) as severe and fairly severe because their ratings are within mean values of 2.5-4.4. It can be deduced that; these challenges hinder TTP management practice. Furthermore, Table 5 show that *facility cost, rate of accidents* among others indicate no significant differences on challenges hindering TTP management practice. The severity of these challenges determined in this study is line with assertion by Izuwah (2018) who opined that, these challenges hinder efficient TTP management practice.

Strategies enhancing TTP management practice

Table 4 show the TTP management strategies in order of their suitability as indicated as follows: *more accurate and flexible standards, overflow parking plans, parking facility design and operation, ridesharing, ride-hailing and transit, address spillover problems, parking regulations, increase capacity of existing facilities, efficient parking pricing and unbundle parking.* The foregoing are considered as the most suitable strategies that enhance TTP Management practice. This is because ratings on the suitability of those strategies are within the range of 3.50 – 4.72.

However, the respondents considered these strategies (*remote parking and smart growth*) of TTP management practice as fairly suitable because their ratings are within mean values of 2.5-3.4. Table 6 show that *more accurate and flexible standards, smart growth* among others indicate that no significant differences exist on respondents rating on those challenges hindering TTP management practice.

The results also show that these strategies enhance TTP management practice, and it conforms with assertion by (Litmann, 2019), who reported that, these strategies promote the TTP management.

CONCLUSION

The current truck transit parks management practice in Nigeria is bedeviled with some challenges which affects or hinders TTP management practice. The challenges determined in this study increase automobile traffic and accidents, encourage and disperse urban fringe development among others. And these challenges which contribute to various economic, social and environmental problems associated with TTP management. The suitable strategies determined in this study enhance TTP management practice. And the adoption of these strategies can be achieved through sensitization of stakeholders on the importance of them, and policies that will force their adoption in TTP management. In conclusion, more safe and befitting trucks transits facilities are needed in order to address the undesirable impacts of parking demand on cities and highways traffic.

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MULTISKILLING OF QUANTITY SURVEYORS IN THE NIGERIAN CONSTRUCTION INDUSTRY: EMPIRICAL ANALYSIS OF PROPELLING MEASURES

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ABSTRACT

The clamour for the roles of Quantity Surveyors in the delivery of construction projects have evolved over time given the dynamic nature and ever-increasing complexities of the construction industry. The need for multiskilling of Quantity Surveyors is pertinent to meet up with the demands of effective project delivery; hence efforts should be geared towards attaining the rudiments of multiskilling of Quantity Surveyors. Based on the aforementioned, this study seeks to assess the propelling measures of Quantity Surveyors multiskilling abilities in the Nigerian construction industry. Questionnaire survey was adopted for study using Lagos state, Nigeria as the study area while purposive sampling was deployed while Quantity Surveyors made up the target respondents. A total of seventy-six questionnaires was distributed while sixty-nine were returned and all deemed appropriate for analysis. With the use of appropriate methods of data analysis, retrieved data was analysed and the findings showed that skill shortage and the need for the reduction of contractors' idle time are the most significant driver of multiskilling among Quantity Surveyors. The study concluded by making insightful recommendations for impelling multiskilling abilities of Quantity Surveyors in the Nigerian construction industry.

Keywords: multiskilling, quantity surveyors, construction industry, Nigeria.

INTRODUCTION

The construction industry is unique in the way it manages and organizes human resources. Unlike manufacturing or process industries, each construction project is different in terms of staffing, organization, strategy and management. Projects vary greatly from small office renovations to large complex construction works. Each project requires a different labour force and as the work on site proceeds, the various work teams that have gradually been integrated during the course of work have to break up and re adjust themselves in different groups on different sites (Odusami *et al.*, 2007). Consequently, every project presents its own challenges and requires a unique complement of tradespeople during various construction phases (Dada and Ekpe, 2006). The increasing complexities of construction projects and construction activities have led to the development of innovative disciplines in the construction industry. These new disciplines with great market opportunities have made professional Quantity Surveyors to acquire new skills different from the core discipline of quantity surveying. The construction industry has been subjected to criticisms for delivering products and services which fall below clients' expectation of quality, cost certainty and assured delivery (Construction Skills, 2012). The need for improvement has been recognized not only by researchers but also various stakeholders in the construction industry (Construction Industry Council, 2012).

The concept of multi-skilling dates back to the construction of mega structures like the Egyptian pyramid and the Great Wall of China. According to Manyi *et al.* (2018), multi-skilling is a labor

utilization strategy where workers possess a range of skills appropriate for more than one work process and the use of these skills are flexibly deployed on different projects within the same organisation. A trade person is now expected to establish a thorough knowledge of all aspects of the trade, rather than simply specializing in one of its components (Dada and Ekpe, 2006). A multi-skilled workforce is one in which the workers possess a range of skills that allow them to participate in more than one work process (Lill, 2009). Multiskilling is therefore the acquisition of skills, knowledge, competency, and experience which enable an individual to perform tasks outside the immediate job requirements, thereby providing the organisation with a flexible and adaptable worker, and a pool of skilled human resources (Davaro and Martin, 2010). Because craft boundaries are blurred using multiskilling, a multi-skilled workforce can be organized in such a way that workers are employed for longer durations at the site while the total project hiring requirements are reduced. A worker may be selected to participate in any activity in which he or she is proficient in and may be saddled with the responsibility of engaging in another activity provided the competence for delivering is proven (Gomar *et al.*, 2002).

In Nigeria, quantity surveying firms and construction organisations are yet to understand or apply the concept of multiskilling and the resultant is the frequent lapses in the attainment of predetermined project outlined objectives. These failures are mostly attributed to lack of skilled workers, poor project scheduling and poor management of funds. The concept of multi-skilling has long been applied to areas of production and positive results have been significant in terms of cost benefit and other key performance indicators. According to Dada and Ekpe (2006), multiskilling is one way to help ensure permanent employment and optimise the rate of turnover which quite evident in developed countries where workers are properly trained to fit into different roles. Moreover, the declining productivity and industrial performance have prompted researchers in the construction industry to seek ways to use resources more efficiently and effectively (Ejohwomu *et al.*, 2005). It has been established that multiskilling is a strategy whereby a worker possesses various skills suitable for more than one work process and used flexibly on project or in organization (Thomas, 2010); therefore, Quantity Surveyors can be given construction tasks based on their ability to perform the necessary skills/tasks, albeit not limited to traditional work boundaries. Based on flexible application of skills the Quantity Surveyor possesses, through content acquisition, professionals can make effective and productive contributions to the output of project processes, though they can get the mastery skill level in all fields. Also, specialisation has been recognized to be a potent driver for the implementation of innovative strategies for the actualisation of set out goals and objectives of organisations (Chan and Dainty, 2007).

Babalola (2009) noted that a fundamental requirement for any profession to continue thriving is its ability to adapt to changes in its working environment. For Quantity Surveyors, these changes are pointers to the call that the profession should begin to engage in construction activities other than the traditional cost management practices. One driving factor for multiskilling among Quantity Surveyors is shortfall of skilled personnel. Chan and Dainty (2007) noted that the shortage in skills has been a perennial challenge facing the actors and stakeholders in the construction industry, and also there are still concerns for the industry that there might be deficiency in personnel capacity for the delivery of construction projects as well as the anticipated growth in both medium and long terms. Furthermore, the perennial issues of delay construction project delivery are a driving factor for multiskilling. Hence, alternative utilisation of strategies

and the espousal of modified industry practices are needed if the construction industry is to mitigate declining performance effectively (Farnham and Hutchinson, 2011). Also, the elimination of redundancy by the adoption of effective multiskilling is a proponent for its utilisation. Chhabra (2017) affirmed that multiskilling aids in avoiding redundancy in the working systems and gives added competitive advantage to any organisation. The ability to maintain production levels under varying circumstances is a driver for multiskilling of any discipline (Fox, 2004). Putting this in place will ensure that workers are able to fill in for absent employees and work in departments or sections that demands increased man power at any time.

The quantity surveying profession is one that demands a high demonstration in the proficiency of various skills, hence, the process of learning and upgrading should be continually encouraged. Inculcating multiskilling capabilities would bring about the utilisation of strategies that has the potential to enhance opportunities for the development of process innovations and the implementation of technological advancements (Ettlie and Rezo, 1992). Furthermore, there is a creation of a more marketable propensity for organisations that adopts multiskilling by its workforce in service delivery (Fox and Yuen, 2004). Based on the highlighted benefits of deploying multiskilling capabilities, this study is geared towards empirically assessing the propelling measures of inculcating multiskilling abilities among Quantity Surveyors in the Nigerian construction industry.

RESEARCH METHODOLOGY

The study aimed at evaluating the drivers of multiskilling of Quantity Surveyors in the Nigerian construction industry. The research design deployed for the study adopted the use of quantitative method with the use of questionnaire as the research instrument for data collection. This is largely influenced from the fact the questionnaire is a viable research tool with the ability to cover a large number of respondents in a limited period of time (Ponto, 2015). The study area for the research was Lagos state, Nigeria; the state serves as the commercial nerve center of the country, and boasts of enormous construction projects of various sizes, and a large pool of construction professionals. The target population for the study was made up of Quantity Surveyors, while purposive sampling was utilised as a result of limitation in time and cost for the study. The questionnaire used in eliciting response from the respondents was made up of two sections; the first section dwelt on the demographic information of the respondents, while the second section inquired on the drivers of multiskilling of Quantity Surveyors in the Nigerian construction industry. A 5-point likert scale was used with 5 being strongly agree, 4 agree, 3 being neutral, 2 being disagree and 1 strongly disagree. The questionnaires were administered via electronic means to the target respondents. A total number of seventy-six questionnaires were distributed while sixty-nine were returned and duly completed. The method of data analysis used was percentage, standard deviation, mean item score and Kruskal-Wallis H-test. Also, the reliability of the research instrument was assessed using Cronbach's alpha test and gave a value of 0.811 which outlines a high reliability of the research instrument since the value is closer to 1.00 (Gujarati, 2003).

RESULTS AND DISCUSSION

Background Information

The background information of the respondents shows that 51% are affiliated with consulting firms while 25.5% work with contracting outfits and 23.5% work for government establishment. Furthermore, on the basis of the highest academic qualification obtained, 54.9% have Bsc/Btech, 29.4% possess HND, 11.8% have Msc/Mtech, and 3.9% have OND. Based on the years of experience, 76.4% of the respondents have 1-5 years of experience, 21.6% have 5-10 years, while 2% have a working experience of 11-20 years.

Drivers of Multiskilling of Quantity Surveyors

The determination of the drivers of multiskilling of Quantity Surveyors was initiated with the identification of the factors following the review of literature. The respondents were asked to rank the drivers based on the level of their agreement. As shown in Table 1, the ranking of the identified drivers using mean item score is indicated. Furthermore, Kruskal-Wallis H test was deployed in ascertaining if there is significant difference in the responses of among Quantity Surveyors who are affiliated with organisations such as government establishment, contractors and consulting. The results show that all the identified drivers all have a mean score well above 4.00. Also, the most important drivers are skill shortage ($MIS=4.88$, $S.D=0.196$), need for reduction in contractors idle time ($MIS=4.72$, $S.D=0.418$), ability to react to unexpected problems encountered during service provision ($MIS=4.70$, $S.D=0.428$) and need to control cost of labour ($MIS=4.69$, $S.D=0.513$). Furthermore, the deployment of Kruskal-Wallis H test in ascertaining if there is a difference in responses given by the three different groups of respondents shows that all the drivers all have a p-value above 0.05, thus indicating that at 95% confidence level, there is a significant relationship in the views of the groups of respondents on the drivers of multiskilling of Quantity Surveyors in the Nigerian construction industry. This implies that the Quantity Surveyors irrespective of their affiliation with different organisations such as government, contractors and consulting all share similar views on the drivers of multiskilling of Quantity Surveyors in the Nigerian construction industry.

Table 1: Drivers of Multiskilling of Quantity Surveyors

Drivers	Mean	Std. Deviation	Chi-Square	Asymp. Sig.
Skill shortage	4.88	0.196	1.128	0.569
Need for reduction in contractors idle time	4.72	0.418	4.236	0.120
Ability to react to unexpected problems encountered during service provision	4.70	0.428	0.682	0.711
Need to control cost of labour	4.68	0.513	1.794	0.408
Ability to repeatedly provide the same level of service to consumers(consistency)	4.60	0.473	1.980	1.980
Declining entry of entrants	4.57	0.469	2.129	0.372
Competitive advantage	4.40	0.469	0.991	0.609
Ability to adjust to service to meet the unique needs of the consumers	4.33	0.528	0.769	0.681

Technology innovation required in the process of	4.30	0.532	0.754	0.686
Construction delays	4.22	0.493	4.125	0.127
Possession of required skill knowledge (competency)	4.19	0.493	3.334	0.189
Economic factors (increase in income generation)	4.08	0.497	0.209	0.901
Need to be more productive	4.01	0.500	8.264	0.116

Discussion

The findings of the study portray that the most significant driver of multiskilling of Quantity Surveyors is skill shortage during the course of delivering quantity surveying services in construction project delivery. This is affirmed by Chan and Dainty (2007) who noted that the shortage in skills has been a perennial challenge facing the actors and stakeholders in the construction industry, and also there are still concerns for the industry that there might be deficiency in personnel capacity for the delivery of construction projects as well as the anticipated growth in both medium and long terms. The profession of quantity surveying plays a pertinent role in the delivery of construction projects; hence it is important that the profession is highly encouraged in multiskilling capacities and abilities which would abate the challenges of skill shortage as reported. Furthermore, the need for reducing contractors' idle time is also a significant driver of multiskilling of Quantity Surveyors. Dada and Ekpe (2006) highlighted that it is necessary that multiskilling capabilities are inculcated for the reduction of idle time in the processes involved in construction project delivery. Also, it is important to note that with multiskilling aids in the collective and timely delivery of processes engaged in during the course of project execution. Quantity Surveyors are huge stakeholders in the realm of construction; hence the adaption of multiskilling capabilities would hugely influence the optimisation of construction processes.

CONCLUSION

An assessment of the propelling measures of multiskilling of Quantity Surveyors was carried out in the study. Following the review of literature, the identification of the measures was attained and subsequently formed the basis for the formulation of the research instrument. Findings gotten from the study indicates that skill shortage and the need for the reduction of contractors' idle time served as the most important measures driving the multiskilling propensity of Quantity Surveyors in the Nigerian construction industry. Furthermore, it was shown that among the various respondents affiliated with different working organisations, it was proven that there is no significant difference on their perception of the drivers of multiskilling of Quantity Surveyors in the Nigerian construction industry. Based on the backdrop of the benefits of inculcating multiskilling capabilities among Quantity Surveyors in the Nigerian construction industry for effective project delivery, the study recommends that the practice of quantity surveying as a profession in the Nigerian construction industry should be carried out within tenets that would spur the adaptation of multiskilling abilities among Quantity Surveyors.

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ASSESSMENT OF THE OCCURRENCE OF CONSTRUCTION CLAIMS IN BUILDING PROJECTS IN NIGERIA

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ABSTRACT

A construction claim is a request for compensation through evidence brought forward by a party in support of their case. The purpose of this research is to determine the occurrence and intensity of construction claims in building projects in the study area. The research method employed was a quantitative method that involved the use of a questionnaire to get information from respondents. The questionnaire was self-administered and the response rate was about 72%. The population for the study was clients (Chief executive of public tertiary institutions), client representatives (professional employed by public tertiary institutions), main contractors, and consultants (Architects and Quantity Surveyors) engaged in building projects executed in four tertiary institutions in Ekiti State, Nigeria from the year 2005 to 2015. Mean Item Score (MIS), and ANOVA was used in analysing the data collected. The study revealed that the three major factors responsible for the occurrence of construction claims in descending order were procurement method, inadequate site investigation, and low price of contract due to high competition. The findings in practice imply that the adversarial method of procuring public projects is the major cause of construction claims. It was recommended that all stakeholders involved in building projects should adopt appropriate procurement methods such as public-private procurement or concession. The study also recommended that adequate site investigation should be carried out before the commencement of contract documentation whilst the lowest price tender syndrome should be discouraged in the award of contracts in the study area.

Keywords: claim management, construction claims, factors, tertiary institutions, types of claim.

INTRODUCTION

A construction claim arises when a contracting party believes the other party in some ways has not met its part (Levin, 1998; Kartam, 1999) by act or omission. In other words, an argument occurs when one party has experienced a loss that the other party ought to pay for. A construction statement is essentially an assertion of the evidence submitted by a claimant and an argument made in favour of his case and a payment request. However, Taher (2012) defines construction claims as to the claim for compensation for damages incurred by another Party to the construction contract by one party. Because of the nature and complexity of operations and activities involved in the production of its end product, the construction industry undergoes unavoidable changes. Singh and Kamdan (2005) argue that the modifications typically affect a large variety of building demands and the final result of construction claims is cost/time overrun. A claim is described as “a request, demand, implication for payment or justification of pressured entitlement to which the contractor rightly or wrongly at this stage considers himself entitled to an agreement that has not yet been reached” in the reference to “Claims in Perspective” by Hughes and Barber (1992).

One of the main concerns of building specialists is to find a solution for preventing or curtailing construction claims and disputes. In response to this question, Yates (2003) is of the view that the possible causes of the allegations and how far they can be discussed should be expressed. In most cases, contractors fail to consider security and risk premiums so that the possibility is not jeopardized, particularly in competitive bidding and publicly funded projects. It is not uncommon

for contractors to claim for a project and hope that through negotiations and lawsuits, the loss will be recovered (Rook, Seymour & Fellows, 2004). During a study conducted by Kahssay (2003) construction complaints arose when the conditions and terms of the contract were altered so that costs and benefits could not be recovered by the contractor. To this end, this research is aimed at evaluating the occurrence and as well as causes of construction claims in building projects in the studied area to overcome the construction cost overruns.

LITERATURE REVIEW

According to Rubin *et al.* (1992), the construction claims scenario came long before people and equipment reached the worksite. Both parties have frequently signed conditions for claims and disputes. This is valid, for example, of incomplete or faulty plans and specifications. More often than not, building agreements are vague, equally restrictive, or unfairly threaten only a single party. Specific statements are frequently made because of the difficulty of the production and management of construction processes. Akinradewo and Oladinrin (2018) clarified that the construction industry is not regulated by a limited number of domestic or multinational companies, whether vertically or horizontally. It is a fragmented, distributed industry with thousands of small and medium-sized construction firms and product suppliers. The study also claimed that in the United Kingdom the construction industry there are more than 150,000 workers, hundreds of specialist subcontractors, hundreds of general entrepreneurs, thousands of large companies, and small entrepreneurs. Construction claims come from a wide range of direct as well as indirect causes (Institute of Civil Engineers, 1986). Jensen and Schnack (1997) believe that due to the negative financial consequences that the scenario has on the return rate of the project, a time-related claim arises. The reasons for an extension of time claims are: unfair weather, storm signal hosting, instructions for resolving inconsistencies, variation, site delayed access, daily advancement interruption because of late instructions of variation, inspections being opened, a time limit for any person or organization working, and Yogeswaran *et al.* (1998) considered that these are the triggers for which a claim might result. Edward and Risk (2000) observe that claims can be made in many ways concerning their source; those sources are the main contracting parties and their documentation; a few reasons for each source can be seen. Such causes and sources are as shown in Table 1:

Table 1: Factors Responsible for Claims

Source	Factor
Owner	1. Lack of know-how
	2. Project organization long-line authority
	3. The working sequence of the owner
	4. Delayed schedule authorization and order adjustment
	5. Processing of Slow Change Order
	6. Incapacity to obtain authorisations
	7. Documents contain no relevant milestone dates.
Contract documents	8. Insufficient timetable provisions
	9. Drawings not indicating work interfaces
	10. Allowance for undefined duties
	11. Unreasonable milestone and interface requirements
	12. Model Specification Compliance Leverage

Consultant	13. Insufficiently defined teamwork 14. Power explicitly identified by the individual party 15. Management plan experience deficiency 16. Command of performance
Contractor	17. Failure to preserve the record 18. Insufficient timeline changes and tracking of progress 19. Coordination on-site 20. The discussions on Work Progress 21. Specification non-compliance 22. Web guidelines not dealing with them. 23. No schedule updates 24. Cooperation and communication reticence 25. Miscellaneous date failure. 26. Failure to include requirements

Source: Edward and Risk (2000)

Frequency of Occurrence of Construction Claims

Several scholars and writers wrote about the inevitability of different types of claims for projects in construction. Diekmann and Nelson (1985) saw the basic facts about the frequency and severity of claims. They analysed the causal relationship between statement incidence and certain other independent building project characteristics. Several project features have been examined. The cost of each contract was one of the variables considered. Due to the scope of the project, the larger the project, the greater the possibilities for modification. They stated that the size of the claim settlement and the contract size is consistently related. Also, the size of individual claims with increasing project size is predictable.

Another variable considered is the annual volume of the contractor, which was suspected of providing greater entrepreneurs with more experience and staff to find solutions to claims. Claims were less likely to grow with the size of the contractor. The contract price ratio and the second low claim in expectation of further reports for projects with a higher value ratio were other factors. The industry's traditional experience implies that an entrepreneur who is well below his competition will try to recoup losses from more claims. The findings supported the conventional wisdom. Because the design error-based claims frequency was observed, they investigated whether the project designer type affected the claim frequency. Several designs have been conducted by in-house professional designers and industrial designers. Results indicate that the record of avoiding claims was higher for commercial designers than for internal designers.

The claims are generally common in building projects and can be made for some reasons which can help to delay a project and/or increase its costs. The completion of a planned project is an unpredictable, complicated, diverse, and competitive project environment (Kartam, 1999). It's a difficult task for us to accomplish. With the high cost and risks of claims and their dispute becoming more familiar to project participants, the construction industry needs to devise methods and techniques to reduce or prevent claims. While construction disputes are common and difficult to resolve, legal advice is often not sought because it is not accessible or is costly (Barrie and Paulson, 1992). Based on the frequency and severity of these causes, Al-Khalil and Al-Ghafly (1999) found the main reasons for claims in public utility projects in Saudi Arabia. The research showed the results of construction claims in the Emirates of Dubai and Abu Dhabi, which were

based on data gathered for one hundred and twenty-four claims relating to various projects in the two Emirates. The collected data shows different types of projects developed over a time of around five years. The obtained data suggested that in UAE building projects the categories of claims may be categorized in six main types of claims that include contract uncertainty, delay claims, claims for acceleration, claim for improvements, claims for extra-works, and specific claims for the condition of the site. The results show that claims for improvement are the most common type of claims. Claims for additional work were ranked second and claims for contract ambiguity were ranked last.

RESEARCH METHODOLOGY

The research method employed in this study is the quantitative method. The quantitative method involved the use of a questionnaire survey to gather the opinion of respondents on the frequency of claims occurrence and the factors responsible for these claims. The population relevant to this study were public clients (chief executive of tertiary institutions), client representatives professionals employed by tertiary institutions), construction firms (main contractors), and consultant Architects and Quantity Surveyors engaged in building construction projects in the Tertiary Institutions in Ekiti State. A total of 152 were identified which comprises 47 clients and client representatives, 24 architects, 15 quantity surveyors, and 66 contractors. Worthy of note is that each participant in the population was considered once regardless of the number of projects in which they were involved and thus reduced the target population to 124 using the Yamane formula (1967). The questionnaire was designed on a 5-points Likert-type scale with 5 been the highest of the rating. The questionnaire designed for this research was a multiple-choice type. The preliminary section of the questionnaire focused on the background information which was designed to collect data on the general characteristics of the respondents to ascertain the quality of the data in readiness for the analysis and interpretation. This first section served as the source of information on the profession, years of working experience, and membership of professional bodies of the respondents. The other sections of the questionnaire dwelt on matters relating to the research which was divided into subsections according to the objectives of the study. Descriptive statistics such as Mean Item Score (MIS) and frequency, percentage distribution was used in analysing the data retrieved while the results were presented in tables. Analysis of variance was also carried out to determine the variance in the response of the different categories of respondents.

FINDINGS AND DISCUSSION

This section of the report presents the profile of respondents who participated in the questionnaire administration. The total questionnaire administered was 124 out of which 90 was returned and 89 of the questionnaires were suitable and fit for analysis. They analysed questionnaires represent 72% of the total questionnaires sent out and based on Oke and Ogunsemi (2009) assertion that the result of a survey could be considered to be biased and of little significance if the rate of return is between 20-30%, thus the analysed questionnaire is considered to be sufficient.

Table 2 shows that Client organisations are in the majority with 56.2% of the respondents working in such an organisation. This was closely followed by those working in contracting and consulting firms with 29.2% and 14.6% of the respondents respectively working in the organisation. The Academic qualification of the respondents showed that 40.40% of the respondents had HND, first-degree holders had a quota of 36% of the respondents and this is closely followed by the master's

degree holder with 21.2% while respondents with OND were the least with 2.2%. The table also shows the professional designation of the respondents and it shows that Quantity Surveyors were in the simple majority with 33.3% respondents and they were followed by Builders with 25.8% while the least were other allied professionals such as Estate Surveyors and Town planner who was just 3.4%. Professional qualification of the respondents shows that 42.7% were corporate members of their respective professional bodies and followed by graduates with 36% while those with fellow qualification were the least with 2.2% of the total respondents. As regards current levels of the respondents in their various organisations, Senior Professional Staff had the largest score of 43.8% closely followed by Senior Technical Staff with 36% while the least is Management Staff with 20.2%. considering the year of working experience of the respondents, years 6-10 had the largest score of 29.2%, closely followed by years 11-15 with 24.7% while the least was years 1-5 and above 20 both with 14.6%.

Table 2: Summary of Characteristics of Respondents

Characteristics	Frequency	Percent
Type of Organisation		
Client	50	56.2
Contracting	26	29.2
Consulting	13	14.6
Total	89	100.0
Academic Qualification		
OND	2	2.2
HND	36	40.4
BSC/BTECH/B.ENG	32	36.0
MSC/MBA/MPM	19	21.4
Total	89	100.0
Professional designation		
Architect	15	16.9
Builder	23	25.8
Engineer	21	23.6
Quantity Surveyor	27	30.3
Other	3	3.4
Total	89	100.0
Professional qualification		
Graduate	32	36.0
Associate	12	13.5
Corporate	38	42.7
Fellow	2	2.2
Non-Member	5	5.6
Total	89	100.0
Current Level		
Management Staff	18	20.2
Senior professional staff	39	43.8
Senior Technical staff	32	36
Total	89	100.0
Year of working experience		
1-5year	13	14.6
6-10year	26	29.2
11-15year	22	24.7
16-20year	15	16.9
Above 20year	13	14.6
Average		7.89

FACTORS RESPONSIBLE FOR THE OCCURRENCE OF CONSTRUCTION CLAIMS

Table 3 shows that the first three major factors responsible for the occurrence of construction claims are procurement methods with a mean score of 4.11, inadequate site investigation with a mean score of 3.98, and low price of contract due to high competition with a mean score of 3.93. However, specifications and drawings inconsistencies, bad quality of contractor's work, and poorly written contracts with mean scores of 3.09, 3.14, and 3.28 respectively were the least three factors responsible for the occurrence of construction claims. The mean score of all the factors was above 2.50 which is the average of the maximum mean score of 5.00. The mean scores of the factors range from 3.09 to 4.11 as indicated in Table 3. A further test was carried out using analysis of variance that is ANOVA statistical test as shown in Table 3. The result shows that there is no significant difference in the opinions of the respondents in respect of all the identified factors. This is because the F-value of the factors was greater than 0.05. This implies that all identified factors have a significant influence on the occurrence of construction claims.

The study revealed that the three major factors responsible for the occurrence of construction claims in descending order were procurement method, inadequate site investigation, and low price of contract due to high competition. On the contrary, Zanelidin (2006) in a similar study in the United Arab Emirates concluded that the three major factors responsible for the occurrence of construction claims were change or written orders, a delay caused by owners, and oral change order by the owner. The reverse is also the case in Ren *et. al.* (2003) that concluded that there are three major causes of the occurrence of construction claims were unforeseeable site conditions, changes by client, and acceleration.

Table 3: Factors Responsible for Occurrence of Construction Claims

Factor	Arc		Builder		Eng		QS		Others		Overall		F	Sig.
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank		
Procurement method	4.27	2	4.17	1	4.00	2	4.00	2	4.67	8	4.11	1	0.515	0.725
Inadequate site investigation	4.13	5	3.91	2	3.67	9	4.19	1	4.00	23	3.98	2	0.954	0.437
Low price of contract due to high competition	3.80	7	3.74	6	4.14	1	4.00	2	4.00	8	3.93	3	0.715	0.584
Delay due to inclement weather-flood, storm, etc.	4.20	4	3.78	3	3.71	8	3.96	4	5.00	15	3.93	3	1.367	0.253
Delay in payments/inappropriate payment method	4.27	2	3.52	13	3.81	4	3.85	6	3.67	23	3.82	5	1.365	0.253
Change orders or variation	4.33	1	3.78	3	3.76	7	3.52	22	3.33	4	3.78	6	1.100	0.362
Acceleration of works	3.73	8	3.74	6	3.90	3	3.69	13	3.33	15	3.75	7	0.278	0.891
Design errors or omissions	3.60	10	3.78	3	3.38	12	3.88	5	3.67	4	3.68	8	0.687	0.603
Inflation/price escalation	3.67	9	3.52	13	3.81	4	3.62	15	4.00	23	3.66	9	0.281	0.889
Contractor not well organized	3.33	17	3.65	9	3.57	10	3.81	8	4.00	8	3.64	10	0.464	0.762
Contractor financial problem	3.60	10	3.57	12	3.81	4	3.58	18	3.67	4	3.64	10	0.204	0.935
Planning errors	4.00	6	3.65	9	3.29	15	3.58	18	4.00	8	3.61	12	0.930	0.451
Inappropriate contractor selection	3.60	10	3.70	8	3.19	17	3.73	10	3.33	8	3.56	13	0.734	0.571
Variations in qualities	3.53	14	3.30	17	3.38	12	3.85	6	3.67	23	3.53	14	1.040	0.392
Estimation error	3.13	21	3.57	11	3.24	16	3.73	10	4.33	3	3.49	15	1.842	0.128
Delay caused by owner	3.60	10	3.35	15	3.38	12	3.62	15	3.33	8	3.48	16	0.281	0.889
Government regulations	3.53	14	3.26	19	3.19	17	3.77	9	3.33	8	3.44	17	0.997	0.414
Incomplete tender information	3.27	20	3.30	17	3.19	17	3.69	13	3.67	15	3.40	18	0.801	0.528
Sub-surface problem	3.33	17	3.09	24	3.05	22	3.73	10	3.67	1	3.33	19	1.824	0.132
Termination of work	3.40	16	3.35	15	3.10	21	3.58	18	2.33	15	3.33	19	1.007	0.409
Sub-contracting problems	3.00	22	3.09	23	3.48	11	3.62	15	3.00	15	3.32	21	1.181	0.325
Poorly written contracts	3.33	17	3.26	19	3.10	20	3.50	23	2.67	15	3.28	22	0.570	0.685
Bad quality of contractor's work	2.80	24	3.22	21	2.76	23	3.58	18	3.00	4	3.14	23	2.128	0.084
Specifications and drawings inconsistencies	3.00	22	3.22	21	2.71	24	3.31	24	3.33	1	3.09	24	0.899	0.469

Table 4: Level of Occurrence of Construction Claims

Variable	Architect		Builder		Engineer		QS		Other		Overall		F	Sig.
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank		
Contractual claims	4.13	1	4.17	2	4.33	1	4.33	1	5.00	1	4.39	1	.800	.529
Extra work claims	3.67	2	4.39	1	3.86	2	4.26	2	4.33	2	4.10	2	2.021	.099
Change claims	3.13	6	3.78	3	3.43	3	4.04	3	4.33	2	3.74	3	2.396	.057
Delay claims	3.60	3	3.13	7	3.24	4	3.59	4	4.00	4	3.51	4	1.218	.310
Different site condition claims	3.33	4	3.39	4	2.71	7	3.52	5	2.67	5	3.12	5	1.813	.134
Different measurement pricing claims	3.20	5	3.30	5	3.05	5	3.37	6	2.33	6	3.05	6	.847	.499
Acceleration claims	2.73	8	3.22	6	2.90	6	3.00	8	2.33	6	2.84	7	.713	.585
Damages claims	2.80	7	3.04	8	2.71	7	3.30	7	2.00	8	2.77	8	1.582	.187

LEVEL OF OCCURRENCE OF DIFFERENT TYPES OF CONSTRUCTION CLAIMS

It is apparent from Table 4 that out of the eight different types of claims, the one that has the highest level of occurrence is contractual claims with an average score of 4.39. This was followed by extra-work claims with a 4.10 mean score while the least is damage claim with a 2.77 mean score. In general, it could be deduced from the analysis that all the various types of construction claims have an averagely high level of occurrence. Further to this, the ANOVA statistical test was also employed to assess variance in the opinion of the respondents for each identified type of claim. The result of the analysis in Table 4 reveals that there no significant difference in the opinion of the respondents for all the eight types of claims because their p-value was greater than 0.05. This confirmed that the level of occurrence of all the eight various types of claims was averagely high.

The result of the study indicated that contractual claims were the most frequent, followed by extra-work claims and change claims. Zanelidin (2006) researched the frequency of occurrence of each of the identified six types of construction claims. The result indicates that ‘changes’ claims are the most frequent type of claims. Extra-work claims were ranked second while contract ambiguity claims were ranked last. Diekman and Nelson (1985) on the frequency of the occurrence of construction claims came out with the result that the single most frequent cause of contract claim was a design error. The result of this study is therefore not at variance with the outcome of earlier researchers on the level of occurrence of a construction claim.

CONCLUSIONS

This study has assessed the occurrence of construction claims in building projects in Ekiti state, Nigeria. As such, it has examined factors responsible for the occurrence of claims and the level of occurrence of various types of claims. It was discovered that all the identified factors were responsible for the occurrence of construction claims, even though some are more important than the others. However, the three major factors responsible for the occurrence of construction claims were procurement method, inadequate site investigation, and low price of contract due to high competition. This may be due to inadequate time for planning at the inception of the project by the stakeholders because in practice the design team is not always giving enough time at the conception stage of the projects. The study also shows that virtually all the identified types of claims occurred frequently. However, it is apparent from the study that contractual claims, extra work claims, and change claims occurred most frequently in descending order. This may be due to a lack of mitigating measures that can guide against the occurrence of claims by the design team. It is therefore recommended that all participants or stakeholders involved in building project planning and execution should synergise to ensure that the award of a contract to the lowest bidder is discouraged or possibly eliminated. This would eliminate or ameliorate the issue of claim in building projects. Having investigated the occurrence of construction claims on building projects in government-owned tertiary institutions, further studies can be carried out to include private-owned tertiary institutions. This study focused solely on building projects, further research could be extended to civil engineering and heavy engineering projects.

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A CONCEPTUAL FRAMEWORK FOR DEVELOPING MACHINE LEARNING MODELS FOR PROCUREMENT PROCESSES

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ABSTRACT

Challenges bedevilling the predominantly conducted manual procurement approach has necessitated procuring entities to transform to the web-based approach. Over the past few decades, several attempts have been made to improve the automation of the web-based procurement systems including the use of machine learning. However, studies that apply machine learning to automate the entire lifecycle of the web-based procurement systems are lacking. This study proposes a conceptual framework for developing machine learning models for procurement processes for deployment as part of a web-based system. A qualitative research approach was adopted through in-depth review of literature for this research. The study shows that potential exists for procurement processes to benefit from machine learning. The study also concludes that human interference will be greatly reduced, thereby reducing humanly errors and corrupt practices by humans, and improving transparency of the web-based procurement approach.

Keywords: Challenges, conceptual framework, machine learning, manual procurement, web-based systems.

INTRODUCTION

Manual procurement of goods, works and services has been the leading approach to the acquisition of goods, works and services. However, this method has been found to be error prone. These errors consist of inefficiency, lack of transparency, piling cases of corruption, problematical procedures, huge interference of the state, and non-functioning bureaucratic ties. (Yap, Soh, and Raman, 1994; Ng, Chin, and Hung, 2007). To tackle these issues, public sector procuring entities started adopting the web-based Tendering/e-Procurement systems (EGMR, 2011). This change to the web-based systems has yielded numerous benefits that bring about reduction in procurement expenditures, enlarging proficiency and transparency, reduction of corruption and swindle, enhancing answerability, and many more (Neupane, Soar, Vandya, Yong, 2010; EGMR, 2011; eTEG, 2012).

Several web-based procurement systems have been designed and implemented by procuring entities so as to execute their procurement activities in various countries. Some of the systems include Korean KONEPS, Malaysian ePEROLEHAN, Japan JETRO, USA FACNET, Philippines PHILGEPS, Scotland ePS, JEPP of Belgium, DOIP of Denmark and UK Tender Direct (EDSA, 2004; Mohamad *et al.*, 2010; EGMR, 2011). The systems have solved numerous challenges haunting various procurement processes in the likes of

prequalification and contractors' registration, as well as consultants and suppliers; advertisement to tender; tender submission; closing of tender; opening of tender; tender evaluation; and contract award notification. Nonetheless, EDSA (2004), Pasupathinathan *et al.* (2009), Kohli (2010), and Mohamad *et al.* (2010) acknowledged a number of confinements that some of the designed systems are possessing. These limitations comprise the failure to evaluate tender automatically, inconformity to security and legal necessities, lack of complete integration of the front-end and back-end processes.

In previous years, developed web-based procurement systems have been evolving from one-way information systems which automates announcement of tender alone to wholly incorporated systems which have entirely automated the front-end and back-end procedures of the procurement system (Betts *et al.*, 2006; Fong and Yan, 2009). Several researches have been conducted to develop web-based procurement systems which are better than the traditional paper-based systems. Some of the works looked at design and implementation (Kedridge *et al.*, 2000; Lai *et al.*, 2007); interoperability and integration across multiple platforms (Noor *et. al.*, 2003; Lick *et. al.*, 2007); tender negotiation (Zhuang *et al.*, 2004); legal and security requirements (Du *et. al.*, 2004a.b; Betts *et. al.*, 2006; Mohammed and Johanshi, 2009; Pasupathinathan and Pieprzyk, 2009; Malik, 2013); and tender evaluation through decision support system (Fong and Yan, 2009; Padumansa and Rehan, 2009; Noor and Man, 2010; and Noor and Mohemmad, 2010; Bin and Tiexin, 2013); and e-Tendering research in Africa (Adebiyi *et. al.*, 2010; Muchiri *et. al.*, 2015; and Afolabi *et. al.*, 2017).

In recent years, machine learning (ML) has been gaining popularity in aiding decision-making. This is because ML is a technique that applies algorithms in finding concealed trends which cannot be recognised by humans to make decisions using existing data. Due to the procurement process being data-rich, it has the prospective to reap from ML. Quite a lot of researches have applied ML in many procurement processes which include spend analysis (Domingos, Carvalho, Carvalho and Ramos, 2016); contractor/supplier prequalification and selection (Khosrowshahi, 1999; Lam, Ng, Hu, Skitmore and Cheung, 2000; Lam, Hu, Ng, Skitmore and Cheung, 2001; Elazouni, 2006; Kar, Pani and De, 2009; and Zhang, Li, Wu and Meng, 2016); tender evaluation and classification (Kayte and Schneider-Kamp, 2019; Rabuzin and Modrušan, 2019; Kim, Choi and Kang, 2018; Ovsyanniko and Domashova, 2020).

Nonetheless, studies that designed a web-based procurement system that takes into consideration the entire procurement lifecycle which has its processes automated with the aid of machine learning are lacking. A system like that will be able to recognise, and adjust itself when new data is introduced, and modify its performance accordingly to have better efficiency. This paper proposes a conceptual framework for developing machine learning models which can be incorporated into a web-based procurement system for the Nigerian public procuring entities.

This paper is divided into sections. The first section introduces the problem. The second section reviews literature on the application of machine learning in the procurement lifecycle. The next section provides the methodology adopted. The fourth section discusses the results of the study. Finally, the last section provides conclusions drawn from the study.

LITERATURE REVIEW

Machine Learning in Procurement Processes

One of the key areas of AI that is gaining wide acceptance in procurement is machine learning (ML). ML deals with the training of software agents to learn from large and complex data set and make an accurate prediction of the future. According to Hurwitz and Kirsch (2018), ML allows business organisations to make a better forecast of the future through the innovative utilisation of the constant stream of datasets. Specifically, ML uses learning algorithms to train a software agent to learn from a data set. The following subsections provide works carried out on the application of ML in procurement lifecycle:

Spend Classification

Domingos, Carvalho, Carvalho and Ramos (2016) used a deep learning (DL) auto-encoder, which is a form of unsupervised learning of artificial neural network (ANN) to detect anomalies in procurement spends using data from procurement records.

Tendering

Studies related to the application of AI within the tendering phase include those of Nguyen (1985), Russell and Skiebniewski (1990b), and Ng (1996). These researchers have applied different AI techniques (fuzzy set, knowledge-based expert system, and case-based reasoning) in the selection of contractors.

Khosrowshabi (1999) developed a neural network for contractor's prequalification for local authority project. They discovered neural network technique as a viable tool for the prediction of success and failure of the contractor to qualify to tender for local authority project.

Lam *et. al.* (2000) applied ANN to develop a contractor prequalification model that classifies contractors into 'qualified' and 'not qualified' classes. They argue that the prequalification models based on the linear relationship will be limited in modelling prequalification decision, as the relationship between the input criteria and the qualification decisions is a non-linear type. They proposed the use of neural network model as an alternative to current models.

Lam, Hu, Thomas, Skitmore and Cheung (2001) applied fuzzy neural network (FNN) for contractor prequalification. The model addressed the non-linearity, uncertainty and subjectivity inherent in contractor prequalification, and further improved the performance of the neural network model by Lam *et. al.* (2000).

Elazouni (2006) developed an unsupervised learning neural network model for classification of contractors into groups based on similarity of financial ratios of liquidity, activity, profitability, and leverages. This approach is adopted where contractors are to be prequalified into various groups based on their capacity. The model performs clustering, where contractors are represented as patterns in a multi-dimensional space, according to attributes in the classification process. Contractors of similar performance are clustered together.

Kar (2009) developed a methodology for classification of suppliers into 'suitable' and 'unsuitable' using fuzzy neural network (FNN) and analytic hierarchy process (AHP) in an e-Procurement. The model was developed for prequalification of suppliers.

Zhang *et. al.* (2016) has explored the use of ML in supplier selection. The model was developed using a Rank Neural Network (RNN) to rank suppliers. Their model becomes better at selecting suppliers as the volume of data increases.

Evaluation/Classification of Documents/Tender

Different works have been carried out in applying ML to evaluate and classify tenders. Kim, Choi and Kang (2018) used K-means clustering to identify the bidding trends of firms in Korea. Kayte and Schneider-Kamp (2019) applied neural network (NN) and support vector machine (SVM) to classify the European Union (EU) Tender Electronic Daily (TED) text documents. Rabuzin and Modrušan (2019) adopted Naïve Bayes classifier (NBC), logistic regression (LR) and SVM in the detection of suspicious tenders. Ovsyannikova and Domashova (2020) applied NN in finding contracts with high risk of non-performance.

Table 1 summarises the finding from the literature review on the application of machine learning in procurement lifecycle.

Table 1: Review on the application of ML in procurement processes:

PROCUREMENT ACT/PROCESSES	AUTHORS	OUTCOMES	ALGORITHM USED	DATA USED	DATA SOURCE
<u>Procurement Planning</u>					
Spend analysis	Domingos, Carvalho, Carvalho and Ramos (2016)	Purchase anomalies	DL (auto-encoder)	Procurement transactions	Procurement records
<u>Tendering</u>					
Evaluation/classification of documents/tender	Kayte and Schneider-Kamp (2019); Rabuzin and Modrušan (2019); Kim, Choi and Kang (2018); Ovsyannikova and Domashova (2020)	Tender evaluation and classification	NBC, LSTM NN, SVM, NLP, LR, K-Means clustering	Project titles; Technical and Professional Criteria from Tenders; Bid rates, number of bidders, and firms tendering rates; Financial information of suppliers and customers, and characteristics of the contracts	Tender documents
Contractor/consultant	Khosrowshahi (1999); Lam, Ng,	Contractor/consultant prequalification	ANN, SVM, FNN, RNN	Assessment criteria	Technical proposal

prequalification /selection	Hu, Skitmore and Cheung (2000); Elazouni (2006); Kar, Pani and De (2009); Lam, Palaneeswar an and Yu (2009); Lam, Hu, Ng, Skitmore and Cheung (2010); Zhang, Li, Wu and Meng (2016)	n and selection in construction project procurements			

METHODOLOGY

For the purpose of this research, a qualitative approach was adopted. It involves the in-depth review of literature on procurement processes to have been automated using ML, and subsequently the nature of data used; the variables used for the ML models development; and the ML algorithms applied in those existing works to logically suggest how other procurement processes can be automated. The results from the literature review were used in proposing the framework.

Hurwitz and Kirsch (2018) have identified 8 steps in the building of an ML model. These include: identify data (say, procurement data); prepare data; select the ML algorithm e.g. deep learning; train the algorithm (using procurement data set); evaluate different models; deploy model to cloud as part of a software system e.g. web-based procurement system; use deployed model to predict with new data; and finally assess legitimacy of model's prediction. Rao (2019) supported this when explaining the ML development lifecycle where he started with problem definition and establishment of ground truth; then he identified the next step to be the phase of data collection, cleansing and preparation; after that, the model is trained and tested; then the model is validated; and finally, the model is deployed, after which a track of the model is kept for monitoring and evaluation.

The proposed framework for developing machine learning models for Procurement Processes is represented in Figure 1, which is adopted from Gao and Pishdad-Bozorgi, 2019. They grouped the steps followed in ML model development into four sections:

1. Identifying the descriptive attributes (or Features)
2. Identifying the target attributes (or Labels)
3. Training the machine learning models (using train data), and
4. Evaluating the models (on test data) and selecting the most suitable one.

RESULTS

Potential Areas for the Application of Machine Learning in the Procurement Lifecycle

Review of works (as contained in Table 1) has shown that ML is applied to help organisations in decision making that include suggestions, recommendations, classification, selection, etc. this means that there are procurement processes which have

the ability to give in to ML for improvement. Table 2 shows the potential areas for the application of ML in the procurement lifecycle.

Table 2: Procurement processes with the potential of reaping the benefit of ML:

PROCUREMENT ACT/PROCESSES	POSSIBLE INPUT	LIKELY OUTPUT	DATA SOURCE	PROBLEM TYPE/DOMAIN
<u>Needs Assessment</u>				
Needs Prioritisation	Price certainty; time certainty; size; complexity; speed; quality; flexibility; price competition; risk allocation; responsibility; familiarity; government policies	High; medium; low	PE Needs	Classification
<u>Procurement Planning</u>				
Spend analysis	Amounts of good, services and works purchased; lifecycle costs of purchased categories; methods of purchase; details of suppliers	Routine products; leverage products; bottleneck products; strategic products	Procurement Expenditure Records	Classification
Selection of Procurement method/strategy	Procurement procedures; delegation of authority; financial thresholds; internal clearance/approval procedures; administrative timeframes; procurement type; complexity/specificity of requirement; market conditions; existing arrangements; contracts; potential for collaborative procurement; urgency of the requirement; specific local conditions; target delivery date; delivery terms; analysis of requisition; selection of responsible unit; considerations of not-buy options;	Open competitive bidding; national competitive bidding; restricted/selective bidding; single sourcing; direct procurement; national shopping; renewal of contract; retainership of service	PE Needs	Classification

	selection method; competition type; contract			
<u>Tendering</u>				
Evaluation/classification of documents/tender	Project titles; Technical and Professional Criteria from Tenders; Bid rates, number of bidders, and firms tendering rates; Financial information of suppliers and customers, and characteristics of the contracts	Building; civil engineering; educational; health, etc. High risk; low risk Likely to perform; unlikely to perform Fraudulent; non-fraudulent	Tender Documents	Classification
Contractor/consultant prequalification/selection	Past performance reference; past experience strength; financial strength; current workload; human resources capacity; technical capability; quality potentials; environment, health and safety performance potentials; management capability; reputation; legal requirements	Qualified; not qualified	Technical Proposal	Classification (Binary)
Bid evaluation	Typical materials critical for every project		BOQ	Unsupervised learning
<u>Contract Administration</u>				
Contract review & Award	Contract documents information	Completion date; payment terms; renegotiation rights; dispute resolution technique; risk insurance; etc.	Contract Documents	Natural Language Processing

Review of literature (as contained in Table 1) has shown that sub-processes like spend analysis; evaluation and classification of documents/tenders; and contractor/supplier/consultant prequalification and selection have been improved using machine learning.

Results from the review has shown that machine learning is used in decision making that include suggestions, recommendations, classification, selection, etc. and therefore conclusion was drawn that there are sub-processes that have the potential of reaping the

benefits of ML. these sub-processes consist of needs prioritisation; selection of procurement method/strategy; and contract review. The rest of the sub-processes have been analysed and have been found to lack the potential of being susceptible to ML.

Framework Development

Section 1: Identification of the descriptive attributes (the independent variables):

This section answers three questions: What decision-making processes can be significantly improved using machine learning in the Procurement Processes, what are the variables used in making those decisions, and what are the types and sources of the data containing those variables? The outcomes obtained from the review of literature provide the answers to these questions. Those features are then to be validated through interview with procurement experts. The identified descriptive attributes have been given in Table 2.

Section 2: Identification of the target attributes (the various groups/clusters the models are expected to achieve):

This section identifies the target attributes which the model is expected to achieve. This section answers two questions: What decisions is the model expected to achieve, and what are the types and sources of the data to be extracted for that? The results from the literature review also answer the questions above. They are as well to be validated through interview with procurement professionals. The identified target attributes are also given in Table 2.

Section 3: Training machine learning models:

After identifying the descriptive and target attributes, training the machine learning models using those data becomes the next stage. For the proposed framework, the machine learning algorithms that can be employed include multiple regression, decision trees, Naïve Bayes, Artificial Neural Networks (ANN), as identified from literature. The various ML algorithms identified to be used in procurement are given in Table 1. The review of literature has also shown that majority of procurement problems are addressed using supervised machine learning. In the proposed framework, the algorithm pool for training models for Procurement Processes is flexible; as novel machine learning algorithms in data analytics are developed, those new algorithms can be embraced and employed inside the framework.

Section 4: Evaluating the models:

Models evaluation and selection of the optimum machine learning algorithm for Procurement Processes can be attained via comparison of the models' efficiency by repetitive random sampling and cross-validation, as identified by Hu and Castro-Lacouture (2019). Initially, a random fragmentation of the dataset into a training set and test set, using a ratio, assume of, 7:3. Several duos are produced through random sampling of data points in the training set and data points in the test set (e.g. m duos). For every duo (e.g. the duo j), its training data point is engaged in training machine learning models employing every

algorithm, and then a cross-validation metric, for example k-fold cross-validation is carried out in yielding a successions of evaluation outcomes on every of the models (P_{j1} , P_{j2} , ..., P_{jk}). The average performance, P_j , is employed in representing the performance of the resultant algorithm. When the repetition of the training and cross-validation procedure for the respective randomly engendered data duos (m in total) is complete, the algorithms will then have a respective m performance evaluation results (P_1 , P_2 , ..., P_j , ..., P_m). The results will then be examined by means of a suitable evaluation metric like mean squared error, mean absolute error, Accuracy etc. in determining the algorithm that outclasses the others.

Popular evaluation metrics for used for machine learning models include mean absolute percentage error (MAPE), the mean squared error (MSE), the root-mean squared error (RMSE), the coefficient of determination (R^2) or adjusted R^2 . MAPE carries out comparison between the predicted and actual outcomes (Makridakis *et al.*, 1998). Where the MAPE is not up to 10%, it is regarded as an outstanding prediction, where it falls within 10% to 20%, it is a good prediction. However, if its range is 20% to 50%, the MAPE produces acceptable prediction, but if it goes above 50%, then it is inaccurate (Lewis, 1982). The MSE on the other hand indicates the extent to which the model fits the data. The RMSE is the square root of MSE. R^2 measures how fitting the model is to the data. R^2 varies within zero to one, $-1 \leq R^2 \leq 1$. When R^2 is 0.9 or greater, it is regarded as excellent, greater than 0.8 is good, more than 0.5 is satisfactory, and less than 0.5 is poor (Aczel, 1989; Ostertagová, 2011). Adjusted R -squared (R^2) is usually below the R^2 value. In model evaluation, R^2 is usually more preferable to R^2 to evade the issue of over fitting (Aczel, 1989; Ostertagová, 2011).

The optimum machine learning technique would probably vary from a particular case to another, dependent upon how long the span of time for the study, the features in use, and the magnitude and quality of the dataset. Finally, after model has been evaluated and tested for efficiency, it will then be deployed as part of the web-based procurement system.

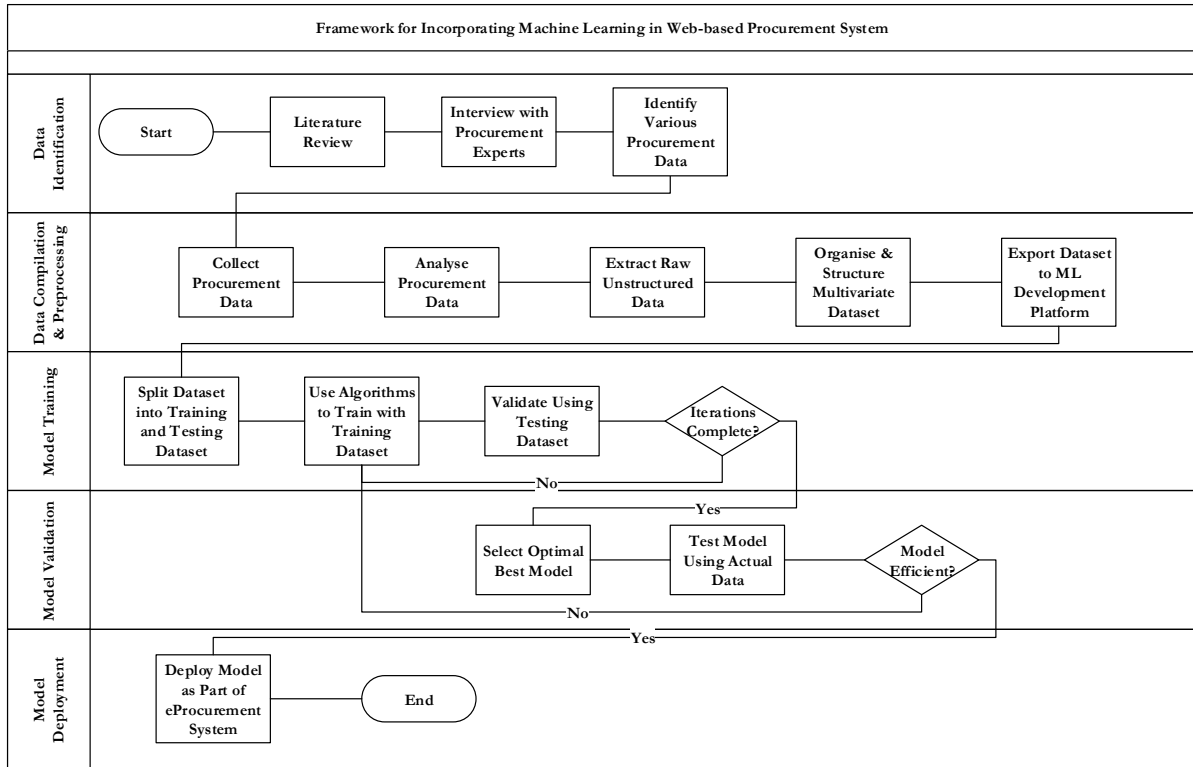


Figure 1: Framework for the Development of Machine Learning Models for Procurement Processes

CONCLUSION

This research has demonstrated that procurement has the potential of benefitting from machine learning. This is because it is data-driven and machine learning relies on data. The various descriptive attributes are existing in data from recorded procurement proceedings. The proposed framework reduces human involvement to the minimum. The less human involvement in carrying out procurement activities, the less chances of humanly errors. Also, it improves transparency of the procurement system. Furthermore, it will aid in keeping the procurement activities more confidential as human involvement is greatly reduced.

However, the proposed framework is not generalisable. A model is to be developed separately for each process and deployed as part of the system. That is because the machine learning type differs from process to process and the attributes vary.

The proposed framework after development, has to be validated before it is adopted.

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INFLUENCE OF CRITICAL SUCCESS FACTORS AND CONSTRAINTS ON THE IMPLEMENTATION OF QUALITY MANAGEMENT BY CONSTRUCTION FIRMS IN BAUCHI STATE

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ABSTRACT

This study determined the influence of critical success factors and constraints on the implementation of quality management by construction firms in bauchi state. Quantitative survey research design was employed to randomly collect data from 183 construction professionals using questionnaire. The collected data was analysed using inferential statistical tool of multiple regression analysis (mra). The research found that, the general implementation of quality management by construction firms in bauchi state was significantly influenced by the quality management critical success factor (csf) and quality management barriers positively and negatively respectively. Quality management implementation can be therefore, be improved by improving the quality management critical success factors and reducing the quality management barriers. Specifically, in order to improve quality management implementation, the study is recommending that the most influential csfs on quality management implementation, corporate quality culture, quality improvement management system, management commitment and external interface management, should be given more emphasis in improvement. Similarly, the influential barriers to quality management implementations, cultural barriers and educational barriers, should be given more emphasis on elimination. This research has practical implication to policy makers, construction industry, contractors and clients and contributes to the body of knowledge on construction quality management implementation.

Keywords- *Critical Success Factors, Quality Management and Quality Management Barriers*

INTRODUCTION

construction industry, according to farooqui, masood and aziz (2008), is globally considered to be a basic industry on which the development of economies depends open, and to some great extent, the growth of a country and its development status is generally determined by the quality of its infrastructures and construction projects. quality is contained in the tripod of construction management; it impacts the appearance, durability and the performance of a project (Al-Mustapha, 2017). the concept of quality is difficult to define as it means different thing to different people.

quality is defined in construction project, as the ability of products and processes to conform to the established requirements and specifications (Arditi & Gunaydin, 1997). thus, for improved performance of construction projects, quality must be managed at all stages of construction life cycle (Neyestani & Juanzon, 2016). quality of construction projects is related to quality management in all the phases of project life cycle (Ashokkumar, 2014). quality management (QM) refers to all activities that encompasses the integration of top management leadership and others in establishing quality policy objectives and responsibilities for all members of the organizations. it includes all activities

that managers perform in an effort to implement the quality policy (Imbeah, 2012; Orji *et al.*, 2016). in construction project however, opoko, ezema and ediae (2014) opined that qm implies preserving the quality of construction works at the requisite standard so as to obtain customers' satisfaction for long term competitiveness and business survival. other scholars viewed qm to involve implementing plans, policies, and procedures to ensure that the established requirements and standards are fulfilled with the aim of improving performance in terms of quality, productivity, customer satisfaction and profitability through active involvement of stakeholders at all steps, phases and level of an organisation (Candidus, 2013; Imbeah, 2012).

Furthermore, QM involves the rigorous activities that entails quality planning, quality control, quality assurance and quality improvement (Imbeah, 2012; Orji *et al.*, 2016). quality management is implemented through the powerful methodological management tool popularly known as pdca (plan, do, check, and act) cycle (Neyestani & Juanzon, 2016). the 'plan' refers to as quality planning, 'do' means quality assurances, 'check' encompasses quality control, while 'Act' refers to quality improvement based on corrective items identified.

The success of QM implementation is related to certain Critical Success Factors (CSFs) (Erande & Pimplikar, 2016; Neyestani & Juanzon, 2016) and constraints. Saeed & Hasan (2012) proposed ten (10) CSFs of QM for construction industry and project that include top management commitment, quality culture, strategic quality management, design quality management, process management, supplier quality management, education and training, empowerment and involvement, information and analysis, and customer satisfaction. Other CSFs were as well mentioned (Ashokkumar, 2014; Orji *et al.*, 2016; Shaari *et al.*, 2015). Various benefits could be derived from successful implementation of QM in construction industry.

The major benefit of QM implementation include increase performance of the construction organisations, meeting client requirements, competitiveness, improvements in products and processes, and increased profitability (Ahmed, Coffey, & Xia, 2017; Ashokkumar, 2014). However, despite these benefits, the threat of substandard quality in construction project is on the increase especially in developing countries (Muiruri & Were, 2016; Orji *et al.*, 2016).

In Nigeria, construction industry has long been associated with poor quality of construction products. This is evident in the high level of construction infrastructures deterioration, which is attributed to ineffective quality management system, knowledge gap and poor communication link among construction stakeholders in Nigeria (Candidus, 2013; Muiruri & Were, 2016; Okoye & Ngwu, 2015). Davies (2013), attributed it to lack of implementation of quality management since at the planning stage of the construction. The consequences of poor QM implementation among others include infrastructure deterioration, accidents, injuries, death, buildings collapse, profits lost, materials and resources wasted and the general productivity declined (Okoye & Ngwu, 2015). Candidus (2013), reported that as a result of poor QM, Nigeria has recorded more than 60 cases of building collapse from 2006 to 2010. Bauchi state, being part of Nigeria, may not be excluded from the menace. With the increased inflow of construction organisations into the state, and the massive unprecedented infrastructure development witnessed in the state in the last decade.

Accordingly, various authors attempted to evaluate quality management generally and in relation to construction activities globally and locally (Arditi & Gunaydin, 1997; Ashokkumar, 2014; Burli *et al.*, 2012; Candidus, 2013; Davies, 2013; Dimgba & Achumba, 2010; Imbeah, 2012; Muiruri & Were, 2016; Neyestani & Juanzon, 2016; Njenga, 2017; Okoye & Ngwu, 2015; Opoko *et al.*, 2014; Orji *et al.*, 2016; Saeed & Hasan, 2012; Shaari *et al.*, 2015; Shaikh & Darade, 2017 and others). Bulks of these studies were foreign. Candidus (2013), submitted that studies on quality management in construction organizations and on projects in developing countries are few and as such relatively limited research has been devoted to studying the factors that influence the successful quality management in developing countries.

Similarly, most of the literatures reviewed descriptively considered the critical success factors and the quality management separately without empirically, and inferentially, establishing the causal link between the critical success factors, the constraints, and the implementation of quality management by construction firms. In the same vein, the studies on quality management in construction industry in Nigeria were conducted in other regions of the country not in North eastern Nigeria where Bauchi state is situated. It is against this background and limitation in the previous works that this study seeks to fill in this gap by establishing the degree of influence of the critical success factors and constraints or barriers to the successful implementation of quality management by construction firms in Bauchi state, Nigeria by analyzing the collected quantitative data descriptively and inferentially using regression technique.

THEORETICAL BACKGROUND/LITERATURE REVIEW

Construction Industry

Construction industry of any country is the pillar of its infrastructure and economy. Though it is a chief contributor to the economy of any country, it faces the problems of high fragmentation, instability, low productivity, poor quality and lack of standards. Due to the above-mentioned quality problems, construction clients are not satisfied with the performance achieved on many of their projects (Kometa & Olomolaiye, 1997). Kometa & Olomolaiye (1997) state that despite many efforts, apart from time and cost overruns, unsatisfied clients and other difficulties continue to plague the industry. Thus, the reputation of the construction industry is ill suited for meeting the competitive challenges of today's fast changing market (Torbica & Stroh, 1999).

Concept of Quality in Construction Works

Quality can be referred to as the point where the legal, aesthetic and functional requirements of a project are met. Requirements may be simple or complex, or they may be specified in terms of the end result required or as a detailed description of what is to be done. Quality is obtained if the stated requirements are adequate, and if the completed project conforms to the requirements (Arditi & Gunaydin, 1997). ISO 8402 describes quality as the degree of excellence in a competitive sense, such as reliability, serviceability, maintainability or even individual characteristics. Other concept of quality in construction works are;

According Besterfield (2004), Quality can be expressed as: $Q = P / E$

Where: Q = Quality P = Performance E = Expectation

If Q is greater than 1.0, then the customer has a feeling of great satisfaction about the product or service rendered. The determination of Q is based on perception, with the contractor determining performance and the customer determining expectations. The customer expectations are continually becoming more demanding.

Quality Systems: Quality systems refer to the organizational structure, process, resource and procedure needed to implement quality management.

Quality Assurances: Quality assurance is the planned and systematic activities implemented within quality system and demonstrated, as needed, to provide adequate confidence that an entity will fulfill requirements for quality. Quality assurance is evaluating the overall project performance on a regular basis to provide a confidence that the project will satisfy the relevant quality standards. The primary function of quality assurance is to obtain completed construction that meets all contract requirements. Assurance is defined as a degree of certainty. Quality assurance personnel continually assure or make certain that the contractor's work complies with contract requirements.

Quality Control: Quality Control is the monitoring of specific project results to determine if they comply with the relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance. Both ANSI (American National Standards Institute) and ISO define quality control as the operational technique and activity; for example, providing a means to control and measure the characteristics of a material, structure, component, or system that are used to fulfil requirements for quality.

Quality Management: Quality management refers to all activities of overall management functions, especially top management leadership, that determines quality policy objectives and responsibilities for all members of the organization.

Total Quality Management (TQM): Total quality management is the management approach of an organization, which concentrates on quality based on the participation of its members and aims at long-term success through satisfaction and benefits to all members of the organization and society. Total quality management (TQM) is often defined as a complete management philosophy that permeates every aspect of a company and place quality as a strategic issue (Tan & Abdul-Rahaman, 2011). It is accomplished through an integrated effort between all levels of a company to increase customers' satisfaction by continuously improving current performance (Biggar, 1990).

Quality planning: Quality Planning is identifying which quality standards are relevant to the project and determining how to satisfy quality standards.

Quality Management Systems Used in Construction Projects

Quality Management has increasingly been adopted by construction companies as an initiative to solve quality problems and to meet the needs of the final customer, if ever an industry needed to take up the concept of QMS in the construction industry (Ashokkumar, 2014). Quality management systems entail having the organizational structure, responsibilities, procedures, processes and resources for implementing quality management such that there is a guiding framework to ensure that every time a process is performed the same information, method, skills and controls are used and practiced in a consistent manner. However, implementing QMS principles in construction industry is particularly difficult because of the many parties involved. According to Ashokkumar (2014), QMS places emphasis on prevention, not correction. The goal which works that is 100% free of errors, free of accidents, and 100% free of waste. To ensure the continually improvement of QMS, it is essential that the top management to give their full support and commitment especially to the development and implementation of construction projects. The types of QMS (or techniques) which have been applied to the construction industry include Total Quality Management (TQM), Process Cost Model (PCM), Lean Principals and, more recently, Six Sigma.

International standards

The ISO 9000 series of standards is the main set of international standards that apply to the management of quality systems. It includes ISO 9001, the standard against which organizations can achieve third-party certification for a QMS. The application of ISO standards has received much attention from researchers (Moatazed-Keivani, *et al.*, 1999; Love *et al.*, 2000). The ISO 9000 family for QMS is included (ISO, 2010):

ISO 9000 – Quality management systems: Fundamentals and vocabulary;

ISO 9001 – Quality management systems: Requirements;

ISO 9004 – Managing for the sustained success of an organization: A quality management approach, and;

ISO 19011: Guidance for internal and external audits of quality management systems.

To achieve ISO 9001 certification, a company must fulfill a number of requirements:

Quality leadership: A statement demonstrating that an organization's quality policy is driven by senior management. This may cover identification of the customer's needs; support and standards of performance for subcontractors and suppliers among others. Leadership also requires senior management commitment to ensuring that the QMS delivers the intended outcomes through communication of the policy, allocation of responsibilities, providing adequate training and resources and so on.

Quality planning: Taking into account the commercial context and customer requirements, the QMS will establish "who, what, how and when" the organization will address risks and opportunities, avoid undesirable effects and achieve desired outcomes. Support: Establishing the resources required to deliver on the quality policy and objectives throughout the organization and supply chain, including communicating the different roles of people within the organization in delivering the requirements of the QMS.

Operational planning and control: Planning, implementing and controlling internal and outsourced processes to design and deliver products and services.

The following are some of the quality management systems used in the construction industry as have been mentioned briefly above.

Total Quality Management (TQM)

TQM is often termed a journey and not a destination (Elghamrawy & Shibayama, 2008). Many researches have been done with recourse to the adoption of TQM and it is believed that the benefit of higher customer satisfaction, better quality product and higher market share are often obtained by the implementation of TQM.

The factors that affect quality in each phase of the construction process as observed in Arditi and Gunaydin (1997) have been identified through a literature review and are discussed below;

Management commitment and leadership: The Business Roundtable construction industry cost effectiveness study concluded that the primary causes for the decline of construction productivity directly or indirectly involved poor management practices. Since quality is part of productivity, the first step for management is to recognize that there is a problem. The success of a TQM program first of all depends on management practices. It can thrive only under a senior management that establishes TQM as a top priority. This commitment must be coupled with a thorough understanding of TQM.

Teamwork: Quality teams provide companies with the structured environment necessary for successfully implementing and continuously applying the TQM process. The ultimate goal of the team approach is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with the TQM process. At the industry level, extending the TQM concept to the parties mentioned above in the form of joint teams achieves higher customer satisfaction. These joint teams are responsible for establishing joint goals, plans, and controls.

Statistical methods: Statistical methods provide problem-solving tools to the TQM process. Arditi and Gunaydin (1997) provide that the teams with the tools to identify the causes of quality problems, to communicate in a precise language that can be understood by all team members, to verify, repeat, and reproduce measurements based on data, to determine the past, present, and to a lesser degree, the future status of a work process, and to make decisions on facts that are based on data rather than the opinions and preferences of individuals or groups. The most commonly used statistical methods in the TQM process include histograms, check sheets, among others.

Cost of quality: The cost of quality is considered by both to be the primary tool for measuring quality. In their approach, it is used to track the effectiveness of the TQM process, select quality improvement projects, and provide cost justification to doubters. By bringing together these easily assembled costs of review, inspection, testing, scrap, and rework, one can convince management and others of the need for quality improvement.

Supplier involvement: The ability to produce a quality product largely depends on the relationship among the parties involved in the process; the supplier, the processor, and the customer. The quality of any stage in a process is contingent upon the quality of the previous stages. The quality of the project built by the constructor is directly related to the quality of the plans and the specifications prepared by the designer, the quality of the equipment and materials supplied by the vendors, and the quality of work performed by the subcontractors. Close and long-term relationships with these suppliers to the construction process are required if the constructor is to achieve the best economy and quality.

Customer service: TQM is a process that requires universal involvement to be successful. This includes customer involvement. As more and more companies become involved in the TQM process and demands for improved quality increase, this concept becomes increasingly important. Customers may be either internal or external. Satisfying the needs of these customers is an essential part of the process of supplying the final external customer with a quality product. The designer is the customer of the owner because the designer has to receive the project requirements from the owner in order to provide a feasible design. The designer supplies plan and specifications to the constructor; in this case the constructor is the designer's customer because the constructor uses the designer's plans and specifications, then conducts the construction process, and finally supplies the completed building to the owner. The owner is now the constructor's customer. Quality in each phase is affected by the quality in the preceding phases. Therefore, customer service in each phase is important for the overall quality performance of the process.

Construction industry-specific factors: While the evolution of quality control in the construction industry is parallel to that of the manufacturing industry, many dissimilar characteristics distinguish the two industries.

Barriers to the Adoption of Quality Management

According to a research by Femi (2015), seven prominent barriers of TQM which he called “seven deadly disease and obstacles of TQM” was pointed out and explained below:

Lack of constancy of purpose: If a company goes out of business after having tried to implement a TQM program, it probably failed to create a constancy of purpose amongst its employees for quality of product and services. To set this program apart from the others, something dramatic may have to be used. Employees need something to convince them that this is different and is also long term.

Emphasis on short term profit: Companies may actually have to take short term loss to make the strategy work; this may require the involvement and cooperation between top management and the major stakeholders. With the probability of long-term growth and profit, problem occurs when attempting to continue to convince impatient, profit driven owner.

Evaluation of performance Merit rating or annual review: Evaluation of personnel encourages competition amongst employees and usually results in less teamwork.

Evaluations and merit rating force people to put themselves number one and the company two. This will result in production of poor quality and services.

Mobility of top management: Retaining the chief executive officer and other top managers is growing problem in the US. With corporate mergers and leverage buyout, top executives find themselves moving around quite often, usually before they have made away real, long-term impact e.g. The average engineer moves around every 2-3 years in an effort to either find a better paying job, one with more responsibility.

Running a company on visible figure alone-counting money: This disease according to Salter (1993) is difficult to avoid because most owners are concerned with hard figures and the bottom line. However, if TQM is given a viable chance to succeed, then the invisible figure will eventually affect the visible ones. E.g. as the number of a company's satisfied customers increases the effect will be an increase in revenue, a visible figure. As quality (an invisible figure) improves, cost, a visible figure, will decrease, the correlation is sometime difficult to prove because they take time to occur.

Excessive medical costs and excessive costs of warranty, fuel by lawyers that work in a contingency: For construction industry, these may be the two biggest deterrents to most implementing TQM, but for survival as well, concerning medical costs for some companies this is the largest single expenditure. Law suites are either generated by internal employee or external entities. Most lawsuits that come within involve safety and health issues. TQM program will correct some of this problem, but not all of it. As quality increases and defects decrease, accidents caused from faulty products will decrease.

Other obstacles to TQM cited in Salter (1993) include: Neglect of long range planning & transformation; the supposition that solving problem, automation, gadgets and new machinery will transform industry; Search for examples; Our problems are different; Obsolescence in schools; Reliance on quality control department; Blaming the workforce for problems; Quality before inspection; False starts; The unmanned computer; Meeting specification's; Inadequate testing of prototypes; Anyone that comes to try to help us must understand all about or business

METHODOLOGY

The choice of Bauchi state comes as a result of the numerous constructions works that are going on, engaged by both small and medium sized construction firms including large firms; and the high concentration of firms in the state capital. The research work used a quantitative research design which used a field survey; and according to Geoffrey, DeMatteo and Festinger (2005) survey studies request large numbers of people questions about their behaviours, attitudes, and opinions. The target population of the study comprise the construction firms in the study area with construction team members in the project execution (construction professional: Architects, builders, contractors, construction managers, engineers, project managers, Engineers, Quantity surveyors, planners, and so on) based in Bauchi state- Nigeria. The target population of the research is the construction firms in Bauchi that have their tax return with Federal Inland Revenue Services. The

sampling frame for the study is the 935 registered construction firms that have their tax return with Federal Inland Revenue Services (FIRS, 2020). Sample size of 274 was arrived at using Krejcie and Morgan (1970). This study used a probabilistic technique (random sampling technique) because of its statistical preference to any type of sampling; due to its significance in generating samples free from unfairness (Sambo, 2008). Data was collected through primary source directly from the respondents using questionnaire instrument. The use of the questionnaire was necessary because of the population literacy and the flexibility of the questionnaire in collecting a lot of information within a short period of time (McNabb, 2009). The data was analysed using inferential statistical tools. This seeks to establish the relationship between the independent's variables of the study and the dependent variable was analysed inferentially using correlation and regression analysis. The correlation analysis establishes the association between the variable, on one hand; the regression analysis established the causality between the independent variables of the study and the dependent variable.

DATA ANALYSIS AND RESULT

The survey was conducted to collect information from professionals in construction industry on quality management implementation including its critical success factors and barriers. The information was sought from 278 respondents which constitute the sample size of the study. The response rate of the collected questionnaires is presented in table 1.

Table 1: Response rate

Questionnaires	Frequency	Percentage
Distributed	274	100%
Returned	206	75%
Useable/Valid	183	67%

Table 1 shows that a total of 274 questionnaires were distributed representing 100 percent of the research questionnaires out of which 206 were returned. The returned questionnaires accounts for 75% of the total questionnaires distributed. Of the returned questionnaires, 23 were discarded in the process of data cleaning due to severe issues of outliers and missing data, leaving 183 questionnaires considered valid and usable for the research analysis. This makes the response rate for the study to be 67%. This response rate is considered adequate for this research based on the argument of Sekaran (2003) that response rate of 30 percent is acceptable for surveys.

The most common measure of reliability is the Cronbach's alpha. Cronbach's alpha measures the reliability of the measurement scale. For internal consistency to be achieved, Cronbach's alpha is required to be above 0.7 (Pallant, 2011).

Accordingly, the reliability of the research constructs was evaluated using Cronbach's alpha as presented in Table 2.

Table 2: Reliability test

Constructs		Cronbach's Alpha
Quality Management Critical Success Factors (QMCSF)		0.946
MCT	Management Commitment	0.838
PCM	People and Customer Management	0.790
SSP	Supplier (sub-contracting) Partnership	0.853
IIN	Improvement Information	0.810
CSO	Customer Satisfaction Orientation	0.784
EIM	External Interface Management	0.831
TST	Team Work Structure	0.803
OQP	Operational Quality Planning	0.822
QIM	Quality Improvement M. Systems	0.906
CQC	Corporate Quality Culture	0.817
Quality Management Barriers (QMB)		0.930
BM	Managerial	0.901
BO	Organisational	0.912
BC	Communicational	0.891
BCU	Cultural	0.781
BED	Educational	0.766
BA	Auditing	0.798
Quality Management Implementation (QMI)		0.911
QP	Quality Plan	0.876
QA	Quality Assurance	0.841
QC	Quality Control	0.892
QI	Quality Improvement	0.914

Table 2: shows the internal consistency of the research's constructs using Cronbach's alpha.

The result shows that all the construts have cronbach's alpha value above the recommended 0.7 minimum. Hence all the research constructs are internally consistent and reliable.

Information about the respondents' gender, position, educational background, professional discipline, years of experience, as well as the emphasis they place on quality management were collected and presented in table 3.

Table 3: Respondents' Profile

S/N	Respondents' Details	Response	Frequency	Percent
1	Gender	Male	174	97.3
		Female	9	2.7
2	Designation/Position	Top Management	71	38.8
		Medium Management	57	31.1
		Lower Management	55	30.1

3	Educational Background	National Diploma	36	19.7
		HND/Degree	80	43.1
		PGD/Masters	65	35.5
		PH.D	2	1.1
4	Professional discipline	Architecture	32	17.5
		Building	45	24.6
		Quantity Surveying	42	23.0
		Engineering	39	21.3
		Others	25	13.7
5	Years of Experience	0-3yrs	28	15.3
		4- 6yrs	42	23.0
		7- 9yrs	45	24.6
		10- 12	33	18.0
		13 years and above	35	19.1
6	Emphasis on Quality Management	Very Much	25	13.7
		Much	45	24.6
		Moderate	55	30.1
		Little	41	22.4
		Very Little	17	9.3

Table 3 shows the demographics of the respondents. It shows that majority of the respondents are male as indicated by 97.3% response. The designation and position of the respondents is almost uniform among the top, middle and lower management as indicated by 38.8%, 31.1% and 30.1% responses respectively. Majority of the respondent have post diploma educational experience as indicated by about 80% response. Professionally, respondents were from Architecture, Building, Quantity surveying, engineering and other related construction disciplines. The result shows that the respondents cut across all these disciplines. The respondents have vast experience in the construction industry as most of them have more than six years working experience. Most of the respondents are of the opinion that they give moderate emphasis on quality management when handling construction projects.

Quality evaluations were conducted at the earlier stage of the analysis to ensure that the data meet the multivariate analysis requirements. This is based on the recommendations of Hair *et al.* (2011) and Pallant (2011) that data must be normally distributed, internally consistent, and devoid of missing values, outliers and multicollinearity. The recommendation was heeded and all the requirements were met. Two regression models were estimated. The first model treated all the individual constructs of both critical success factors and barriers as the independent variables. This makes the total number of independent variables to be 16. The essence of this is to identify the individual influence of each variable in the model so as to enable specific actions to be taken. The second model treated the independent variables as multi-items constructs such that all the individual constructs are aggregated into single critical success factors construct and barriers construct. Both the two regression models have the quality management implementation as the dependent variable.

The regression model was specified to produce the model summary, the analysis of variance (ANOVA) and the coefficient to determine the individual influences of each of

the independent variables or predictors on the dependent variable as presented in tables below.

Disaggregated Regression Model

The disaggregated regression model incorporates all the individual critical success factors and barriers into the regression model as presented in tables 4.

Table 4: Model Summary and ANOVA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.945	.894	.883	.237	87.091	.000

Table 4 shows the regression model summary and the ANOVA result. The model produced overall R value of 0.9 and R square value of 0.894 with F-statistics of 87.091 which are significant as indicated by p value of 0.000 far below the recommended maximum of 0.05 (Pallant, 2011). This shows that the model predicts about 89.4% of the variation in quality management implementation. In other words, about 89.4% in the changes in quality management implementation whether high or low can be explained by changes in the critical success factors and the barriers. The model is fitted well and good as it produced a strong R square and F statistics values. The individual influence of each critical success factors and the barriers on quality management implementation is presented by the standardized regression coefficients in table 5.

Table 5: Regression Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.475	.196		2.42	.017
	Operational Quality Planning	.025	.038	.027	.66	.506
	Management Commitment	.151	.040	.169	3.74	.000
	Customer Satisfaction Orientation	.048	.030	.063	1.58	.115
	Improvement Information	.025	.037	.030	.683	.495
	People and Customer Management	.023	.044	.024	.514	.608
	Supplier Partnership	-.033	.034	-.042	-.96	.336
	Team Work Structure	-.004	.030	-.006	-.14	.882
	External Interface Management	.085	.022	.101	3.89	.000
	Corporate Quality Culture	.395	.033	.563	11.96	.000
	Quality Improvement M. Systems	.177	.032	.260	5.50	.000
	Managerial Barrier	.035	.043	.035	.821	.413
	Organisational Barrier	-.029	.042	-.030	-.69	.487
	Communicational Barrier	-.023	.038	-.023	-.61	.538
	Cultural Barrier	.106	.026	-.120	-4.13	.000
	Educational Barrier	.060	.025	-.067	-2.35	.020
	Auditing Barrier	.003	.031	.003	.100	.92

Table 5 shows the individual influence of the independent variables on the dependent variable. The result shows that the critical success factors with significant influence on

quality management implementation are management commitment, external interface management, corporate quality culture, and quality improvement management systems as indicated by t-statistics values of 3.74, 3.89, 11.96 and 5.5 respectively all with p-values of 0.000. Corporate quality culture is the CSF with the highest influence on quality management implementation as indicated by standardized beta coefficient of 0.563 followed by quality improvement management system with beta value of 0.206. This is followed by management commitment and external interface management having beta values of 0.169 and 0.101 respectively. The other critical success factors do not have significant influence on quality management implementation. Teamwork structure is the CSF with the least influence on quality management implementation.

The quality management barriers that have significant influence on quality management implementation were cultural barriers and educational barriers as indicated by t-statistics values of -4.13 and -2.35 with p-values of 0.000 and 0.020 respectively. The cultural barrier is the barrier with the greatest influence on quality implementation followed by cultural barriers as indicated by standardized beta coefficients of -0.120 and -0.067 respectively. This revealed an adverse relationship between the barriers and the quality management barriers. Increase in the level of barriers reduces the level of implementation of quality management and vice versa. Managerial barriers, organizational barriers, communicational barriers, and auditing barriers do not have significant influence on quality management implementation with the auditing barriers having the least influence as indicated 0.003 beta value.

Aggregated Regression Model

The aggregated regression model aggregated the individual critical success factors into a single measure construct and the barriers also into a single measure construct. The aggregated constructs were entered into the regression model as presented in tables 6.

Table 6: Model Summary and ANOVA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1						
2	.763	.582	.577	.452	125.202	.000

Table 6 shows the regression model summary and the ANOVA result. The model produced overall R value of 0.763 and R square value of 0.582 with F-statistics of 125.202 which are significant as indicated by p value of 0.000 far below the recommended maximum of 0.05 (Pallant, 2011). This shows that the model predicts about 57.7% of the variation in quality management implementation. In other words, about 57.7% in the changes in quality management implementation whether high or low can be explained by changes in the quality management critical success factor and the quality management barriers. The model is fitted well and good as it produced a strong R square and F statistics values. The individual influence of aggregated critical success factors and the barriers on quality management implementation is presented by the standardized regression coefficients in Table 7.

Table 7: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.377	.321		-1.18	.242
QM Critical Success Factors	.886	.056	.761	15.76	.000
QM Barriers	-.160	.075	-.103	-2.14	.03

Table 7 shows the individual influence of the independent variables on the dependent variable. The result shows that the aggregated critical success factors have significant positive influence on quality management implementation as indicated by t-statistics value of 15.76 with p-value of 0.000. This direct relationship shows that improvement in quality management critical success factors significantly improves quality management implementation. The result indicated that any 1-unit change in critical success factors causes quality management implementation to change by 0.761 as indicated by the standardized beta coefficient.

The quality management barriers, on the other hand, has significant negative influence on quality management implementation indicated by t-statistics values of -2.14 with p-values of 0.034. This revealed an adverse relationship between quality management barriers and quality management implementation. Increase in the level of barriers reduces the level of implementation of quality management and vice versa. Thus, any 1-unit increase in quality management barriers causes the quality management implementation to reduce by 0.103 units as revealed by the standardized beta coefficient. Hence, quality management implementation can be improved by improving the critical success factors and reducing the quality management barriers.

DISCUSSION OF RESULT

This research determined the influence of quality management critical success factors and the quality management barriers on the implementation of quality management by construction firms in Bauchi state. The critical success factors with significant influence on quality management implementation to be management commitment, external interface management, corporate quality culture, and quality improvement management systems. This finding confirms the proposal of Ahmed *et al.* (2017) that management commitment, external interface management, corporate quality culture, and quality improvement management systems have significant causal effect on quality management implementation. It also confirms the finding of Saeed & Hasan (2012) who found management commitment to significantly affect quality management implementation. However, they found external interface management which they called “client focus” not significant in influencing quality management implementation by construction firms.

The research, however, did not find people and customer management, supplier (sub-contracting) partnership, improvement information, customer satisfaction orientation, team work structure, and operational quality planning to have significant effect on quality management implementation. This finding is contrary to the submission of Ahmed *et al.* (2017) who hypothesized them to have significant influence on quality management implementation. The finding that operational quality do not have significant influence on

quality management implementation deviates from that of Muiruri & Were (2016) who found operation quality planning not only having significant influence but has the strongest influence on quality management implementation. It is also contrary to the finding of Saeed & Hasan (2012) who found supplier management to have significant effect on quality management implementation. However, their findings that people and customer management which they referred to as “employee participation” do not have significant influence on quality management implementation conforms to the finding of this research. Erande & Pimplikar (2016), on the other hand, found all the quality management critical success factors to have relative importance in quality management implementation. The disparity of this finding is because they used only descriptive relative importance index without inferential establishing the causal effect of the CSFs on the quality management implementation.

The quality management barriers that have significant influence on quality management implementation were cultural barriers and educational barriers. This finding conforms to the submission of Ahmed *et al.* (2017) who proposed them to have significant negative influence on quality management implementation. The findings also confirms that of Femi (2016). Managerial barriers, organizational barriers, communicational barriers, and auditing barriers do not have significant influence on quality management implementation with the auditing barriers having the least influence. This finding invalidate the framework of Ahmed *et al.* (2017) who proposed managerial, organizational, communicational, and auditing barriers to have significant influence on quality management implementation.

Finally, the aggregated model found the quality management CSFs and quality management barriers to have significant positive and negative influence respectively on quality management implementation by construction firms in Bauchi state. This finding validate the quality management framework developed by Ahmed *et al.* (2017) who proposed significant positive and negative influence respectively of quality management CSFs and quality management barriers on quality management implementation. The finding is also in agreement with the submissions on quality management implementation (Ashokkumar, 2014; Erande & Pimplikar, 2016; Femi, 2016; Orji *et al.*, 2016; Rashed, 2015; Saeed & Hasan, 2012; Shaari *et al.*, 2015).

CONCLUSION AND RECOMMENDATIONS

Construction is normally evaluated based on three performance evaluation criteria. These criteria are cost, time and quality. Although all these criteria are indispensable in construction, the first two are mostly given more attention neglecting the equally important criteria – Quality. Consequently, attainment of acceptable levels of quality in the construction industry has long been a problem especially in developing countries (Nigeria inclusive).

Accordingly, this research determined the influence of critical success factors and quality management barriers on the implementation of quality management by construction firms in Bauchi. The research concludes that quality management CSFs and quality management barriers have positively and negatively influenced quality management implementation significantly.

Quality management implementation can therefore be improved by improving the quality management critical success factors and reducing the quality management barriers.

To achieve this the study recommended that the most influential CSFs on quality management implementation; corporate quality culture, quality improvement management system, management commitment and external interface management be given more emphasis in improvement. Similarly, the influential barriers to quality management implementations; cultural barriers and educational barriers, be given more emphasis on elimination. This research has practical implication to policy makers, construction industry, contractors and clients and contributes to the body of knowledge on construction quality management implementation.

As noted earlier, most of the literatures reviewed descriptively consider the critical success factors and the quality management separately without empirically, and inferentially, establishing the causal link between the critical success factors, the constraints, and the implementation of quality management by construction firms. This research overcome this limitation and established, empirically, the influence of quality management CSFs and quality management barriers on quality management implementation. Thus, this study contributed to knowledge in this regard. In the same vein, the studies on quality management in construction industry in Nigeria were conducted in other regions of the country not in North-East Nigeria where Bauchi state is situated. By evaluating quality management implementation by construction firms in Bauchi this research contributed to knowledge by filling the vacuum of knowledge of quality management in Bauchi. Further research can be conducted to explore addition factors that have influence on quality management implementation. The research is also limited to quantitative approach using survey research design. Another study may be explore using the mixture approach. This will give the research the advantage of each approach and minimizes the disadvantages of the approaches. The research also used first generation multivariate analysis technique of Multiple Regression Analysis (MRA) to analysed the data. Another study can be conducted to replicate the research using second generation multivariate analysis techniques such as the variance based Partial Least Square-Structural Equation Modelling (PLS-SEM) and covariance based Structural Equation Modelling (SEM).

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APPRAISAL OF BIDDING STRATEGY FOR QUANTITY SURVEYOR'S CONSULTANCY SERVICES IN LAGOS STATE, NIGERIA

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ABSTRACT

Professional Service Firms (PSFs) are knowledge-intensive organisations that provide expert advice to clients based on inputs of technology and human capital to offer services which rely heavily upon professional knowledge. Studies had noted several bidding strategies and models applied in the prequalification and selection of contractor for construction project but the prequalification and selection of consultants has always been on rule of the thumb. Therefore, this paper appraises the bidding strategy adopted by quantity surveying firms to secure consultancy engagement in Nigeria. The paper adopted questionnaire survey on the population of registered quantity surveying firms in Lagos state, Nigeria. The sample frame of 57 was obtained from Lagos State Chapter of Nigerian Institute of Quantity Surveyors as at 2016. This population was sample using simple random sampling technique. The questionnaire was structured on the rubric of dimensions of external, internal and environmental factors stimulating the adoption of bidding strategy in the study area. A total of 108 questionnaires were distributed and 84 collected for analysis representing response rate of 77.78%. Data collected were analysed with the aid of mean item score and factor analysis. The findings indicated that professional service firms supply services that are tailored on one-off project for specific clients and were selected on the basis of character of relationship with the client and ability to customise project delivery. The paper concluded that the intensity of interaction between construction professionals and clients for project services are over a long-term than on single new projects and recommended that principal partners of service firms should expand the scope of their service delivery and be dynamic in response to service proliferation.

Keywords: Bidding strategy, consultancy, Nigeria, professional service firms, Quantity Surveyor.

INTRODUCTION

Globalised competition has made companies to develop certain strategies to maintain their competitiveness in order to survive in the national and international market. The strategy is usually regarded as being pivotal to the existence of the organisation. Wibowo *et al.* (2015) defined strategy as skilful management in getting the better of an adversary; the means by which a company uses its financial and physical resources to accomplished its objectives; the science and art of meeting competition under the most advantageous condition possible; a careful plan or methods; managements idea regarding a firm's objectives, the means by which these objectives will be accomplished and the reason for pursuing them. In a simplest term bidding strategy means a plan for success. Bidding strategy in construction comprises a number of decisions to be made including whether to bid or not bid; the level of mark up to be adopted, if the decision is to bid; the winning strategy to be adopted to maximise chance of winning or the degree of effort and competitiveness to applied. This view was corroborated by Prajapati *et al.* (2015) that the search for greater choice and value for money leads to more purchases being made by

competitive methods. The perceived benefits of these methods have resulted in a phenomenal rise in the number of bids and tenders.

Quantity surveying consultancy firms are knowledge-intensive organisations that provide expert advice to clients based on inputs of technology and human capital to offer services which rely heavily upon professional knowledge. Studies had noted several bidding strategies and models such as Friedman (1956) and Gates (1967) applied in the prequalification and selection of contractor for construction project but the prequalification and selection of consultants has always been on rule of the thumb. Therefore, this paper appraises the bidding strategy adopted by quantity surveying firms to secure consultancy engagement in Nigeria.

LITERATURE REVIEW

Professional service firms

Construction sector had been noted to be heterogeneous in nature and covers a long and fragmented value chain (McClements *et al.*, 2012). One thing all construction professional service organisations have in common is that they provide Knowledge Intensive Business Services (KIBS) and concentrate on their inputs of technology and human capital (Liu *et al.*, 2008). KIBS was defined by Desmarchelier *et al.* (2013) as "services which rely heavily upon professional knowledge, and either supply products (services) which are primarily sources of information and knowledge to its users, or use its knowledge to produce services which are intermediate inputs to the clients' own knowledge generating and information processing activities.

Fong and Shonia (2009) defined Professional Services Firms (PSFs) as knowledge-intensive organizations that provide expert advice and professional knowledge to clients. However, there is need to focus on the characteristics of the service firms in order to distinguish one service from another based on the mode of production and delivery (McClements *et al.*, 2012).

A number of studies have considered the characteristics of the service firms and the relationship with the customer rather than just the service provided (Lowendahl, 2007; Liu *et al.*, 2008; Jewell *et al.*, 2010). These studies identified common highlights among the typical characteristics of professional service as: (i) Knowledge intensive; (ii) Involves professional assessment and judgement; (iii) Highly customised; (iv) High degree of interaction; (v) Professional training; (vi) Constrained by professional norms; (vii) Heterogeneity; and (viii) Location specificity.

These wide-ranging activities are delivered to a broad spectrum of customers/clients, from small to medium to large (either in the public or private sector) and a variety of types of construction such as residential, non-residential, civil engineering, heavy engineering etc.

Quantity surveying services

Oyediran (2011) emphasised the importance of quantity surveyors as members of the design and construction teams in both private and public sectors of a nation. Their pivotal roles in construction project development and delivery are well acknowledged by literature.

On a broad perspective, quantity surveyors ensure that the resources of construction industry are utilised to the best advantage of the stakeholders and the society.

However, Ashworth and Hogg (2007) noted that in the course of reviewing the development of quantity surveying that there has been a shift in the emphasis from cost to value with many quantity surveying firms expanding the horizons of services offered. Quantity surveyors are becoming increasingly involved in project management, value engineering, risk and facilities management, life cycle costing among other new innovations. Also, in the United Kingdom, some quantity surveying firms carry out insolvency and corporate restructuring, survey on hazardous materials and environmental audit; but in Nigeria; the growth rate from the traditional core practice areas to new directions is steady and slow. This view was corroborated by Ajanlekoko (2012) that quantity surveying practice is still in the mainstream areas in Nigeria.

Babalola (2009) considered the uniqueness of services offered by professional quantity surveyors in the areas of financial probity in the execution of construction projects and noted that the major concern of the client is for the project to be completed to cost, quality and schedule. However, it has been observed that it is not all executed projects that the clients are satisfied. This dissatisfaction brings to focus the quality of services rendered by construction professionals. Hence, the need for construction professionals to seek ways to increase and sustain the quality of services rendered.

Phoya and Kikwasi (2008) reported that the demand for quality, accountability and efficacy of professional services has highlighted the need for professionals to demonstrate that they are keeping abreast of new knowledge, techniques and developments related to their professions while the proliferation of knowledge in the construction sector, combined with the impact of technology in the workplace, means that construction professionals must maintain the currency of their qualifications by learning about such advances and developments. Therefore, there is need for service quality models which will enable management of service providers to identify quality programme and plan a strategic quality improvement programme. This will enable the service organisation to identify sources of quality, discover quality problem and offer possible courses of action.

Bidding strategy

The subject of the bidding strategy has interested various researchers across the globe since the mid-1950s (Yang, 2017). Numerous researchers such as Towakoli and Utomo (1989) Prajapati *et al.* (2015) have developed models for bid/no bid and mark-up size decisions. However, it is difficult to develop realistic models that capture the complexity and uncertainty of the full construction contract bidding situation, which is perhaps why many stakeholders did not show interest in such models (Astama *et al.*, 2015). The complexity of the problem, regarding the two decisions in bidding stage, is so overwhelming that even the experienced contractors feel that the industry should have a better technique for arriving at bid/no bid or mark-up size decisions.

However, there is a renewed interest in the competitive bidding problem and this is reflective in over the last five decades there has been a relatively modest addition to the

state of the art. For example, Banki *et al.* (2008) suggested that bidding strategy models be grouped into three main categories: (i) Models based on probability theory (e.g., Friedman (1956); and Gates (1967) to maximize the expected profit; (ii) Models based on decision-support systems (e.g., Ahmad and Minkarah (1987) to account for the multi attributed nature of bidding decisions; and (iii) Newly emerging models based on artificial intelligence techniques (e.g., Towakoli and Utomo (1989) to consider the heuristic and unstructured nature of such a decision problem.

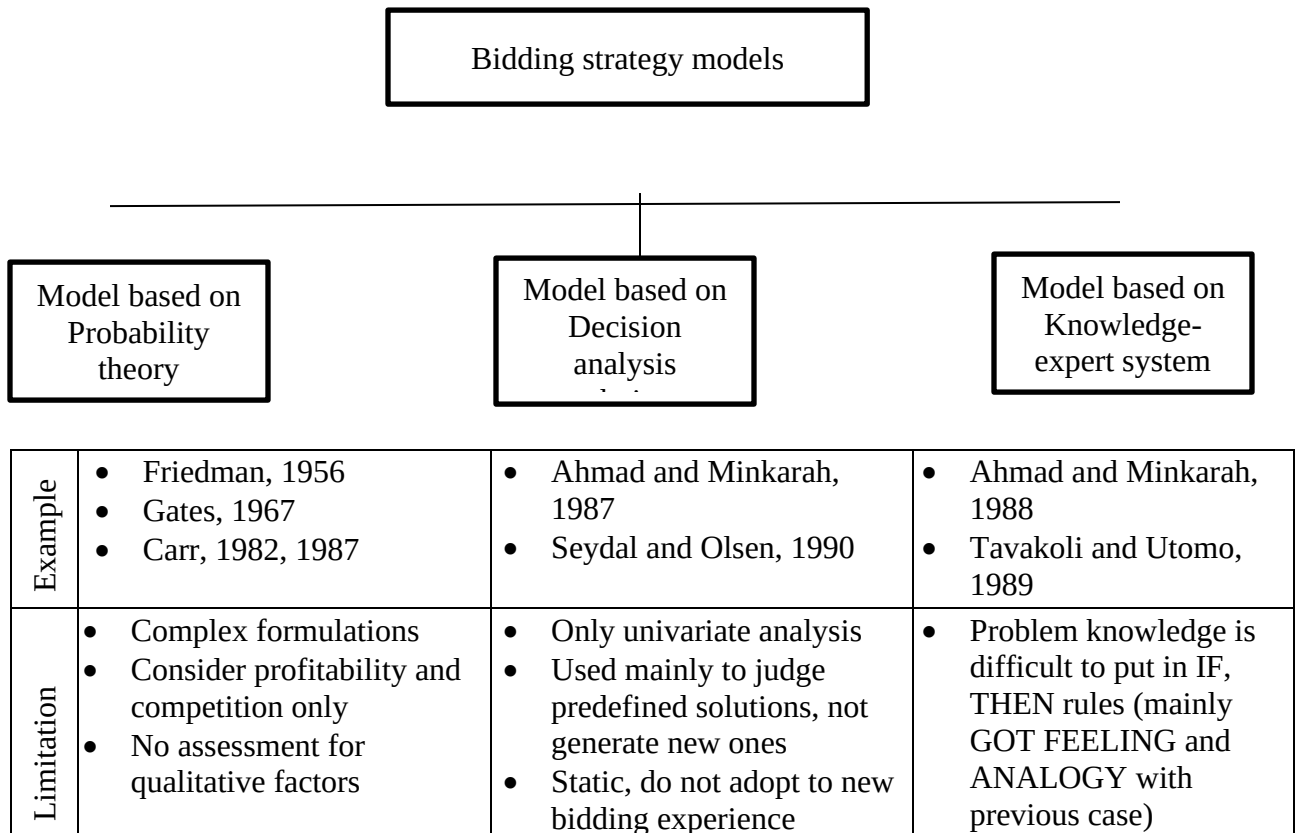


Figure 1: Bidding strategy models
Source: Banki *et al.*, (2008) Pp. 154

Table 1: Variables of Bidding Strategy

FACTORS	DIMENSIONS	S/N	INDICATORS
EXTERNAL	1.Client Characteristics	1	Local custom
		2	Relationship with owner
		3	The client reputation among consultants
		4	The client requirements
		5	Owner (Private/Public)
		6	Prompt payment habit from owner
		7	The client financial capacity

INTERNAL	2. Project Characteristics	8	Contract Size
		9	Duration of the project
		10	Type of project
		11	Methods of construction
		12	The project's stakeholder
		13	Safety hazards
	3. Contract	14	Contract type
		15	Use of Nominated Sub-contractors
		16	Fines for delay
		17	Clearness of the work and specifications
	4. Benefit of Business	18	The contract special requirements
		19	The benefits expected
		20	Need for continuity
		21	Establishing long relationship with owner
		22	Original price estimate by client
	5. Project Financing	23	Project cash flow
		24	Project Mark-up
		25	Percentage of insurance
		26	Anticipated value of liquidated damage
		27	Tax liability
		28	Market Share
	6. Company Characteristics	29	Availability of required cash
		30	Ability of doing the job
		31	Availability of required equipment
		32	Availability of qualified human resources
		33	Current workload
		34	Project matching with the company strategy
		35	Specific features that provide competitive advantage
ENVIRONMENT	7. Company Experience	36	Past experience with similar project
		37	Past profit in similar job
	8. Bidding Situation	38	Past experience with general contractor
		39	Required bond capacity
		40	Time allowed to submitting bids
		41	Bidding document price
		42	Prequalification requirements

	43	Bidding methods
9. Economic Condition	44	Risk involved
	45	Overall economic situation
	46	Fluctuation in material and labour
10. Competition	47	Who else likely to bid for this job?
	48	How many bidders will there be?
	49	Future project
	50	Market condition

Source: Ahmad and Minkarah (1987)

A major aspect in the use of bidding exercise is the prequalification of suitable bidders to enter the auction. Yang (2017) described bidding strategy as where bidders take the action guiding principles and behavioural ways according to the special details of the competition environment. It is the human's in competition environment guiding ideology. The study identified and categorised the circumstances that influenced the adoption of particular bidding strategy as (a) External factors (b) Internal factors and (c) Environment factors. The external factor includes the (i) client characteristics, (ii) project characteristics, and (iii) contract. The internal factors consist of (iv) business benefit, (v) project financing, (vi) company characteristics, (vii) company experience. While the environment factors are (viii) bidding situation, (ix) economic condition and (x) the competition.

Conclusively, bidding strategy is intended not only to win the competition but also that the project can be implemented in accordance with contract and established specifications; and thereafter generate maximum performance.

RESEARCH METHODOLOGY

The paper adopted questionnaire survey on the population of registered quantity surveying firms practising in Lagos State. The sample frame of 57 was obtained from Lagos State Chapter of Nigerian Institute of Quantity Surveyors as at 2016. This population was sample using simple random sampling technique. The questionnaire was structured on the rubric of dimensions of external, internal and environmental factors stimulating the adoption of bidding strategy in the study area. A total of 108 questionnaires were distributed and 84 collected for analysis representing response rate of 77.78%. This is above the usual rate of 20 – 30% for questionnaire survey in construction management studies (Fellow and Liu, 2008). Data collected were analysed using mean item score and factor analysis. Factor Analysis (FA) is an exploratory technique applied to a set of observed variables that seeks to find underlying factors (subsets of variables) from which the observed dimensions were generated. A total of fifty indicators were generated from literature to form the ten dimensions of three factors stimulating bidding strategy. Factor analysis was used to correlation matrix of the observed variables and reduces the number of indicators. The number of indicators generated from literature is reflected in Table 1 as:

RESULTS AND DISCUSSION

Table 2: Demographic Information of Respondents

Variables	Frequency	Percentage
Membership Cadre of Partners		
Member	61	72.62%
Fellow	23	27.38%
Total	84	100.00%
Educational Qualification		
Ph.D Degree	9	10.72%
M.Sc Degree	25	29.76%
B,Sc/B.Tech/HND Degree	50	59.52%
Total	84	100.00%
Years of Experience		
Range	Mid-value (X)	Frequency (F)
1 – 5	3.00	-
6 – 10	8.00	20
11 – 15	13.00	13
16 – 20	18.00	17
21 – 25	23.00	16
26 – 30	28.00	18
	$\Sigma=93.00$	$\Sigma=84$
Mean	=16.20 years	$\Sigma=1,507.00$
Firm Existence		
1 – 10	5.50	20
11 – 20	15.50	30
21 – 30	25.50	22
31 – 40	35.50	12
	$\Sigma=82.00$	$\Sigma=84$
Mean	=19.05 years	$\Sigma=1,562$

Table 2 reveals the background of the respondents. This shows that 72.62% and 27.38% are member and fellow category of the Nigerian Institute of Quantity Surveyors while 59.52%, 29.76% and 10.72% have obtained first degree, master degree and doctoral degree respectively in Quantity Surveying. This Table 2 also indicated that the respondents have had more than 16 years of experience and the firms surveyed have been in the practice for more than 19 years.

Table 3: Engagement strategy for consultancy services

S/N	VARIABLES	MEAN SCORE	RANK
1.	Nature of relationship with client	4.00	1
2.	Ability to customise project delivery	3.97	2
3.	Competitiveness	3.90	3
4.	Assurance of quality service	3.87	4
5.	Reliability of service delivery	3.85	5
6.	Technical know-how	3.74	6
7.	Type/Form of client organisation	3.68	7

Table 3 shows the strategy adopted by the quantity surveying firms to secure service engagement. It is noted that relationship with the client, ability to customise project

delivery and competitiveness of bidding with a mean value of 4.00, 3.97 and 3.90 respectively were prominent among the factors of securing service engagement. It is also noted that all the variables are well above the average of 2.50. This implied that all the strategy must be combined to secure the consultancy engagement. This finding is in tandem with Astama *et al.* (2015) that the complexity and uncertainty surrounding construction contract bidding situation warrant the use of combination of strategy.

The fifty indicators of bidding strategy were subjected to factor analysis using Varimax Rotation to generate Eigen value. Varimax rotation is an orthogonal rotation technique. In this technique, the axes are rotated to maximize the sum of the variances of the squared loadings within each column of the loading's matrix. The hope is that by rotating the factors, one will obtain new factors that are each highly correlated with original variables. This simplifies the interpretation of the factor to a consideration of two or three variables. The eigenvalues are used to determine how many factors to retain. The rule-of-thumb is to retain those factors whose eigenvalues are greater than one. The sum of the eigenvalues is equal to the number of variables.

Table 4: Factor rotation of bidding strategy

S/N	DIMENSIONS	EIGEN VALUE	INDIVIDUAL PERCENT	CUMULATIVE PERCENT
1	Client characteristics	2.803478	43.25	43.28
2	Project financing	2.102399	32.28	75.74
3	Competition	1.549342	23.92	99.66
4	Project characteristics	0.308242	4.76	104.42
5	Bidding situation	0.137108	2.12	106.54
6	Business benefit	0.039781	0.61	107.15
7	Contract characteristics	0.006154	0.10	107.24
8	Company characteristics	-0.113017	-1.74	105.50
9	Company experience	-0.140473	-2.17	103.33
10	Economic condition	-0.215772	-3.33	100.00

Eigen value after Varimax Rotation

Robust estimation: None

Missing value estimation: None

Table 4 indicated that client characteristics, project financing and competition are the dimensions with eigenvalue greater than one and are therefore retained as prominent factors to secure consultancy engagement. This finding collaborated Yang (2017) that bidding strategy for consultancy engagement is action guided by behavioural principles based on special details of the competition environment.

SUMMARY OF FINDINGS

Table 2 reveals the demographic information of the respondents and indicated that the respondents have had more than 16 years of experience and the firms surveyed have been in the practice for more than 19 years. Table 3 shows the strategy adopted by the quantity surveying firms to secure service engagement. It is noted that personal relationship with the client, ability to customise project delivery and competitiveness of bidding were prominent among the factors for securing service engagement. Table 4 indicated that client

characteristics, project financing and competition are the prominent dimensions of bidding strategy to secure consultancy engagement.

CONCLUSION AND RECOMMENDATION

The development of the construction industry has led to an increase in the number of criteria imposed by project clients for selecting contractors while previous research efforts have been devoted to finding solutions for helping clients to select a contractor when multiple project objectives are considered. The trend of development has now necessitated client to focus attention on the selection of consultants as well. Hence, consultancy firm must have the capability to deal with various bidding situations successfully in today's highly competitive construction market and take a decision whether to bid or not to bid for consultancy engagement. Therefore, this paper concluded that the intensity of interaction between construction professionals and clients for project service delivery are over a long-term than on single new project; services are based on ability to customise project delivery. The paper recommended that principal partners of service firms should expand the scope of their service delivery and be dynamic in response to service proliferation in order to meet the changing need of the client.

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ENRICHING QUANTITY SURVEYING CURRICULUM FOR LEADERSHIP IN THE BUILT ENVIRONMENT

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ABSTRACT

The changing structure of the Built Environment, necessitates that contemporary and future Quantity Surveyors (QS) play a leading role in service delivery in order to gain competitive advantage. The study examined factors responsible for the need to enrich quantity surveying curriculum for leadership in the Nigerian Built Environment. This was achieved through the following objectives: examination of the factors that pose challenge to QS role visibility; and examination of the extent to which both traditional and multidisciplinary services curriculum of QS requires enrichment for leadership in the Built Environment. The study adopted a survey design with a population of 450 quantity surveyors obtained by a random selection of twelve (12) quantity surveyors from each of the 36 states of the federation, and eighteen (18) from the federal capital territory, Abuja. The research instruments were a structured questionnaire. 387 structured questionnaires were validly completed and returned out of 450 administered, implying 86% response rate. The findings revealed a 'low public awareness of Qs professional services'; while enrichment of curriculum on 'financial reporting', and 'privatization/ commercialization' respectively ranked the most for traditional and multidisciplinary service innovation. The study concludes that improved knowledge and quality of QS services determines its visibility, competitiveness, and leadership in the BE industry. The study recommends improvement of the present low public awareness of Qs professional services, enrichment of current traditional and multidisciplinary service curriculum, especially in the areas of financial reporting, and privatization/commercialization.

Keywords: Built Environment, Curriculum, Enriching, Leadership, Quantity Surveying

INTRODUCTION

Contemporary construction industry business model propels clients to demand for completion within schedule, budget, quality, reliability, safety, and other predetermined project performance benchmarks. As such, globalization places a burden on built environment industry professions to continuously upscale the quality and broaden the scope of their professional services in order to meet contemporary demands of employers, construction financiers, civil society/end-users, and industry stakeholders in a manner that assures maximum value for money. Aside the built environment, organizations in other sectors of the national economy are also under increasing pressure to offer value added services, and must continue to innovate in their areas of economic endeavor. Business enterprises are also under threat from their competitors to continually offer superior and more comprehensive services to customer's ever-changing needs as a global strategy; else,

they structurally take the back seat and glide their way into extinction. As such, they must learn to survive and grow in the face of increased competition and rapid change.

The changing structure of the built environment in which quantity surveying profession belong is predicated on the fact that contemporary as well as future practitioners must be prepared to play a leading role in all facets of their professional practice, as doing so is the only way they can gain competitive advantage through superior service offering to their clients, more so, at this time of interdisciplinary convergence. Quantity surveying is a global profession that provides services across various industries. Quantity Surveyors are involved in all the phases of a facilities lifecycle such as feasibility, design, construction, extension, refurbishment, maintenance, and demolition (Olanrewaju & Anahve, 2015). The nations' quantity surveying practitioners must be proactive to provide cutting-edge leadership in all aspects of their traditional professional service offerings as well as multidisciplinary service areas since other built environment professionals also compete to undertake the same services. The services should essentially be rendered in a manner that distinctively places Quantity surveyors as built environment industry pacesetters, rather than competitors.

The value quantity surveyors deliver depends on their market profile with regards to the quantity, quality (skills and competences), availability, pricing, value addition potential and competitiveness of services within the built environment professions. The quality of the offerings determines her industry rating, brand image, service acceptability, global marketability, and competitiveness among best of class. According to measuremanage.com.au (2020), a Quantity Surveyor is a valuable resource for any construction project that requires timely delivery at minimal expenses, as the effectiveness of projects lie in the proper use of its resources with minimum possible expenses. Quantity surveying professionals have specialized skills and competences for knowledge leadership in the construction industry (Yeshwanth, 2020).

Statement of the Problem

A large segment of the general public is often not aware of the role played by Quantity Surveyors in the entire project procurement and delivery chain. Quite a number of times, QS have been approached by some persons, even by the elite community to describe their role, and in some occasions to explain the difference between a QS, an Estate surveyor, or a Land surveyor. In many projects Quantity Surveyors have been severally referred by the site workmen as 'Architect' or 'Engineer'. The situation is often made worse when the employer refers to every skilled manpower at the site as either an 'engineer' or an 'architect'. A random casual visit to schools at all levels-primary, secondary, and tertiary hardly have the pupils and students heard of 'quantity surveying', 'quantity surveyor', except a few, whose parents or relations are one. For those in this latter category, hardly do they know the role quantity surveyors perform. In general, the students or persons are comparatively more familiar with the other built environment professionals like – architects, engineers, land surveyors and could even go further to mention persons they know that are practicing those fields. The low visibility of the Quantity Surveyor in the built environment creates problem to their early appointment into project teams as other participants often take advantage of the apparently poor knowledge of clients on the services/roles of quantity surveyors and the value they add on projects. This practice gives room for usurpation of role by other members of the built environment in their desire for

dominance and leadership, as such, they publicly portray the QS as ‘an appendage or at best, a cost service subsidiary advisor to the other built environment consultants in a bid to mask her direct patronage by clients and other stakeholders in what seems to be a conspiracy. The implications of these unfortunate perceptions or practices result in a widening gap of QS service visibility by clients and other project procurement stakeholders. The effects of gap in QS service visibility is simply fatal, as her role in the total cost management of the nation’s vast infrastructures cannot be fully harnessed for national development. The foregoing background report obviously creates a huge challenge for the Nigerian Quantity Surveyor in her quest for leadership in the built environment industry. Arising therefrom, this study aims at examining factors responsible for the need to enrich quantity surveying curriculum for leadership in Nigerian Built Environment.

Objectives of Study

1. To examine the factors that pose challenge to QS role visibility
2. To examine the extent to which both traditional and multidisciplinary services curriculum of QS requires enrichment for leadership in the built environment.

Historical perspectives of Quantity surveying in BE industry

QS assumption of leadership among built environment contemporaries is a daunting and onerous task that is fraught with several challenges of which some have a medieval origin. The profession of quantity surveying is dated back to the Egyptian civilization in which dedicated personnel were deployed for costing of magnificent structures. It is believed to have transformed into a profession around the 17th century restoration of London, after the great fire (Yeshwanth, 2020). In 1836, Quantity Surveying emerged as a new age profession when the new Houses of Parliament of Great Britain, designed by Sir Charles Barry, turned into the first public contract to be completely measured and tendered utilizing Bills of Quantities. Projects like the ‘Egyptian Pyramid’, and one of the seven Wonders of the World, which today stands as the ‘hallmark of Egyptian civilization’ historically date back to 2550BC. Also, ‘Taj Mahal’, another wonder of the world which dates back to the period 1626-1648AD. In spite of the enormous human resources employed on both landmark projects numbering about 20,000 persons, there was no specific mention of QS involvement among the somewhat casual listing of specialists that were engaged in the erection of these spectacular edifices.

Most Built environment industry projects were up till 1900, generally managed by certain industry professionals who subsumed the role of quantity surveyors, comprising architects, engineers, and master builders. The projects included those of Vitruvius (first century BC), Christopher Wren (1632-1724), and Thomas Telford (1757-1834). The non-inclusion of quantity surveyors in the roll call of the aforementioned projects seemed to indicate the origin of Qs relegation to the background at an early stage of human and economic development history. The quantity surveyor eventually emerged into the built environment landscape as an independent field through the aegis of the master builders who needed to provide cost services on demand by their growing clientele. Thus, the later arrival of the Quantity Surveying profession vis-à-vis other earlier recognized professions like Architecture, Building, Civil Engineering, Land Surveying, Estate Management, Urban and Regional planning, in the historical landscape of the built environment industry has

continued to create an identity crisis in the quest and power tussle for leadership. Until date, certain clients appoint quantity surveyors late in their contract procurements. As such, most of her roles are undertaken at rush hours often involving late working and immense pressure to meet assigned timelines especially during the pre-contract stages. These, among several others, pose immense inhibition to the early engagement of quantity surveyors in built environment services talk less of her stand-alone recognition as ‘leader’. The role of leadership in the built environment industry is a challenge the Quantity Surveyor, must vigorously pursue, overtake and occupy for her to reverse the hand of history. This can be achieved by an aggressive skill marketing strategy that aims at improving her overall visibility in the built environment space based on proven capacity to provide value-driven traditional and multidisciplinary services in the BE space. Multidisciplinary services by their nature, cut across other built environment professions and could as well be rendered by them. The capacity to provide superior services must be coupled with a sustainable innovation and best practice policy. This is the only way the QS can lead and sustain leadership. Thus, the recent formal approval by the Nigerian Institute of Quantity Surveyors of the use of the prefix ‘Qs’ by all fully registered quantity surveyors, to be specific with effect from 28th April, 2017 is a step in the right direction in the ardent desire to improve QS professional service visibility, assert her relevance and forcefully enforce her role as a major stakeholder in the BE industry, more so, when her competitors for service leadership in the sector had long embraced this practice. You can only lead when you are visible and not when operating from position of obscurity.

The Private Public Partnership (PPP) procurement route has increased the potentials and relevance of the quantity surveyors towards best service delivery (Olanrewaju & Anahve, 2015).

Global review on the prospects and challenges of Quantity Surveying profession

The advent of information technology and the potential it offered, coupled with the downturn in construction activity in the UK and a number of other countries during the mid-1980s and late 1990s, gave rise to a more intense competition in the construction industry with firms seeking opportunities beyond their professional domains. Many recent scandals show that the business world faces corporate malfeasances and ethical transgressions (Mehta, 2003; Manz, Anand, Joshi, & Manz, 2008). Unethical leaders have been able to exploit the loopholes in management systems to fulfill their personal desires (Schaubroeck, Walumbwa, Ganster, & Kepes, 2007). This, led many observers to predict, and many within the profession to fear, that quantity surveying might disappear as a formal profession (Toor & Ofori, 2008). Cartlidge (2006) study however rekindled hope within the profession and noted that there was a severe shortage of quantity surveyors and cited the result of the survey of the Royal Bank of Scotland which found that quantity surveyors were the best paid graduate professionals in 2005. The reasons for the rise of fortune within the profession included an increase in the volume of construction activity, and the rising demand for experts in cost engineering and financial management.

Many clients are also becoming more knowledgeable and hence more demanding and selective in what they want from consultants and to whom they award the work (Preece, Moodley & Smith, 2003). This assertion was corroborated by Songer *et al.* (2006) study which stated that ‘there is lack of quality people to undertake huge amount of professional services in the built environment industry’.

There have been a call wake-up for greater focus on how project procurement processes can be improved (Kumaraswamy & Dulaimi, 2002), how the level of professionalism in the industry can be enhanced (Vee & Skitmore, 2003); how corruption in the industry can be eradicated (Stansbury, 2005; Transparency International, 2006); and how to attract, retain, and develop talent (Toor & Ofori, 2008). Recent studies show that quantity surveyors have generally expanded on the nature and scope of services they now provide (Olanrewaju & Anavhe, 2008; Ashworth, 2010; Cartlidge, 2011). In Nigeria, quantity surveying profession is practiced to a great extent along the same pattern as in the United Kingdom and other common wealth countries. In the Americas, they are referred to as Cost Engineers. QS functions are also carried out in other nations of the world under a variety of names including-cost engineering, construction economics, building economics, infrastructure development economics, project cost management, total cost management, etc. In spite of difference in nomenclature, the roles of QSs are universal globally (NIQS, 1998). The Regulated and other Professions (Miscellaneous Provisions) Act, 1978 recognized Quantity Surveying profession as one of the scheduled professions, while Decree No. 31 of 1986 gave it legal backing and recognition, and further set-up the Quantity Surveyors Registration Board of Nigeria (QSRBN) by Act of 1986 (Now, CAP Q1 LFN, 2004) as an agency of the Federal Government responsible for the registration, regulation, control, administration, discipline etc., within the quantity surveying profession in Nigeria. The duties of a QS can be broadly classified into two namely-specific (traditional) and shared (multidisciplinary) services.

The Qs duties is a necessary rallying point for all other members of the design and construction team including the client, despite his rare appointment as lead or prime consultant under the traditional procurement system (Ashworth, 2010; Towey, 2012; Ashworth, Hogg & Higgs, 2013; Olanrewaju & Anahve, 2015). Disparities arising from educational gap and work culture constitute major challenges towards Qs appointment in building engineering services procurement (Olanrewaju & Anahve, 2015).

Highlights of traditional & multidisciplinary roles of Quantity Surveyors

Traditionally, the activities of professional quantity surveyors are concerned with contracts, measurement, cost planning and cost control of construction projects. Quantity surveyors' culture of accountability, transparency, elasticity, coupled with clients' ever-changing needs have necessitated a diversification of Qs traditional service offerings into other sectors like- agriculture, manufacturing, mining, telecommunication, automobile, transport, shipping, petrochemical, etc.

The methods they employ cover a range of processes including but not limited to cost planning, value engineering, value management, feasibility studies, cost benefit analysis, life-cycle costing, risk analysis, tendering, valuation, change control, dispute resolution, claims management, project management, cost estimation and value for money assessments (Olanrewaju & Anahve, 2015).

Yeshwanth (2020) outlines the principal services rendered by quantity surveyors or quantity surveying firms across the globe as follows:

1. Preliminary Cost Advice
2. Cost Planning
3. Feasibility Estimates
4. Advice on Selection of Consultants & Contractors
5. Preparing of Tender Documents
6. Advising on Contractual Methods

7. Evaluation of Construction Work	10. Tax Deduction Services
8. Project Management Services	11. Technical Auditing
9. Periodic Financial Reporting	12. Feasibility Estimates

Studies have also revealed an increase in the following modern services rendered by quantity surveyors:

1. Asset Advisory
2. Facilities Consultancy
3. Building Surveying
4. Due diligence
5. Litigation support
6. Risk Mitigation
7. Property taxation

Generally, the traditional and multidisciplinary roles of quantity surveyors include but not limited to the following:

i. Cost Management of Projects	xix. Cost Studies and Cost Planning of Capital projects
ii. Construction Cost Modelling	xx. Construction Management
iii. Construction Procurement	xxi. Project Cost Control
iv. Contract Administration and Management	xxii. Commercial Management of construction projects
v. Capital Project Monitoring	xxiii. Civil Engineering projects - roads, railways, bridges, dams, wharves, seawalls, Jetties, etc (Construction, Measurement and Economic studies)
vi. Capital Expenditure Management	xxiv. Oil & Gas industry projects (downstream and upstream)- Construction, Measurement and Economic studies
vii. Feasibility Studies of Capital projects	xxv. Mechanical and Electrical Engineering (M&E)- Construction, Measurement and Economic studies
viii. Direct Labour Project Cost Management	xxvi. Construction Contract Law
ix. Project Management	xxvii. Alternative Dispute Resolution (ADR)
x. Programme Management	xxviii. Expert witness
xi. Facility Management	
xii. Value management	
xiii. Risk Management	
xiv. Contract Auditing	
xv. Development Planning and Appraisal	
xvi. Fire Insurance of Capital Projects	
xvii. Estimating	
xviii. Cash flow planning and analysis	

Ideally, Qs services are required in all phases of the construction process namely, viz: pre-construction phase, design phase, tendering phase, tender selection & appraisal phase, construction phase, and the post construction phase.

According to Yeshwanth (2020), ‘the exact role of a QS cannot be defined in a confined way because of day to day changing requirements in the construction industry’. Qs also seek to play a vital role in multi-disciplinary services resultant from the changing needs of

the industry and need to be involved in both the downstream and upstream sides in the construction supply chain market in order to provide value added services (Olanrewaju & Anahve, 2015; Yeshwanth, 2020).

Overview of Quantity Surveyors' Skill Set for Value-driven performance

Olanrewaju & Anahve (2015) posits a need for value added tools, skills, and expertise for quantity surveyors to remain competitive. Akintoye (2001) citing Connaughton declared that 'much of the core skills of the Quantity Surveyor is borrowed from disciplines like-geography, mathematics, economics, finance, management, law, etc. Contemporary skills of Quantity surveyors also include - numerical skills, problem solving ability, analytical and data interpretation skills, teamwork and interpersonal skills, ability for independent working, written and verbal communication skills, presentation skills, information technology and digital literacy skills, negotiation skills, and attention to details and methodical skills. Thus, the unique nature of Quantity Surveying profession is the combination of these diverse knowledge and skills in the context of construction. The above scope of specific and general duties are areas in which the Nigerian Quantity Surveyor can competently exhibit skill and showcase superior ability and take-up an unequalled, incontestable leadership within the built environment considering the peculiarity of her training and diversified background. The changes in the construction industry discussed above pose a number of to all who work in it. They particularly offer tremendous business opportunities and avenues for greater achievement from the perspective of the quantity surveying profession. Harun and Torrance (2006) suggest that quantity surveyors should not contain themselves within the traditional boundaries of cost management; they need to develop new niches, cultivate new knowledge and break into new areas in order to enhance their competitiveness. Smith (2004) suggests that there is some uncertainty about the capacity in which, and for whom, the quantity surveyors would work, and the nature of quantity surveying firms in the future. Brummer (2004) suggests that quantity surveyors should play a more effective and proactive role across all stages of the project life cycle and draws attention to constantly changing procurement systems, necessitating refinement in the services that quantity surveyors offer. Olanrewaju & Anahve (2015) observed that quantity surveyors usually offer their service when major design decisions have been made. Their study on the appointment of the quantity surveyors showed that only 21% of the appointments are based on their self-recognition, otherwise they are engaged based on advice of architects (39%), engineers (11%), projects managers (22%) and others (6%). This statistic alludes to their low visibility. The implication is that quantity surveyors would be unable to provide strategic roles on the project if appointed at later stages. Grant (2004) proposes that the Quantity Surveyors should diversify their domain of expertise and strengthen the bases of their strategic assets such as education, training, experience and knowledge. Professional development is primarily aimed at promoting growth within the body of knowledge of a profession. It involves building on previous efforts to emancipate a profession, moving from the present unsatisfactory position to a preferred one that provides a better and more robust opportunity by making a greater impact, and establishing superior intellectual and professional leadership among best of class (Adindu & Ofoegbu, 2014). The adoption of business competitive strategy is imperative for quantity surveying profession to subdue the growing rate of role interference, usurpation in the traditional services, and to survive the stiff competition and lobbying for service patronage that characterize the multidisciplinary services. Competitive strategy is about being different

and rendering superior performance. The essence of strategy in business activities is choosing to perform activities differently from rivals (Chase, Aquilano & Jacobs, 2001). The fundamental theory is that for any service or product organization to be of world class rating, it must recognize that its ability to compete in the market it serves depends on developing an operations strategy that is properly aligned with its mission of serving the customer. A company's competitiveness refers to its relative position in comparison to other firms in the local or global market place. The major competitive dimensions for which firms and organizations seek competitive positions include-cost leadership, product/service quality, reliability leadership, and delivery speed leadership (Chase *et.al*, 2001). Thus, for the QS to achieve leadership in the built environment landscape, she must improve her role visibility and sub-sectoral skills and competences for competitive advantage and leadership in the built environment industry through service innovation. Literature on construction industry innovation distinguishes between several different kinds of technological and process innovations (Winch, 1998). The innovation strategy would have to involve a long-term deliberate policy that must bring about desired change for built environment leadership by the QS. Rates of innovation generation and innovation adoption are difficult to compare because definitions are diverse and the apparent difficulty in distinctively identifying individual innovations in an ongoing development process. Glaringly, some areas of built environment activity are more visible than others and therefore better understood. Ivory (2005) reports the tendency of Architects in particular, to innovate beyond the scope of the original client requirements and operate from their own agenda. Such innovations are certainly noticed but their contribution to the success of the project will not always be a positive one. On the other hand, process innovations of the kind that quantity surveyors are likely to introduce may go unnoticed by other participants not directly affected. Architects and Engineers often display their Architectural and Engineering drawings for all to appreciate and criticize their expertise on a development project. Same cannot be said of the QS Cost Plan, Preliminary Estimate of Cost, Bidding document (BOQ), tender documents, Variation Claim documents, Fluctuation Claim Documents, Interim Valuation, Financial Statements, and Final Accounts, Post Contract Auditing, among several other roles. Most of the QS's roles are of a 'strict and confidential' nature and involve documents of a largely restricted use. Professional ethics of most QS services often demand the highest level of confidentiality in a bid to protect the client and other project stakeholders from exploitation and economic fraud, by way of bloated contracts, over-invoicing, resources mis-use, wastage, and other forms of mis-management of project resources. These services are rendered in the best interest of the society and the nation at large. Another obvious impediment to the Quantity Surveyors visibility is their lack of advertising of any kind. Quantity Surveyors do not advertise their service offerings be it in the print or electronic media. Their office locations do not often display notice or signboards talk less of showcasing their services. As, such, their existence is only brought to a public notice when they have projects that require use of consultants' name boards. The lack of public advertisement of services as a marketing strategy is a major setback on QS visibility in the built environment industry.

Thus, contemporary description of a Quantity surveyor includes- an auditor, facilitator, leader, manager, an innovative and dynamic stakeholder of an infrastructure development chain. Modern Quantity Surveying is viewed as a multi- disciplinary practice that aims at achieving optimum economic output and value for money (Yeshwanth, 2020). Quantity

surveyors must possess an in-depth knowledge of required job offerings for them to render value-based services to clients and other project stakeholders.

RESEARCH METHODOLOGY

The study adopted a survey design with a population of 450 quantity surveyors chosen from the academia, consultancy practices, clients' organizations, and contracting firms obtained by a random selection of twelve (12) quantity surveyors from each of the 36 states of the federation, and eighteen (18) from the federal capital territory, Abuja. The research instruments were a structured questionnaire. 387 structured questionnaires were validly completed and returned out of 450 administered, implying 86% response rate. This, in the view of the researchers was considered adequate for purposes of this study especially with respect to data representativeness. Cronbach Alpha test conducted for the reliability of research instrument yielded 0.925 value. The study analysis was carried out with the aid of average relative index (ARI) as per Olanrewaju & Anahve (2015) study.

$$ARI = \frac{\sum_{i=0}^5 a_i x_i}{5 \sum_{i=0}^5 x_i} \quad (0 \leq ARI \leq 1) \quad (1)$$

Where a_i is the index of a group; a constant expressing the weight given to the group; x_i is the frequency of response; $i = 1, 2, 3, 4, 5$, x_1, x_2, x_3, x_4, x_5 , are the frequencies of the response corresponding to $a_1=1, a_2=2, a_3=3, a_4=4, a_5=5$, respectively. As such, for purposes of interpretation, 0 (zero) is the lowest possible score, whereas, 1 (one) is the highest possible score. ARI values closer to 1, indicate higher extent of respondent's agreement on variable factors under measure. Thus, the higher the cumulative weighted total (CWT), the higher the average relative index (ARI), and the higher the strength of agreement among respondents on the identified variable factor. For this study, ARI values of 0.700 and above are considered the most critical, as such, require prompt managerial action. The more the ARI values tend towards 1.000 (maximum value for a perfect agreement), the greater the effect of the variable factor on the construct measured.

RESULTS AND DISCUSSION

The results in Table.1 on the factors that pose challenge in QS role visibility for leadership in the Built Environment, show that 'low public awareness of Qs services' has the highest ARI value of 0.825 and ranked 1st, implying the factor poses the greatest challenge to Qs role visibility for leadership in the BE industry; followed by QS indirect appointment by clients -2nd, ARI :0.800. According to Ashworth (2010); Towey (2012); Ashworth, Hogg & Higgs (2013); and Olanrewaju & Anahve (2015), 'the Qs duties is a necessary rallying point for all other members of the design and construction team including the client, despite his rare appointment as lead or prime consultant under the traditional procurement system. This assertion also corroborates the following results- indirect reporting of roles to clients -3rd, ARI:0.774; Low public awareness of Qs services -4th, ARI:0.770; and non-publicity of Qs roles- 5th, ARI: 0.750. Lack of competitiveness in the wider BE services ranked 6th, ARI:0.692, while usurpation of traditional roles by other BE professions ranked 7th, ARI: 0.668 amongst others.

Discussion of Findings: Grant (2004) proposes that the Quantity Surveyors should diversify their domain of expertise and strengthen the bases of their strategic assets such as education, training, experience and knowledge. Furthermore, Harun and Torrance (2006) suggest that quantity surveyors should not contain themselves within the traditional boundaries of cost management; they need to develop new niches, cultivate new knowledge and break into new areas in order to enhance their competitiveness. In view of the foregoing, for objective no.2, the results on table.2 below, show that ‘Financial Reporting’ has the highest ARI value of 0.815, implying that the variable factor has the most critical need for review by enriching both the academic and professional curriculum in the subject area, for Qs leadership of the BE industry. The results also show that ‘contract auditing’ is next in the order of need to enrich academic and professional curriculum, hence an ARI value of 0.771; followed by contract documentation & tender evaluation; management of capital project expenditure; and cost modelling, with ARI values of 0.760, 0.722, and 0.703 respectively. Enriching Qs traditional curriculum would enable her establish superior intellectual and professional leadership among best of class (Adindu & Ofoegbu, 2014).

Table 1: Factors that pose challenges in QS role visibility for leadership in the Built Environment

Enquiry code	Factors that pose challenges in QS role visibility	To a Great Extent		To a Considerable Extent		To a Moderate Extent		To a Fair Extent		To a No Extent		Cumulative Weighted Total CWT	Average Relative Index
		5		4		3		2		1			
		Freq	WT	Freq	WT	Freq	WT	Freq	WT	Freq	WT	CWT	ARI
1.1	Lack of innovation in QS roles	38	190	113	452	169	507	47	94	20	20	1263	0.652
1.2	Low Public Awareness of QS profession	66	330	217	868	85	255	19	38	0	0	1491	0.770
1.3	QS Indirect Appointment by Clients	160	800	123	492	57	171	38	76	9	9	1548	0.800
1.4	Largely Discreet Nature of QS Roles	38	190	76	304	255	765	9	18	9	9	1286	0.664
1.5	Indirect reporting of roles to client.	94	470	198	792	57	171	28	56	10	10	1499	0.774
1.6	Non-Publicity of Roles	151	755	94	376	66	198	47	94	29	29	1452	0.750
1.7	Usurpation of traditional roles by other BE Professions	57	285	94	376	161	483	75	150	0	0	1294	0.668
1.8	Irrelevance of role in BE Industry	0	0	0	0	0	0	0	0	0	0	0	0.000
1.9	Deficiency in Qs Academic/Professional training	28	140	85	340	189	567	66	132	19	19	1198	0.619
1.10	Lack of Competitiveness in the wider BE services	94	470	113	452	76	228	85	170	19	19	1339	0.692
1.11	Low Public awareness of the QS Services	151	755	170	680	38	114	19	38	9	9	1596	0.825
1.12	Process nature of Qs roles	57	285	94	376	123	369	94	188	19	19	1237	0.639

Source: Field Survey, 2019 & 2020

Table 2: Extent to which QS traditional service curriculum require enrichment for leadership in the Built Environment

Inquiry Code		Value Label											
	Variable factors -Areas of traditional QS services curriculum	To a Great Extent		To a Considerable Extent		To a Moderate Extent		To a Fair Extent		To a No Extent		Cumulative Weighted Total	Average Relative Index (ARI)
		5		4		3		2		1			
		Freq	WT	Freq	WT	Freq	WT	Freq	WT	Freq	WT		
2.1	Cost Modelling	66	330	170	680	76	228	47	94	28	28	1360	0.703
2.2	Contract Documentation & Tender Evaluation	113	565	160	640	57	171	38	76	19	19	1471	0.76
2.3	Contract Administration	38	190	85	340	151	453	76	152	37	37	1172	0.606
2.4	Contract Auditing	85	425	198	792	66	198	38	76	0	0	1491	0.771
2.5	Financial Reporting	113	565	227	908	19	57	19	38	9	9	1577	0.815
2.6	Valuation of Work done	76	380	104	416	76	228	85	170	46	46	1240	0.641
2.7	Management of capital project expenditure	94	470	142	568	85	255	38	76	28	28	1397	0.722
2.8	Expert Witness	57	285	113	452	113	339	47	94	57	57	1227	0.634

Source: Field Survey, 2019 & 2020

Table 3: Extent to which QS multidisciplinary service curriculum require enrichment for leadership in the Built Environment

		Value Label											
Inquiry Code	Variable factors-Areas of multi-disciplinary services curriculum	To a Great Extent		To a Considerable Extent		To a Moderate Extent		To a Fair Extent		To a No Extent		Cumulative Weighted Total (CWT)	Average Relative Index (ARI)
		5		4		3		2		1			
		Freq	WT	Freq	WT	Freq	WT	Freq	WT	Freq	WT	CWT	ARI
3.1	Feasibility Studies of Capital Projects	85	425	123	492	76	228	66	132	37	37	1314	0.679
3.2	Project Management	132	660	151	604	57	171	38	76	9	9	1520	0.786
3.3	Value Management	94	470	161	644	85	255	28	56	19	19	1444	0.746
3.4	Facilities Management	161	805	95	380	47	141	47	94	37	37	1457	0.753
3.5	Technical auditing	76	380	142	568	104	312	38	76	27	27	1363	0.704
3.6	Risk Management	123	615	113	452	76	228	57	114	18	18	1427	0.738

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3.7	Privatization & Commercialization	142	710	161	644	37	111	19	38	28	28	1531	0.791
3.8	Capital Market Finance proposals	104	520	123	492	76	225	57	114	27	27	1378	0.712
3.9	Facilities management	57	285	85	340	170	510	38	76	37	37	1248	0.645
3.1	Property Taxation	95	475	103	412	142	426	19	38	28	28	1379	0.713
3.11	Fire Insurance Assessment	85	425	141	564	94	282	47	94	20	20	1385	0.716
3.12	Due diligence reporting	94	470	179	716	57	171	28	56	29	29	1442	0.745

Source: Field Survey, 2019 & 2020

DISCUSSION OF FINDINGS

Studies show that quantity surveyors have generally expanded on the nature and scope of services they now provide (Olanrewaju & Anavhe, 2008; Ashworth, 2010; Cartlidge, 2011). After identifying the nature of services, the Qs need to expand the scope to align with clients' everchanging needs for services. Thus, the results in Table 3, on Extent to which QS multidisciplinary service curriculum require enrichment for leadership in the built environment shows that 'Privatization & Commercialization' recorded the highest ARI value of 0.791, implying that the variable factor has the most critical need for review or enrichment of its curriculum for Qs competitive advantage and leadership in the BE. This result is followed by the curriculum on 'Project management' with an ARI value of 0.786, Facility management-ARI:0.753, Value management -ARI: 0.746, Due diligence reporting -ARI: 0.745, Risk management- ARI: 0.738, Fire insurance assessment-ARI:0.716,Property Taxation-ARI:0.713, Capital market finance proposal ARI:0.712, and Technical auditing-ARI: 0.704. Olanrewaju & Anahve (2015); Yeshwanth (2020), state that 'QSs also seek to play a vital role in multi-disciplinary services resultant from the changing needs of the industry and need to be involved in both the downstream and upstream sides in the construction supply chain market in order to provide value added services. The above results also corroborate the assertion of Chase *et al.* (2001), that the major competitive dimensions for which firms and organizations seek competitive positions include-cost leadership, product/service quality, reliability leadership, and delivery speed leadership.

CONCLUSION

Globalization in the built environment industry demands that BE professions upscale the quality and broaden the scope of their professional services in order to meet contemporary demands of society. The changing structure of the Built Environment, necessitates that contemporary and future Qs practitioners play a leading role, in order gain competitive advantage. The nations' quantity surveying practitioners must be proactive to provide cutting-edge leadership in all aspects of her traditional and multidisciplinary service offerings. The lack of QS visibility in the BE notably creates problem to her early appointment as other BE participants often take advantage of this, to usurp her traditional roles in addition to multidisciplinary roles. This empirical study has attempted to provide solutions to the problems of low QS visibility, and has also revealed priority areas of curriculum enrichment in order to upscale her traditional and multidisciplinary services. The quality of QS services determines her visibility, industry rating, brand image, service acceptability, global marketability, competitiveness and leadership in the Built Environment.

RECOMMENDATION

Arising from the results of the study, the following recommendations are therefore made for policy:

1. An urgent improvement of the present low public awareness of Qs professional services through a massive orientation and enlightenment process, right from the primary school level
2. Early and direct appointment of Quantity surveyors by clients and BE industry stakeholders in proposed infrastructure projects
3. Enrichment and immediate review of current traditional services curriculum especially in the area of financial reporting. Other critical areas include: contract auditing, contract

documentation & tender evaluation, management of capital project expenditure, and cost modelling

4. Enrichment and immediate review of current multidisciplinary services curriculum especially in the area of privatization & commercialization. Other critical areas include: project management, facilities management, value management, due diligence reporting, risk management, fire insurance assessment, property taxation, capital market finance proposal, and technical auditing.

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PROJECT MANAGERS' PERFORMANCE ON SUSTAINABLE CONSTRUCTION OF RESIDENTIAL ESTATES IN ABUJA, NIGERIA

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ABSTRACT

Encouraged by the support given to the sustainability agenda globally by the United Nations, Nigeria along with many other countries is slowly focusing on achieving a sustainable built environment. This paper assessed the performance of project managers on sustainable construction of residential estates in Abuja, Nigeria by examining project managers' perception of their own competence, and the performance of project managers on the sustainable construction of residential estates. Data was collected from 26 Project Managers using close-ended-design questionnaires and analyzed through descriptive statistical methods (Mean Score and Relative Importance Index). Historical project data was also obtained on 22 residential estate projects, and was analysed using Percentage analysis. Findings from data analysis revealed that Project Managers are rated high in ten competencies and moderate in six competencies namely Budgeting, Risk management, and Emotional intelligence. The competencies of Project Managers had the strongest influence on project quality performance. All three of the traditional 'iron triangle' of project performance indices (cost; quality; time) were highly influenced by technical competencies such as Budgeting and Procurement management. It was recommended that Project Managers participate in Continuing Professional Development (CPD) in order to hone their competencies in areas such as budgeting, risk management, and emotional intelligence where some weakness has been identified in this study.

Keywords: construction, performance, project manager, residential and sustainability.

INTRODUCTION

Nigeria, like many other countries globally is beginning to focus on achieving a sustainable built environment (Dimuna and Omatson, 2010; Akande *et al.*, 2015). With the support given to the sustainability agenda by the United Nations, construction professionals have to work towards attaining a high level of satisfaction of occupants' safety and comfort within the constraints of the sustainable development (SD) agenda requirements. A globally accepted definition of sustainable development provided in the Brundtland Report is 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987). Sustainable development is now a major part of the mission statement of many global organisations, national institutions, corporate companies, states and localities (Kates *et al.*, 2005). Buildings play a major role in the degradation of the natural environment (Mora *et al.*, 2011) through the consumption of major amounts of energy, water, and land usage. The high

percentage of non-renewable resources consumed by it makes the building industry one of the least sustainable industries (Edwards, 2010). The built environment accounts for 40% of waste and greenhouse gases generated (CIOB, 2004). Buildings use as much as 45% of generated energy for air-conditioning and heating (Reed *et al.*, 2011), one-sixth of the world's fresh water usage, and one-quarter of wood harvested (Emmanuel, 2004).

The NCI is bedevilled with poor design and construction that uses harmful and non-renewable materials (Abigo *et al.*, 2012) as well as non-adherence to building practices that result in functional, healthy, and fit-for-purpose buildings (Jiboye, 2012). Adejimi (2005) noted that none of the building professionals in the NCI takes responsibility for unsustainable and unsatisfactory buildings. The project manager, who only coordinates the process of design and construction, is left in a frustrating position. This paper focuses on the competency and performance of the project manager at the construction stage; the aim is to assess the performance of project managers on sustainable construction of residential estates in Abuja, Nigeria, with a view to enhancing sustainability in mass housing delivery. As a means of achieving this aim, this paper examined: (i) project managers' perception of their competency, and (ii) project managers' performance on the sustainable construction of residential estate projects.

LITERATURE REVIEW

Sustainable Construction

Sustainable development and environmental protection have become a major focus for governments based on scientific evidence that existing buildings consume a high amount of energy and materials, while also releasing significant quantities of harmful greenhouse gases (Thilakaratne and Lew, 2011). Efforts to reduce the ecological footprint of the construction industry threw up green building during the green movement of the 1970s to 1980s (Retzlaff, 2010). The underlying principle has been to find alternatives to traditional construction; such new methods of construction must save energy and reduce environmental pollution. Accordingly, green building construction (GBC) is another way of describing sustainable construction (SC), which is an important means of reducing environmental pollution and improving quality of life (Tan *et al.*, 2011). SC has been touted as a significant measure to mitigate the significant (and mostly negative) impacts of the building stock on the environment, society, and economy (Zuo and Zhao, 2014). The theoretical and practical aim of green building

or sustainable construction is to design and construct buildings using recycled materials, less water, less energy, and resource efficient techniques (Olubunmi *et al.*, 2016).

The success of SC projects is measured by a wide range of indicators primarily because of differences in cultural and climatic conditions across the globe. Sang *et al.* (2018) found through literature analysis that the various definitions of the key success indicators all aim at minimal destruction of the environmental system. The United Kingdom in 1990 established the first environmental certification system, the Building Research Establishment Environmental Assessment Method (BREEAM); it covered nine aspects: management, health, and comfort, energy, transportation, water, materials, land use and ecology, garbage, and pollution (Lee and Burnett, 2008). Globally, the most widely used evaluation system for sustainable construction is The Leadership in Energy & Environmental Design (LEED) rating system. LEED consists of seven systems and multiple indicators, namely sustainable building sites, water efficiency, energy and atmosphere, resources and materials, indoor air quality, innovations in design, and regional priority (Suzer, 2015). There are many similar evaluation systems such as the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan, the German Sustainable Building Council (DGNB) in Germany, and the Building Environmental Assessment Method (BEAM) in Hong Kong (Sang *et al.*, 2018).

Sustainable construction has been studied from different perspectives. Tabassi *et al.* (2016) studied project manager leadership in sustainable building projects and identified six groups of success indicators: energy efficiency, indoor environmental quality, sustainable site planning and management, materials and resources, water efficiency, and innovation. Mattoni *et al.* (2018) defined six macro-indicator groups (site, water, energy, comfort and safety, materials and outdoor quality) derived from a comparative study of various evaluation systems. The multiplicity of SC standards in China was studied by Ye *et al.* (2015) and revealed the existence of 17 national and trade standards and more than 50 local standards. The results of Sang *et al.* (2018) demonstrated that Leadership and organization, Target management, and Emotional intelligence of project managers are important factors that affect SC performance.

Project Managers' Competence

A project manager, according to Zwikael and Smyrk (2011) is the person contractually responsible for meeting the project's output targets; within the construction industry, project managers initiate, plan, execute, monitor and close projects. The five key stages of project

management in construction (initiating, planning, executing, monitoring and closing) involve a multiplicity of participants. Thus, the primary role of project managers is coordinating construction activities by the different team members to ensure that they perform the right tasks at the proper time (Gido and Clements, 2012). Project managers must ensure that people involved with the design and construction process possess the appropriate knowledge and resources needed to accomplish their assigned tasks (Sutton, 2011).

Competence has been defined as “the ability of an individual, a team, or a company to mobilize and combine resources (i.e., knowledge, skills, and attitudes) in order to implement an activity in a situation” (Loufrani-Fedida and Missonier, 2015). Although project manager leadership competencies are critical factors of failure or success that can be used to assess project performance (Anantatmula, 2010; Nixon *et al.*, 2012), this is an area in which limited research has been conducted (Anantatmula, 2010; Fung, 2014). Jabar *et al.* (2018) found that project managers in Malaysian Industrialized Building System (IBS) construction projects have to undertake extra roles which required additional competency as compared to the generic construction projects.

Quite a number of frameworks for the evaluation of competency can be identified in project management. Examples include the International Project Management Association (IPMA) ‘Competence Baseline’ and the ‘Guide to the Project Management Body of Knowledge (PMBOK)’, developed by the Project Management Institute (PMI, 2013). The Competence Baseline of IPMA classified 46 competency elements into contextual, behavioural, and technical groups of competencies. On the other hand, the PMBOK identified project management competences in ten knowledge areas (PMI, 2013). However, these competency models do not reflect leadership competencies required to improve project performance (Hollenbeck *et al.*, 2006).

Performance of Project Managers

Performance of projects in the construction industry has been measured in a variety of ways; compliance with cost, schedule and quality targets has been used traditionally (Meng, 2012). Although project management processes have a significant impact on project time and cost (Almahmoud *et al.*, 2012), these metrics alone are no longer sufficient to assess project performance (Nixon *et al.*, 2012). Project performance encompasses other dimensions such as quality performance and stakeholder satisfaction, which must be considered in order to fully

measure project performance (Almahmoud *et al.*, 2012; Yang *et al.*, 2014; Berssaneti and Carvalho, 2015). There is evidence of the influence of project managers' leadership competence on project performance; Ahmed and Anantatmula (2017) demonstrated that all five leadership competencies of project managers are significantly related to achievement of project performance in terms of schedule, cost, and quality as well as stakeholder satisfaction.

METHODOLOGY

This study adopted a quantitative research design approach which involved the use of questionnaires and historical project data. A structured questionnaire was designed in five sections, using Likert-style response options. Data was collected through a simple random questionnaire survey of 28 recently completed mass housing projects in Abuja; only 26 questionnaires however contained valid data. Historical project data on initial and final costs and completion times were obtained for 22 projects. The study was limited to construction professionals who are performing project management roles on mass housing projects. They may be registered Project Managers or registered members of ARCON, CORBON/NIQB, NSE/COREN & NIQS/QSRBN (which are the recognised associations for the allied professions of Architecture, Building, Civil/Structural/Electrical Engineering and Quantity Surveying). It is believed that they have adequate knowledge about the state of project management practice in Nigeria and can answer the questions of this study. The data was analysed using descriptive statistical method (Mean Score and Relative Importance Index), which allowed the ranking of competencies and performance of Project Managers. Historical project data was analysed using Percentage analysis.

RESULTS AND DISCUSSION

Respondent Demographics

A breakdown of the demographics of the data collected through questionnaire is provided in Table 1. Female respondents constituted just 11.5% of the sample. Male respondents thus dominated the questionnaire survey, and this meant that the results will unavoidably be skewed towards a male point of view. This is unavoidable, as it reflects the current reality of gender imbalance in construction industries the world over. It also shows that the Nigeria Construction

Industry (NCI) is not an exception in this respect. Within the NCI, the job of Project Manager is often performed by people from diverse professional backgrounds. There appears to be no clear-cut legislation on who should perform project management roles on construction projects. Engineers were most plentiful in the sample (some 42.6%). This is probably because of the different specialisations such as civil, mechanical and electrical engineering that were simply grouped together as ‘engineers.

The educational background of the respondents comprised mainly possession of higher national diplomas (HND) and bachelor degrees (B.Sc) in construction disciplines; some 61.5% of the sample fell into this group. The rest 38.5% comprised respondents who had obtained a second, more advanced degree. In this case, such respondents had obtained a master’s degree. It was found that a little over two thirds of the study had worked for less than 16 years. 19.2% of the respondents had worked for between 16 years and 25 years, while the rest 11.5% of the sample had worked for more than 25 years.

Table 1: Demographic analysis of questionnaire survey results

Demographic parameters		Frequency	Percentage
Gender	Female	3	11.5
	Male	23	88.5
Profession	Architect	4	15.4
	Builder	1	3.8
	Engineer	12	46.2
	Estate Surveyor	0	0.0
	Quantity Surveyor	5	19.2
	Town Planner	0	0.0
	Other (specify)	4	15.4
Education	OND/NCE	0	0.0
	HND/B.Sc	16	61.5
	M.Sc	10	38.5
	Ph.D	0	0.0
Experience	Less than 5 yrs	10	38.5
	6 yrs – 15 yrs	8	30.8
	16 yrs – 25 yrs	5	19.2
	More than 25 yrs	3	11.5

Source: Field Work, (2020)

Perception of Project Managers’ Competence

The results presented in Table 2 can be clearly delineated into two main groups of competencies, on the basis of MS and/or RII. The first group comprises competencies that respondents perceived themselves as being highly competent in, since the MSs were higher than 3.50. The ten competencies in this group were Interpersonal skill, Scoping, Integration, Quality management, Scheduling, Networking ability, Document and contract administration,

Transformational leadership, Apparent sincerity and Procurement management. This group was dominated by technical competencies (4 out of 10).

The other group comprised 6 competencies in which respondents were only moderately competent, based on the observation that MS lay between 2.50 and 3.49. These six competencies included Budgeting, Risk management, Interpersonal influence, Emotional intelligence, Visioning and Social astuteness. There was no consensus among the respondents on any of the competencies. Consensus attainment is indicated by a situation where the sum of responses in the ‘very high competence (VHC)’ and ‘high competence (HC)’ categories are at least 70% of all responses. The highest level of agreement observed was 68% in the case of ‘Scoping’, which was a ‘Conceptual’ competence. The only technical competence where the level of agreement exceeded 60% was ‘quality management’.

Table 2: Ranking of project managers’ competencies

Competency group	Competency components	Mean Score	SD	RII	Rank	Level of agreement	Remark
Human	Interpersonal skill	3.68	1.38	0.71	1	68	No consensus
Conceptual	Scoping	3.64	1.08	0.70	2	64	No consensus
Conceptual	Integration	3.64	1.08	0.70	2	62	No consensus
Technical	Quality management	3.62	1.17	0.72	4	60	No consensus
Technical	Scheduling	3.58	1.33	0.72	5	58	No consensus
Political	Networking ability	3.58	1.27	0.72	6	58	No consensus
Technical	Document and contract administration	3.58	1.14	0.72	7	58	No consensus
Human	Transformational leadership	3.58	1.06	0.72	8	58	No consensus
Political	Apparent sincerity	3.54	1.17	0.71	9	58	No consensus
Technical	Procurement management	3.54	1.14	0.71	10	54	No consensus
Technical	Budgeting	3.42	1.14	0.68	11	50	No consensus
Technical	Risk management	3.35	1.20	0.67	12	50	No consensus
Political	Interpersonal influence	3.35	1.06	0.67	13	50	No consensus
Human	Emotional intelligence	3.31	1.05	0.66	14	50	No consensus
Conceptual	Visioning	3.31	0.93	0.66	15	35	No consensus
Political	Social astuteness	3.04	0.77	0.61	16	27	No consensus

Source: Field Work, (2020)

Notes: MS = Mean Score; SD = Standard Deviation

These results were in agreement with the findings in previous studies that had canvassed the need for additional competencies for project managers (Yepes *et al.*, 2012; Jabar *et al.*, 2018). With project managers being highly competent in only 10 out of the 16 competencies examined, this study has established the need for action to improve the competency of project managers.

Project Managers’ Performance

Project managers’ performance was measured using five (5) indices of construction projects against sixteen (16) project management (PM) competency components. The five (5) indices of

construction projects were (i) Cost (ii) Dispute resolution (iii) Health and safety (iv) Quality and (v) Time. The paper employed a 3-item semantic scale to show level of influence ('3' for 'High Influence'; '2' for 'Moderate Influence'; '1' for 'Low Influence'). A score of 2.50 or higher is thus required to indicate high level of influence.

Table 3 revealed that the three 'conceptual' competencies (Scoping, Integration and Visioning) have significant influence only on the cost, quality and time performance. The cost of projects was most strongly influenced by 'Scoping' competency (MS = 2.58); respondents did not believe that the abilities to scope, integrate and vision a residential housing estate project would significantly affect how the project performs in terms of (i) dispute resolution and (ii) health and safety. 'Human' competency (composed of Emotional intelligence, Interpersonal skill and Transformational leadership) had significant influence only on the health and safety, quality and time performance of residential housing estate projects. The implication of this is that the Interpersonal skill of project managers does not significantly affect the cost, dispute resolution, health and safety and time performance of projects. Emotional intelligence of project managers does not significantly affect the cost, dispute resolution, and health and safety performance of projects. While the findings of the study agreed with Sunindijo (2015) regarding influence of conceptual competencies on cost and schedule performance, it did not follow Todorovic *et al.* (2015) position entirely; this study provided no evidence that dispute resolution and health and safety should be adopted as part of project managers' performance metrics.

Only two of the four (4) competencies under the 'Political' competency group exerted significant influence on the quality performance of projects. These were Interpersonal influence, which had a MS of 2.62 and Apparent sincerity (MS = 2.65). It was interesting that the political competency of project managers has significant effect on only quality performance. This might indicate a belief in the pivotal position of quality in construction; it has the ability to affect all other performance indices. The 'Technical' competency of project managers comprised Scheduling, Budgeting, Quality management, Document and contract administration, Risk management and Procurement management. Only dispute resolution performance of projects was uninfluenced by any of the six 'technical' competencies. Risk management competency exerted significant influence on only performance of projects in term of quality. This might be an indication of the low level of familiarity with risk management by project managers.

Table 3: Influence of ‘Conceptual’ competencies on project performance

Competency group	Competency components	Cost		Dispute resolution		Health and Safety		Quality		Time	
		MS	SD	MS	SD	MS	SD	MS	SD	MS	SD
Conceptual	Scoping	2.58	0.64	2.20	0.58	2.38	0.70	2.65	0.63	2.62	0.64
Conceptual	Integration	2.50	0.71	2.19	0.57	2.48	0.65	2.68	0.56	2.62	0.64
Conceptual	Visioning	2.50	0.65	2.27	0.60	2.27	0.72	2.69	0.55	2.62	0.70
Human	Emotional intelligence	2.12	0.71	2.31	0.74	2.46	0.65	2.56	0.65	2.50	0.72
Human	Interpersonal skill	2.35	0.75	2.27	0.72	2.31	0.62	2.50	0.71	2.46	0.71
Human	Transformational leadership	2.42	0.64	2.42	0.64	2.62	0.50	2.73	0.45	2.54	0.65
Political	Social astuteness	2.15	0.78	2.23	0.71	2.31	0.74	2.38	0.70	2.27	0.78
Political	Interpersonal influence	2.31	0.62	2.46	0.51	2.42	0.58	2.62	0.50	2.42	0.58
Political	Networking ability	2.35	0.56	2.38	0.64	2.42	0.58	2.42	0.58	2.42	0.58
Political	Apparent sincerity	2.42	0.70	2.27	0.60	2.48	0.59	2.65	0.63	2.46	0.71
Technical	Scheduling	2.65	0.56	2.32	0.63	2.58	0.58	2.62	0.70	2.62	0.57
Technical	Budgeting	2.54	0.65	2.19	0.63	2.38	0.57	2.69	0.47	2.64	0.57
Technical	Quality management	2.50	0.65	2.35	0.56	2.50	0.58	2.77	0.51	2.54	0.58
Technical	Document and contract administration	2.58	0.58	2.31	0.68	2.42	0.64	2.58	0.58	2.54	0.65
Technical	Risk management	2.40	0.71	2.35	0.63	2.46	0.51	2.62	0.50	2.35	0.69
Technical	Procurement management	2.50	0.71	2.23	0.65	2.42	0.64	2.58	0.58	2.54	0.58

Source: Field Work, (2020)

Notes: MS = Mean Score; SD = Standard Deviation; **Bold face** type indicates significant MS values

The results presented above generally agree with previous researchers (such as Berssaneti and Carvalho, 2015) where traditional measures of project performance are considered (cost, time and quality). The study does not provide support for the use of other dimensions such as dispute resolution, health and safety, risk management and stakeholder satisfaction to measure project managers’ performance as advocated by Ahmed and Anantatmula (2017).

Cost and Time Performance of Projects

Composite line charts were employed to show the variations in cost and time performance. To control for the effect of size of project, the gross floor area of the projects was included in each chart. The salient points observed in Fig. 1 include a small but noticeable improvement in the cost performance of projects as the size of the projects increase; the costs of larger projects thus tended to be closer to their initial planned costs. Project managers have apparently been able to complete projects at costs ranging between 0% and 30% higher than were initially planned. Since

larger projects tend to have more clearly-defined project management structures, this finding is in line with Ibbs and Reginato (2002) that good project management in construction is correlated with lower cost.

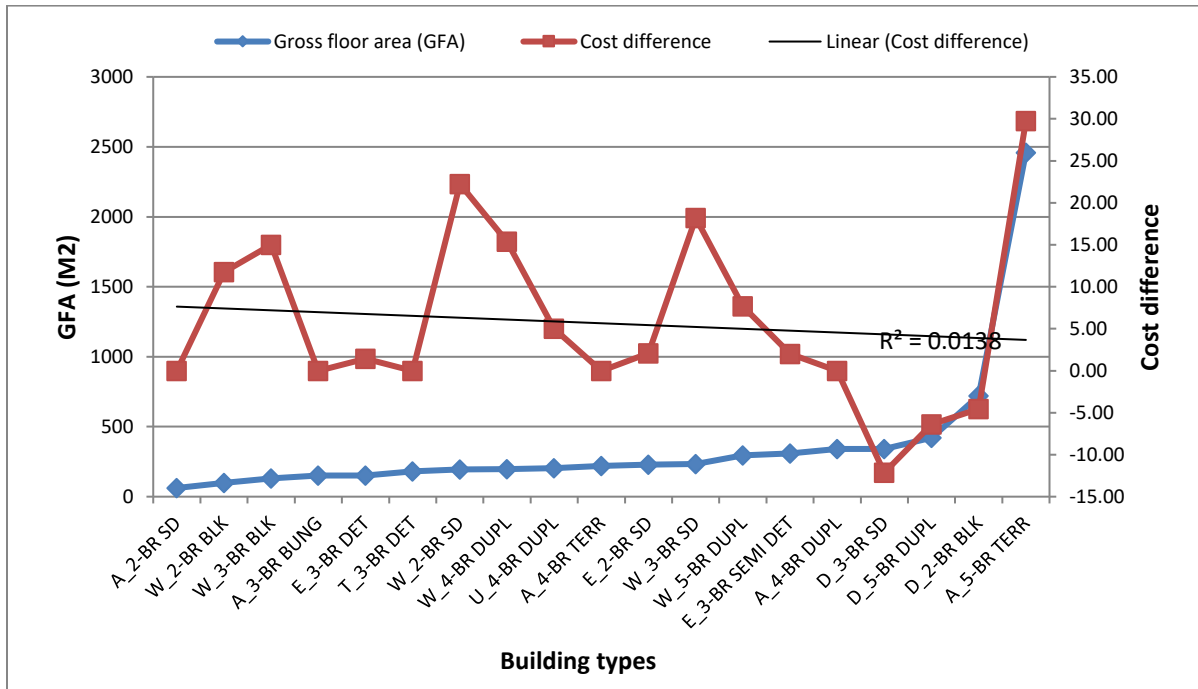


Fig. 1: Difference between initial and final costs

The time performance of projects, which was presented in Fig. 2, showed that projects were generally completed between 0% and 100% of their initially planned periods. The upward sloping trend line indicated that larger projects tended to be completed at longer periods than initially planned. These results reveal that time performance of residential housing estate projects should be an area of concern for project managers. In fact writers such as Meng (2012) argue that schedule is the key factor affecting project performance. The success of efforts to improve project schedule performance can also be expected to have positive impact on project cost performance, since Ahadzie *et al.* (2014) has identified a close relationship between project cost and time.

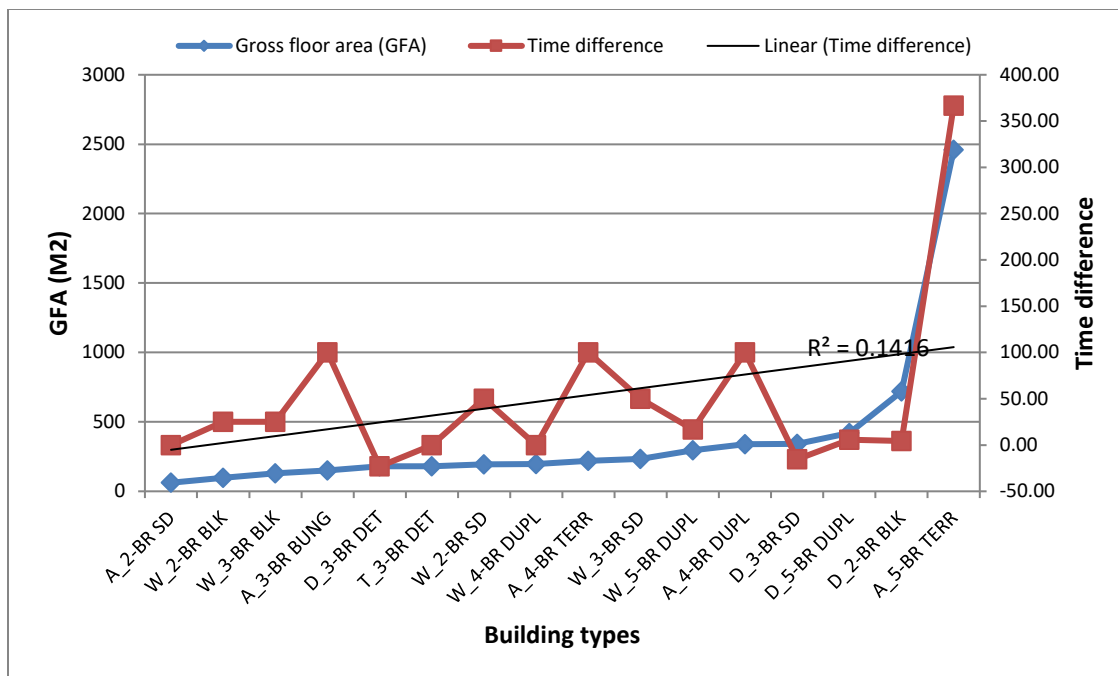


Fig. 2: Difference between initial and final time schedules

CONCLUSION

The paper revealed that Project Managers are rated high in ten competencies and moderate in six competencies that include Budgeting, Risk management, and Emotional intelligence. All three of the traditional ‘iron triangle’ of project performance indices (cost; quality; time) were highly influenced by technical competencies such as Budgeting and Procurement management. It was inferred from the data that larger projects had better cost performance, but poorer schedule performance. Residential estate projects were generally completed at up to 30% higher than initial costs, and up to 100% of initially scheduled completion periods. Further action is needed to improve the competency of project managers; however, the study does not provide support for the use of other dimensions such as dispute resolution, health and safety, risk management and stakeholder satisfaction to measure project managers’ performance

Based on the findings, it was recommended that Project Managers participate in Continuing Professional Development (CPD) in order to hone their competencies in areas such as Budgeting, Risk management, and Emotional intelligence where some weakness has been identified in this study. Project Managers should pay greater attention to managing project schedules, because significant unplanned extensions in completion times are bound to have some negative effect on the cost and quality performance of projects. This is an area where improvements in ability to

apply soft competencies such as those in the Political category (Social astuteness, Interpersonal influence, Networking ability, and Apparent sincerity) will be useful.

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ASSESSMENT OF FINANCIAL RISK FACTORS IN ADOPTION OF BUILDING INFORMATION MODELLING FOR CONSTRUCTION PROJECTS IN ABUJA

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ABSTRACT

Building Information Modelling (BIM) is a reliable information data base in form of a 3D digital prototype graphics that represents in details the total life cycle of a facility. Literature revealed that the process of implementing new technology involves numerous challenges, and the performance of new technology can be weakened by unidentified risk factors during implementation. This study assessed the financial risks in adoption of BIM for construction projects in Abuja. Literature reviewed revealed 8 benefits and 8 financial risk factors of BIM respectively. This forms the basis for adopting a structured questionnaire that was administered using simple random sampling to a sample frame of 81 professionals at building design firms in Abuja. The three most important benefits of BIM were identified as ‘Visualization’, ‘Estimating is improved through the ability to model project options before and during Construction’ and ‘The quality level of the finished projects is improved as the quality of data in BIM models is maintained by its users. It is therefore recommended that identified risks some of which include high cost of software and high cost of hardware upgrade should be fully understood by consultants, contractors and all BIM practitioners in the construction industry. It is also recommended that a systematic analysis of financial status and capability to identify the changes needed to facilitate BIM implementation in the construction industry should be undertaken.

Keywords: Adoption, Benefit, Building Information Modelling, Construction Industry, Financial risk.

INTRODUCTION

Building Information Modelling (BIM) is one of the most promising developments in Architecture, Engineering, and Construction (AEC). With BIM technology, one or more accurate virtual models of a building are constructed digitally. It supports design through its phases, allowing better analysis and control than manual processes. Building Information Modelling (BIM) is also a powerful set of design management’s tool that has been highlighted by the AEC. BIM has significant advantages over the entire building lifecycle, particularly design but also construction and facility management. BIM is emerging as a new powerful technology. Firstly, it has all the functions of 3D CAD. Whereas 3D CAD modelling was merely collections of points, lines, 2D shapes and 3D volumes, in the BIM concept, such geometric entities can also have symbolic or abstract “meaning”, as well as quantitative or qualitative data (Yan and Damian, 2008).

Enhanced usage of electronic design and construction processes holds promises for saving time and money, reducing claims and increasing the quality of performance, especially on complex projects. one must consider and recognize however the individual risks associated with this new process (Stanley, 2014).

Cost and Finance play a very vital role in any construction project, therefore, proper understanding of the financial risks’ factors affecting BIM adoption is necessary to ensure that

BIM is efficiently adopted. This research is aimed at assessing the financial risks in adoption of BIM for construction projects in Abuja by identifying and examining the risk factors as this was not done by previous researchers.

REVIEW OF LITERATURE

Building Information Modelling (BIM)

Abubakar *et al.* (2014) stated that Building Information Modelling (BIM) is one of such innovative processes that promise to bring about the continuous improvement and desired change in the construction industry and revolutionise the processes of its operation to achieve better collaboration between project parties and ensure successful project delivery. BIM stimulates the construction activities in a virtual environment. With BIM technology, an accurate virtual model of a building known as Building Information Model is digitally constructed and used to support the design, procurement, fabrication and physical site construction activities required to realize the structure are all developed. The model is also used for the maintenance and facility management of the building after completion.

BIM extends its use to incorporate a 4th dimension (4D) - time and a 5th dimension (5D) - cost, which specifically concerns the quantification, modification and extraction of data contained within the model in order to become the primary source of information for Quantity Surveying (QS) services (Stanley, 2014).

BIM has been defined as the digital representation of the physical and functional characteristics of a facility, which serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward (Building Smart, 2010). According to (Thuraijah and Goucher 2013) Building Information Modelling (BIM) represents the formation of digital models for use during the planning, design, construction and operation stages of a facility 's life.

BIM Application

BIM entails a seven-dimensional process. The 3D modelling process extends to scheduling and sequencing (4D), cost estimating (5D), sustainable design also termed Green Design (6D) and facility management (7D)” (Hassan and Yolles, 2009). Fansworth *et al.* (2014) identified thirty-two different applications of BIM use for commercial construction, and those most commonly used included clash detection, 3-D modelling, team collaboration, constructability issues of design, and sales. Communication, scheduling, coordination, visualization, and clash detection were identified as the top advantages of using BIM. Regarding the effects of using BIM, companies reported a positive impact on profitability, time of construction, and marketing.

Benefits of BIM

The productivity and economic benefits of Building Information Modelling (BIM) to the global building industry are widely acknowledged and increasingly well understood. Further, the technology to implement BIM is readily available and rapidly maturing (Pittman *et al.*, 2007).

The benefits of BIM are obvious in its ability to capture, organize, integrate, maintain and grow the wide amount of knowledge, data and information required to conceive, plan, design, construct, operate, maintain, adapt, renovate and, finally, beneficially deconstruct a building at the end of its life cycle.

Eastman *et al.* (2012) found that the team experience level was very important in maximizing benefits from BIM, and with little experience, it is possible to see negative results from its implementation.

Generally, the major benefits of BIM can be highlighted as: ‘Visualization’, ‘Collaboration’, ‘The quality level of the finished projects is improved as the quality of data in BIM models is maintained by its users’, ‘Project conceptualization is made easier’, ‘5D offers more efficient take-offs during the Budget Estimate Stage’, ‘Earlier risk identification e.g. potential clash detection is improved, at an earlier stage than with traditional approaches’, ‘Improve Energy Efficiency and Sustainability’, ‘Estimating is improved through the ability to model project options before and during Construction’.

Risks of Adopting BIM

BIM brings with it many advantages for the digital design of buildings. Yet with BIM comes issues and risks that a design professional must consider. Enhanced usage of electronic design and construction processes holds promises for saving time and money, reducing claims and increasing the quality of performance, especially on complex projects. One must consider and recognize however the individual risks associated with this new process (Stanley, 2014).

Bello (2016) assessed risk factors impacting on adoption of BIM at organizational level and identified 30 risk factors in relation to technical, financial, management and legal aspects of BIM. Previous research identified a list of financial and cost issues which form the financial risks of adopting Building Information Modelling.

The risk factors affecting BIM can be grouped into Technical risks, Management risks, Environmental Risks, Financial Risks, and Legal Risks.

Financial risks affecting BIM adoption

Table 1 shows a summary of the financial risk factors affecting BIM adoption as identified in the literature review.

Table 1: Summary of financial risks.

S/N	Factors	Sources
1	High Cost of Integrated software/Models	Abubakar, 2014
2	High cost in terms of time and training	Chengshuang <i>et al.</i> , (2015)
3	High cost of implementation process	Thomson & Miner, (2010); Azhar, (2011); Ganah & John, (2014)
4	Cost of required software upgrade	Giel & Issa, 2011:2013; Rezgui <i>et al.</i> , (2013); Eadie <i>et al.</i> , (2013); Porwal & Hewage, (2013)
5	Cost of hardware upgrade	Abubakar <i>et al.</i> , (2014)
6	Increase in short term cost	Kuo-Feng <i>et al.</i> , (2014)
7	Transition and behavioural costs	Kuo-Feng <i>et al.</i> , (2014)
8	Additional Expenditure	Kuo-Feng <i>et al.</i> , (2014)
9	No proof of financial benefits	Khosrawshashi <i>et al.</i> , (2012)

RESEARCH METHODS

The target population of this research is the Nigerian Building Design firms. Since not all the design firms could be studied, a sample of the population was focused on. The study identified Architectural, Engineering, Building and Quantity Surveying consultancy firms as those responsible for design of buildings in Nigeria. Considering a sample frame of 420 design firms in Abuja. Using Yamane's formula, a sample size of 81 design firms was determined and used in the study.

The primary data was obtained through survey, using a structured questionnaire designed into three major sections (Sections A and B and C). Section A was used to obtain information regarding the profiles of the respondents and their companies. Section B concentrated on the benefits of adopting BIM on a 5-point Likert scale where; 5 = very important, 4 = Important, 3 = Moderately Important, 2 = Slightly Important, 1 = Not Important at all. Section C of the questionnaire, on the financial risk factors based on a 5-point Likert scale, where 1 indicates "very rare", 2 indicate "rare", 3 indicates "occasionally", 4 indicates "frequently" and 5 indicates "very frequently". The respondents were also requested to rate the effect of financial risks on the adoption of BIM based on a 5-point Likert scale, where 1 indicates "lowest effect", 2 indicate "low effect", 3 indicate "moderate effect", 4 indicate "high effect" and 5 indicate "highest effect"

Data Analysis

Statistical analyses were undertaken using the Statistical Package for Social Sciences (SPSS), Version 21 for Windows. The ranking of financial risk factors was based on arithmetic mean value scores.

RESULTS AND DISCUSSIONS

Characteristics of Surveyed Respondents and their Firms

Out of the 81 questionnaires administered, 62 were returned which amounted to a response rate of 77%. 65% of the respondents were male while 35% were female. 90% of the respondents had their tertiary education while 5% had their basic education and 5% had their secondary education. 37% of the respondents were Architects, 11% were Engineers and 52% were Quantity Surveyors. 21% of the respondents worked for small firms, 65% worked for medium sized firms and 14% worked for large firms.

Benefits of Adopting BIM

The results obtained from the research as shown in Table 2 shows that the most important benefits of BIM are Visualization, Estimating is improved through the ability to model project options before and during construction, quality level of the finished projects is improved, Project conceptualization is made easier. This is consistent with the study carried out by (Umezinwa, 2017). The least important benefits are 5D offers more efficient take-offs during the Budget Estimate Stage and also Earlier risk identification.

Table 2: Benefits of Adopting BIM

S/N	Benefits of Adopting BIM	MIS	Rank
1	Visualization	3.93	1
2	Estimating is improved through the ability to model project options before and during Construction.	3.70	2
3	The quality level of the finished projects is improved as the quality of data in BIM models is maintained by its users.	3.67	3
4	Project conceptualization is made easier	3.56	4
5	Improve Energy Efficiency and Sustainability	3.51	5
6	Collaboration	3.47	6
7	5D offers more efficient take-offs during the Budget Estimate Stage	3.35	7
8	Earlier risk identification e.g. potential clash detection is improved, at an earlier stage than with traditional approaches	3.05	8

Source: Researcher's Analysis, 2018

Financial Risk Factors in Adoption of BIM in Construction Project

Table 3 shows that the most important risks are High cost of Integrated Software, Cost of required software upgrade, Cost of hardware upgrade, High cost in terms of time and training and High cost of implementation process. This is in Line with the research carried out by (Bryde *et al.*, 2013) where he stated that most of the challenges of adopting BIM are focused on software or hardware issues. The three least occurring financial risks are additional expenditure, transitional and behavioural cost, no proof of financial benefits having means 3.35, 3.07 and 2.67 respectively.

Table 3: Frequency of BIM Financial risks.

S/N	Financial Risk Factors	MIS	Rank
1	High Cost of Integrated software/ models	3.86	1
2	Cost of required software upgrade	3.84	2
3	Cost of hardware upgrade	3.81	3
4	High cost in terms of time and training	3.58	4
5	High cost of implementation process	3.53	5
6	Increase in short term cost	3.47	6
7	Additional Expenditure	3.35	7
8	Transition and behavioural costs	3.07	8
9	No proof of financial benefits	2.67	9

Source: Researcher's Analysis, 2018

CONCLUSIONS AND RECOMMENDATIONS

This research highlighted the various financial risks that affect the adoption of Building Information Modelling. The study identified that the most important benefits of BIM are Visualization, Estimating is improved through the ability to model project options before and during construction, quality level of the finished projects is improved, Project conceptualization is made easier. The study also concluded through ranking that the most important financial risks are High cost of Integrated Software, Cost of required software upgrade, Cost of hardware upgrade, High cost in terms of time and training and High cost of implementation process.

This study identified a number of Financial risks which is consistent with previous research. In order to facilitate proper adoption of Building Information Modelling: Identified risks should be fully understood by consultants, contractors and all BIM practitioners in the construction industry. Also, a systematic analysis of financial status and capability to identify the changes needed to facilitate BIM implementation in the construction industry should be undertaken.

RECOMMENDATION FOR FURTHER STUDIES

The scope of this study covered the identification of financial risks, the frequency of occurrence and effect of these financial risks. Once risk factors are identified and their effects are assessed, the next step is to develop risk response strategy.

Due to time constraint, this research was not able to do that. Thus, it is recommended that other research in this area should develop such risk response strategies.

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EVALUATION OF CAUSATIVE FACTORS OF CONSTRUCTION DELAY IN HIGH-RISE BUILDING PROJECTS: A CASE OF LAGOS STATE

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ABSTRACT

The construction of high-rise building projects in Nigeria suffered delay problems on program schedule and has resulted in giving bad impression to foreign investors about the capability and performance of construction industry in Nigeria. This poor performance deprived foreign investors in contributing to the development of property market through direct foreign investment (DFI). Therefore, this paper considered the implications of causative factors peculiar to construction of high-rise building projects using a case study approach. Three cases of high-rise building projects were purposely selected in Lagos Island. The paper adopted mixed method with the aid of questionnaire and interview. Questions were formulated on the rubric of thirty-eight (38) factors of construction delays identified from literature. The data collected were analysed using Relative Important Index (RII), Kruskal-Wallis test for the questionnaire and Content Analysis for the interview. Major findings indicated that funding is the main factor that give rise to unanticipated delay events in high-rise projects. Kruskal Wallis results showed that there was no difference in the opinion of the professionals based on these factors on high-rise building projects. The paper concluded delay in progress payments by clients, late procurement of materials, high rate of inflation, delay in material delivery and escalation of material prices as the top (5) most important causative factors of construction delays affecting delivery of high-rise building projects in Nigeria. And identified sixteen (16) causative factors of delay classified into four (4) major groups across the cases as the most predominant causative group of delay factors affecting high-rise building projects in Nigeria. The study recommends that clients should ensure that they have well established consistent cash flow before starting a high-rise project to prevent subsequent delays. Also, contractors should ensure early procurance of materials to prevent disruption of planned activities.

Keywords: Building project, causative factors, construction delay, high-rise building, Nigeria.

INTRODUCTION

Construction projects in Nigeria suffer setbacks in completion within specified period and budgets (Olaniran, 2015). Reports evidenced that majority of Nigerian construction projects in recent time are still experiencing high rate of time (between 59.23% and 92.64% for building projects) and cost overrun (Hosseini *et al.* 2013; Olawale and Sun, 2015). This is similar to the reports of Idoro (2012) and Ameh and Ogundare (2013) that the rate at which construction projects in Nigeria fail to meet basic performance expectations has become more critical in recent years with no serious concern raised. Ameh and Ogundare (2013) reported that between 50% and 70% of Nigerian construction projects encountered delays due to lapses in reliability and ineffective response to delay factors.

Adekunle and Ajibola (2015) defined delay as the slowing down of work without stopping construction entirely which often result in cost and time overrun beyond the contract agreement. It is an unplanned disruption of schedule with cost, time and quality consequences on all

stakeholders. These delays happen in every construction and varies substantially from one project to another (Adekunle and Ajibola, 2015). However, delay magnitude is often critical in complex constructions, especially high-rise building projects. Moryadee *et al.* (2019) stated that the critical problems of high-rise building projects often is failure to completion on schedule and budget. Similarly, Hamid, Botiti and Mohandes (2015) noted that the more complex the project, the more substantial delays in completion.

According to Al-Kodmany (2018) high-rise buildings are structures having more than 14 stories with height above 50 meters (164 ft+) as defined by the Council on Tall Buildings and Urban Habitat (CTBUH). The development of high-rise buildings trends in modern cities all over the world majorly to overcome the challenges of urban over population, optimization of scarce land, as status symbol, as tourist attractions and for beautiful skylines (Ede, 2014). Regardless of these advantages, high-rise development in Nigeria has been experiencing drawbacks due to delay factors. Study by Hamid *et al.* (2015) revealed that high-rise building projects have low chance of completion on or before the proposed due date. Due to the complex nature of high-rise building constructions, a delay factor initiated at an early stage, could lead to delays and problems in that stage as well as subsequent stages. The consequent problems will not only result in cost overruns but also affect subsequent activities (Moungnos and Charoenngam, 2003). High-rise buildings are the future of urban development that foster a nation's growth and if this delay phenomenon is this much pivotal, it is very important to evaluate these factors of delays peculiar to high-rise buildings in Nigeria. Therefore, this study empirically evaluates the causative factors of delays on project delivery of high-rise buildings in Lagos state, Nigeria.

LITERATURE REVIEW

High-Rise Building Development

The high-rise building or skyscraper is a tall building or structure that is used as a residential, office tower, hotel and as a symbol of recognition for example The Empire State Building in New York, World Trade Centre Twin Towers in New York and The Burj Khalifa in Dubai among others (Ede, 2014). In globalization and modern business era, the high-rise building is one of the most significant elements to achieve in terms of economy and urbanization in many developed countries. The skyscrapers were built in large countries and have been raised continuously in order to stimulate commercialism (Farouk, 2011; Al-Kodmany *et al.*, 2013). There are many reasons why tall buildings are given an emphasis in modern urbanization. According to Beedle *et al.* (2007) the two main reasons are apparently to accommodate influx of people immigrating to urban areas for work and to save commuting time which can help increase productivity and reduce fuel consumption and provide more public facilities to raise the quality of life.

High-Rise Building Developments in Nigeria

Nigeria is the most heavily populated and one of the most economically developed nations on the African continent. Nigeria ranks as the 10th country with the largest population in the world growing at an average of 3 percent annually with a rapid pace and little changed over the years. This population growth has influenced urbanization with an increase in housing demand which prompted modern developments (Olanrele *et al.*, 2014). Ede (2014) opined that demands for dwelling units in densely populated areas impelled developments of high-rise buildings in

Nigeria. However, existence of high-rise buildings In Nigeria are not uncommon phenomenon, the development has emerged since the late 20th century. Such buildings include Independence House, Lagos which is the first high-rise building constructed in Nigeria having 23 floors at 103 m (338 ft). The Cocoa house formerly called "Ile Awon Agbe" (House of Farmers) is a 26-floor building at 105 m (344 ft) located in Ibadan. The Nigerian External Communications (NECOM) building formerly refers to as NITEL TOWER with 32 floors at 160m (520ft) and remains the tallest building in Nigeria and West Africa till date among others (Adebisi *et al.*, 2018). Ede (2014) noted that concentration of high-rise buildings and ongoing mega projects is significantly localized around Lagos and Abuja. Beyond these two mega centres, development is marginal. Their dominance can largely be attributed to the fact that most of the major financial and governmental activities are conducted in these two cities. This poor developmental plan has put so much pressure on the provision of buildings, infrastructure and urbanization of these two cosmopolitans. Hence, the need for high-rise development in Nigeria to foster growth and developments.

Causative Factors of Delay

Delay is caused by many factors in construction project, which are based on experiences, perceptions and project complexities in both developed and developing countries. The causes of delay can be influenced by many factors from different countries. In order to identify the major causes of delay, the delay is categorized into different groups according to factors causing the delay in which numerous researchers have studied. For instance, Marzouk and El-Rasas (2014) classified the delay causes in Egypt by categorizing seven causative groups as: owner related, consultant related, contractor related, material related, labour & equipment related, project related and external factor related. Similarly, Assaf and Al-Hejji (2006) investigated causes of delay in Saudi Arabia and listed seventy-three causes of delay categorized into nine causative groups as: owner, contractor, consultant, design, project, materials, equipment, labour and external factors. Also, Doloi *et al.* (2012) studied the factors affecting delay in Indian construction project by separating attributes affecting delay into six causative groups which were project related, site related, process related, human related, authority related, and technical issues.

RESEARCH METHODOLOGY

This research adopted a mixed-method approach using the quantitative approach for structured questionnaires, while the qualitative approach for interviews to answer the research questions based on the causative factors of construction delay in high-rise building projects in Lagos State, Nigeria. The paper purposively targeted some cases of high-rise building projects which have been susceptible to construction delays due to the complexity and magnitude of the works involved. Pilot survey was conducted on identified buildings having more than 14 stories with a height of 50 meters above ground level, affected by delays and completed within the last 5 years. Three high-rise building projects in Lagos State met the identified criteria, hence they were purposively selected for the study. Comparative cross-sectional analysis of projects was done using multiple-case study approach to explore similarities and differences between cases involved.

The targeted participants in the survey are the construction professionals (Architects, Mechanical and Electrical Engineers, Civil Engineers, Quantity surveyors and Builders) involved with the selected project. These entails 15 respondents in all. The questionnaire survey on the rubric of

delay causes in high-rise buildings while the interview survey explores the experiential knowledge of those construction professionals to determine the major causes of delays on the purposively selected case of high-rise building projects in the study area. Using a case study approach, fourteen (14) questionnaires were returned. The quantitative data was analyzed using Relative Importance Index and Kruskal-Wallis test to know the differences in the views of the professionals on the causative factors of construction delay on the projects under study. The interview was analysed with content analysis.

DATA PRESENTATION AND DISCUSSIONS

Thirty-eight (38) causative factors of construction delays were identified from literature review which was assessed. The factors were grouped into seven (7) different categories which are clients related factors, consultants related factors, contractor related factors, material factors, equipment factors, labour factors and external factors. Result from Table 2 below reveals that delay in progress payments by clients with a relative importance index (RII = 0.97) and standard deviation (± 0.581) was ranked first and rated “Very High” under clients related factors. Delay in approving major changes in the scope of work with (RII = 0.81, $\pm 0.708SD$) was ranked first and rated “VH” under consultants related factors. Delays in site mobilization with (RII = 0.89, $\pm 0.670SD$) was ranked first and rated “VH” under contractor related factors. Late procurement of materials with (RII = 0.81, $\pm 0.708SD$) was ranked first and rated “VH” by 11 (78.6 percent) under material factors. Equipment breakdowns with (RII = 0.81, $\pm 0.708SD$) was ranked first and rated “VH” under equipment factors. Shortage of labour with (RII = 0.81, $\pm 0.708SD$) was ranked first and rated “VH” under labour factors. High rate of inflation with (RII = 0.81, $\pm 0.708SD$) was ranked first and rated “very high” by 10 (71.4 percent) under external factors. While, the least causative factors of high-rise building delays under each causative categories are; late in revising and approving design documents, inadequate experience of consultant, delays in sub-contractor’s work, material theft, low productivity and efficiency of the equipment, unskilled labour and changes in government regulations and laws with (RII = 0.79, $\pm 0.727SD$), (RII = 0.66, $\pm 0.604SD$), (RII = 0.50, $\pm 0.344SD$), (RII = 0.73, $\pm 0.985SD$), (RII = 0.83, $\pm 0.630SD$), (RII = 0.74, $\pm 0.832SD$ and (RII = 0.81, $\pm 0.317SD$) respectively.

However, the overall result from Table 1, indicated delay in progress payments by clients, late procurement of materials, high rate of inflation, delay in material delivery and escalation of material prices as the most important causative factors of construction delays affecting delivery of high-rise building projects.

Table 1: Causative factors of construction delays peculiar to high-rise buildings

Causative Factors	RII	Std.Dev	Ranking by categories	Level of Importance	Overall Rank
Clients’ Related Factors					
Delay in progress payments by clients.	0.97	0.581	1	VH	1
Change order by clients during construction.	0.91	0.652	2	VH	7
Conflicts between joint-ownership of the project poor.	0.83	0.883	3	VH	20
Slowness in decision making.	0.81	0.740	4	VH	24
Poor communication with client.	0.79	0.705	5	H	28

Late in revising and approving design documents.	0.79	0.727	6	H	29
Consultants' Related Factors					
Delay in approving major changes in the scope of work.	0.81	0.708	1	VH	23
Poor communication and coordination with team members.	0.80	0.765	2	VH	26
Delays in producing design documents.	0.77	0.643	3	H	30
Mistakes and discrepancies in design documents.	0.71	0.744	4	H	36
Inadequate experience of consultant.	0.66	0.604	5	M	37
Contractors' Related Factors					
Delays in site mobilization.	0.89	0.670	1	VH	13
Ineffective planning and scheduling of project.	0.89	0.681	2	H	14
Difficulties in financing project by the contractor.	0.89	0.686	3	VH	15
Poor communication and coordination with project team.	0.83	0.884	4	VH	21
Rework due to errors during construction.	0.74	0.989	5	VH	32
Improper construction method.	0.74	1.022	6	H	33
Conflicts between contractor and other parties.	0.73	0.870	7	H	34
Delays in sub-contractor's work.	0.50	0.344	8	M	38
Materials Factors					
Late procurement of materials.	0.96	0.386	1	VH	2
Delay in material delivery.	0.94	0.510	2	VH	4
Changes in material types and specifications during construction.	0.80	0.860	3	VH	27
Poor Quality material.	0.80	0.656	4	VH	25
Material theft.	0.73	0.985	5	H	35
Equipment's Factors					
Equipment's breakdown.	0.89	0.593	1	VH	11
Shortage of equipment.	0.84	0.743	2	VH	16
Low productivity and efficiency of the equipment.	0.83	0.630	3	VH	18
Labour Factors					
Shortage of Labours.	0.83	0.879	1	VH	19
Unskilled Labour.	0.74	0.832	2	H	31
External Factors					
High rate of inflation.	0.94	0.432	1	VH	3
Escalation of material prices.	0.94	0.512	2	VH	5
Weather effects on construction activities.	0.91	0.570	3	VH	6
Restriction at job site.	0.90	0.501	4	VH	8
Effects of subsurface conditions (e.g. soil, high water table, etc.).	0.90	0.745	5	VH	9
Strike Actions.	0.90	0.802	6	VH	10

Accident during construction.	0.89	0.593	7	VH	12
Delay in obtaining permits from the government.	0.84	0.801	8	VH	17
Changes in government regulations and laws.	0.81	0.317	9	VH	22

RII – Relative Importance Index; VH – Very high, H – High; M- Moderate; L – Low; VH – Very low.

Kruskal-Wallis test was carried out to know the differences in the views of the professionals on the causative factors of construction delays in high-rise projects. The result of the test revealed that twenty-nine (29) out of the thirty-eight (38) factors considered as causative factors of construction delays in high-rise projects were not significant. This implies that the professionals had the same mind towards the causative factors. The perception of the professionals were not different from each other as a result of the $P\text{-value} > 0.05$. The variables also showed that the null hypothesis which stated that there was no significant difference in the perception of professions was not rejected at 5% level of significance (approximately 95% confidence interval). This means that there was no difference in the opinion of the professionals based on these factors on high-rise building projects.

However, the remaining nine (9) causative factors were significant with $p\text{-value}$ less than 0.05. This shows that there is significant difference in the opinions of the professionals. The null hypothesis was rejected at 5% level of significance. This proved that there were differences in the opinions of the professionals on the causative factors of construction delays in high-rise building projects.

Table 2: Perception of professionals on the causative factors of construction delays

	Mean Rank				Kruskall Wallis		
Causative Factors	Arc.	Qs.	Eng.	Bldr.	Chi-Square	P-value	Remarks
Clients' Related Factors							
Delay in progress payments by clients.	8.67	9.25	5.40	7.50	2.429	0.488	Not Significant
Change order by clients during construction.	8.50	6.50	6.90	9.50	1.213	0.750	Not Significant
Late in approving and revising design documents.	6.67	7.25	9.00	5.50	2.910	0.041**	Significant
Poor communication with client.	9.00	9.00	6.10	5.75	3.519	0.318	Not Significant
Conflicts between joint-ownership of the project.	6.17	6.00	9.40	7.75	0.792	0.851	Not Significant
Slowness in decision making.	8.00	6.25	8.40	7.00	2.303	0.512	Not Significant
Consultants' Related Factors							
Delay in approving major changes in the scope of work.	10.67	6.88	6.30	7.00	1.627	0.653	Not Significant
Poor communication and coordination with team members.	9.67	6.63	6.80	7.75	1.332	0.722	Not Significant
Inadequate experience of consultant.	9.17	6.25	6.10	11.00	3.276	0.047**	Not Significant
Mistakes and discrepancies in design documents.	6.50	8.13	8.80	7.50	7.347	0.032**	Significant

Delays in producing design documents.	8.17	5.50	8.30	8.50	2.637	0.037**	Significant
Contractors' Related Factors							
Difficulties in financing project by the contractor.	8.00	5.75	8.80	7.00	1.729	0.630	Not Significant
Rework due to errors during construction.	11.17	4.75	6.40	10.25	1.121	0.772	Not Significant
Conflicts between contractor and other parties.	5.83	7.25	8.70	7.50	2.572	0.027**	Significant
Poor communication and coordination with project team.	9.17	6.88	7.40	6.50	0.807	0.848	Not Significant
Ineffective planning and scheduling of project.	5.50	6.75	9.30	7.50	2.199	0.532	Not Significant
Improper construction method.	9.83	4.13	7.70	10.25	3.271	0.025**	Significant
Delays in sub-contractor's work.	8.50	6.75	6.30	10.50	2.199	0.013**	Significant
Delays in site mobilization.	8.00	5.25	9.60	6.00	4.780	0.189	Not Significant
Materials Factors							
Delay in material delivery.	6.17	8.75	8.20	5.50	3.889	0.274	Not Significant
Changes in material types and specifications during construction.	9.50	4.13	8.20	9.50	0.506	0.918	Not Significant
Material theft.	7.83	8.38	6.90	6.75	4.831	0.019**	Significant
Late procurement of materials.	5.50	7.75	9.70	4.50	1.584	0.663	Not Significant
Poor quality material.	10.33	3.50	8.20	9.50	5.343	0.001**	Significant
Equipment's Factors							
Equipment breakdowns.	5.50	3.50	8.20	9.50	2.459	0.483	Not Significant
Shortage of equipment.	7.17	7.75	8.10	6.00	0.639	0.887	Not Significant
Low productivity and efficiency of the equipment.	7.50	7.38	8.40	5.50	0.818	0.845	Not Significant
Labour Factors							
Shortage of Labours.	8.17	3.88	9.70	8.25	4.892	0.180	Not Significant
Unskilled Labour.	7.57	4.10	9.40	9.50	5.074	0.166	Not Significant
External Factors							
Effects of subsurface conditions (e.g. soil, high water table, etc.).	8.33	8.20	5.08	7.12	1.571	0.666	Not Significant
Delay in obtaining permits from the government.	8.33	5.25	8.40	8.50	1.887	0.596	Not Significant
Weather effects on construction activities.	7.83	10.00	5.60	6.75	3.561	0.313	Not Significant
Restriction at job site.	9.00	7.38	6.10	9.00	2.346	0.504	Not Significant

Accident during construction.	9.00	8.00	5.70	8.75	1.814	0.612	Not Significant
Changes in government regulations and laws.	8.83	6.13	7.70	7.75	0.944	0.815	Not Significant
High rate of inflation.	6.17	8.50	7.10	8.50	1.873	0.598	Not Significant
Strike Actions	6.75	7.38	5.50	6.70	3.450	0.345	Not Significant
Escalation of material prices	7.45	8.84	5.10	7.03	1.671	0.625	Not Significant

Where ****p** value is < 0.05.

Note: Arc- Architects, Qs- Quantity Surveyors, Eng- Engineers, Bldr- Builders.

Table 3: Interview Results with professionals on the selected high-rise building cases

Question	Professional Interviewees		
	CASE I	CASE II	CASE III
Main causes of delays on the project?	Funding, Weather (rain), Soil stability issues, Strike, Inflation, Price fluctuation, Exchange rates, Scope changes, Restrictions, Approval challenges, Material delay, Logistics, Equipment breakdown, Suspension, Accident and Late ordering of long grid items.	Funding, Logistics, Approval delay, change in scope, Strike, Weather (rain), Inflation, Material delay, Ground water level, Fluctuation, Exchange rates, Suspension, Fall from heights, Late ordering of long grid items, Equipment failure and Restrictions.	Funding, Restrictions, Change orders, Material delay, Soil issues, Logistics, Work restrictions, Strike, Late ordering of long grid items, Approval delays, Weather (rain), Accident, Suspension, Exchange rates, Equipment breakdown, Inflation, Fluctuation.

The results from the interview, as shown in Table 3, revealed the main causes of construction delay on three (3) selected cases of high-rise buildings (Eden Heights, Nestoil Tower and Kings Tower) in Lagos state which delay has had adverse effects. The findings from the interviewees indicated that there are common factors causing delays among the three (3) cases. However, funding was established as the main factor that give rise to delay events in high-rise projects. This finding was in tandem with Artidi and Chotibongs (2005) who stated that all the problems in the construction industry begin when payment in the exact amount due by the date shown on the statement is not received.

Table 4: Comparison of delay factors based on Literature and Case study

Factors from Literature		Factors Across Cases (Case I – III)
Group	Factors	Causative Factors
Client factors	Financial Issues	Inadequate funding.
External factors	Restrictions	Inflation, Price fluctuation, Exchange rates.
	Approval	Work restriction.
	Accidents	Approval delay.
	Force majeure	Fire outbreak/Fall from heights
Client factors	Scope	Change in weather (rain), Soil stability issues, Labour strike.
	Suspension	Scope changes.
Equipment factor	Equipment	Temporal suspension.
Material factors	Materials	Equipment breakdown.
		Material delays, Late ordering of long grid items, Logistics.

The interview findings across the cases from Table 4, revealed a total of sixteen (16) factors as the critical delay factors affecting delivery of high-rise building projects in Nigeria. These factors were classified into four (4) major groups which are client related factors, external factors, equipment factor and material factors. This finding is in tandem with the study of Marzouk and El-Rasas (2014) on classification of delay causes in Egypt.

DISCUSSION OF FINDINGS

The findings revealed delay in progress payments by clients, late procurement of materials, high rate of inflation, delay in material delivery and escalation of material prices as the top five (5) most important causative factors of construction delays affecting delivery of high-rise building projects in Nigeria. Financial difficulties faced by clients during construction of high-rise building subject contractors to unexpected delays from untimely progress payments. This was in line with the findings of Sweis *et al.* (2008) that financial difficulties faced by many contractors is the significant cause of delay in construction projects. Also, Abdul-Rahmanet *et al.* (2011) stated that the greater the delay in payment to contractor, the greater the cash flow problems and the greater the extent of delays. Late procurement of materials will extend activity periods resulting in supply delays. Scheduled activities on the high-rise projects will be affected when construction materials are untimely ordered. This was in accordance to the observation of Fallahnejad (2013) that late delivery of construction materials as a result of late ordering is one of the main causes of delay in major industrial construction projects. Timely procurement of materials is essential to ensure meeting completion date. Inflation, Increase material prices, machinery and other inputs to construction projects extends the project period. This was in line with Alinaitwe *et al.* (2013) who noted that Inflation and increase in the prices of materials, machinery and other inputs to construction projects result in cost overrun.

CONCLUSIONS AND RECOMMENDATIONS

It was discovered that delay in progress payments by clients, late procurement of materials, high rate of inflation, delay in material delivery and escalation of material prices are the top (5) most important causative factors of construction delays affecting delivery of high-rise building projects in Nigeria. The case study interview identified a total of sixteen (16) causative factors of delay classified into four (4) major groups. Funding was established as the main factor that give rise to unanticipated delay events in high-rise projects in Nigeria. This means that there is converging opinion in the view of professionals on the causative factors of high-rise building delay. The study recommend that client should ensure they have well established cash flow before starting high-rise project to prevent subsequent delays. Also, Contractors should ensure early procurance of materials to prevent disruption of planned activities.

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ASSESSMENT OF LEVEL OF APPLICATION OF KNOWLEDGE MANAGEMENT SYSTEMS IN CONSTRUCTION FIRMS IN ABUJA, NIGERIA

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ABSTRACT

Knowledge Management is very vital in the growth of every organization which helps to increase useful knowledge within the organization. However, research has shown that knowledge management in organizations face numerous challenges which adversely affect its application. Hence, this research aimed at suggesting workable strategies which will lead to the successful application of knowledge management systems in construction firms. This was achieved through the identification of the various knowledge management systems, evaluating the level of application of knowledge management systems and examining the barriers hindering the successful application of knowledge management systems. Primary data were obtained from 24 active construction firms in Abuja, Nigeria through a well-structured questionnaire distributed to 150 randomly selected respondents with a response rate of 47%. Relative Importance Index (RII) and Mean Item Score (MIS) were employed for the analysis of data. The findings from this research reveals that professionals are aware of knowledge utilization with MIS of (3.71) but are undecided on the other five (5) knowledge management systems. It was also seen that professionals believed their firms have considerably applied knowledge sharing system (MIS=3.52) but are still lacking in the application of the other five (5) knowledge management system. Lack of effective policy for applying knowledge management (RII=0.94) was identified to be the major barrier hindering the successful application of knowledge management systems in construction firms. Notwithstanding these challenges, this study concludes that most professionals are aware of knowledge management systems but construction firms are yet to formally apply knowledge management into their organizational system. Hence, this study recommends various strategic measures that could be adopted to ensure the successful application of knowledge management systems they include appointing a knowledge manager for the regular upkeep of knowledge (RII=0.94) and creating awareness of the benefits attached to the application of knowledge management systems (RII=0.90).

Keywords: construction firms, knowledge application, knowledge management, knowledge sharing, knowledge utilization.

INTRODUCTION

Knowledge has developed into a vital innovative influence of production and an imperative means of modest benefit. For some time now in developed countries, lots of construction organizations have engaged mostly in knowledge management application in order to respond to the rising demands which can lead to the improvement of their professional practices (Idris *et al.*, 2015). In Nigeria, firms in the construction industry are known for their poor performance as regards to service delivery and capacity of meeting the demands of their clients (Kolo and Ibrahim, 2010). Also, arguments have risen among experts about the industry being weak when it comes to innovation (Odediran *et al.*, 2012). However, Tan *et al.* (2010), noted that some construction firms have taken it a priority in addressing these new challenges and have chosen

to advance and apply a more organized approach to manage their knowledge assets, likewise most construction firms have decided to assume the usual approach to manage their knowledge assets which is rather passive.

The study of McConalogue (2011) revealed that construction firms lack a good uptake record for presenting innovative ideas. This was affirmed by Kasimu *et al.* (2013a) that majority of the civil engineering construction firms in Nigeria have been ridiculed for low improvement and lack of innovation in the construction process as well as development in organizational efficiency and effectiveness. Therefore, this results to the reason why they need to take advantage of the benefits attached to knowledge management initiatives by practicing knowledge management in order to boost sharing of knowledge and professional skills among its employees.

Despite the amount of success of knowledge management application in various countries which includes, Malaysia, Asmi *et al.* (2009), India, Desai (2002), South Africa, Tobin (2006). Reviewed studies over the years has clearly shown that there are certainly not adequate research which had been focused on the concept of the application of knowledge management systems in Nigeria (Adeeko, 2012). Hence, this study intends to fill this gap by assessing the level of application of knowledge management systems with the view of suggesting workable strategies that will lead to the successful application of knowledge management systems in construction firms. In order to achieve this aim, the study identifies the various knowledge management systems; evaluate the level of application of knowledge management systems and examine the barriers hindering the successful application of knowledge management systems.

LITERATURE REVIEW

This section gives a review of relevant literature in order to create a background for achieving the objectives of the study.

Concept of Knowledge

Knowledge had been identified to be a vital resource for construction-oriented organizations. Baofeng and Song (2009) stressed that knowledge can be seen as the combination of knowledge and experience which an individual acquires in his place of work over a period of time, and it is a conceptual matter, which can be created, managed and utilized by individual's brain alone. Knowledge, according to Abubakar *et al.* (2019), is a combination of contextual information, expert's experience, value that results in innovation and framed experience.

Liyanage *et al.* (2009), claim that knowledge is situated in individual's mind and can only be interpreted into information by such individual. They went further to opine that knowledge could be seen from two main perspectives; which are tacit and explicit knowledge. Baloh *et al.* (2011) revealed that tacit knowledge is embedded in processes, values, procedures, action and commitments and can only be accessed indirectly. Tacit knowledge has to do with intuition and resides with the one who possess it and is said to be largely skill based (Odor, 2018). Omotayo (2015) however, states that explicit knowledge is systematic and formalized. It can be codified, collected, stored and easily transmitted from one individual to another.

Knowledge Management

Different perspective of knowledge management is created by the different perspectives of knowledge. If knowledge is referred to as an access to information, then knowledge management should be considered as knowledge storage and its management. If knowledge is regarded as a process, then knowledge management should pay attention to knowledge creation, sharing and utilization of such knowledge (Galena and Mylana, 2013). Kasimu *et al.* (2013b) further opined that knowledge management systems are traditional methods, facilities, technological as well as management tools, equipped for developing, sharing and interpreting concepts in addition to building organizations ' skills.

According to Mohammed and Egbu (2010), the implementation of knowledge management strategy can offer several benefits to organizations. Some of the which are; innovation, improved performance, improved construction project delivery, facilitate the transfer of knowledge management across a variety of project interface, increased intellectual capital, better placed to respond quickly to client's needs and other external factors, improved support for teams of knowledge workers, retain the tacit knowledge, increased value, construction organizations can be more responsive to organizational changes and risk minimization.

However, according to Guilló and García (2009), knowledge management is comprised of eight factors such as human factors, quality of information, knowledge culture, knowledge transfer, generation of knowledge, use and exploitation of knowledge, information and communication technologies and innovation. All these factors must work in together in order for organizations to efficiently manage knowledge.

Knowledge Management in Construction Firms

Knowledge management has been empirically designed to improve the quality, time, speed, efficiency and production costs of the construction industry. Therefore, according to Kasimu *et al.* (2013c), the benefits of knowledge management practice in the civil engineering construction companies include; reduction in construction rework problems, improvement in problem solving and decision making, enhancement of company competitive advantages, improvement in economic profitability, improvement in the ability to respond to market and client needs, improvement in problems solution and improvement in project delivery process in term of cost.

In construction firms, Lyles (2014) opined that *“Firms can create it knowledge internally through their research and development or through generating new ways of handing situations. Also, firms can acquire knowledge from external sources such as hiring new employees who have worked for competitors or from industrial networks which allow the firm to be in direct contact with advanced knowledge of other firms”*. Fadeke *et al.* (2015) confirms the various knowledge management activities undertaken within construction firms to include: knowledge acquisition, creation, storage, sharing, utilization and maintenance.

Knowledge Acquisition

According to Stanislaw (2011), knowledge acquisition is the process in which knowledge is being acquired outside the team undertaking a task. Such knowledge can be gotten from the organization's knowledge repository, be conveyed from those with the required knowledge or it

may be acquired depending on the requirements of the specific task to be carried out from an environment outside the organization.

Knowledge Creation

Knowledge creation according to Calabretta *et al.* (2017), is the process that involves integrating new ideas, conceptual structures and ways of thinking into organizations which needs adaptation into the specific practices and socio-cultural background of the target institution. Knowledge creation can therefore be accomplished through different forms of human social interactions, including contact, teamwork and cooperation for different purposes.

Knowledge Storage

Created and acquired knowledge needs to be properly stored and preserved for subsequent access and use and also for the sake of posterity. Therefore, knowledge storage according to Orzea (2010), allows projects to take advantage of earlier experiences in order to minimize the risk of repeating mistakes and to control existing materials to allow deliverables to be produced more efficiently, all at a relatively low cost to the project.

Knowledge Sharing

According to Gelena and Mylana (2013), knowledge sharing is a people-to-people process of exchanging knowledge. Hence, in the case of an organization, it is necessary to have employees who are interested and motivated to share the knowledge they possess. They further argue that knowledge sharing is the main element in an organizational context, such that without it a company cannot reach its goal or achieve it competitiveness.

Knowledge Utilization

Knowledge, once shared among people within an organization, it should be applied to solve problems as well as in decision making. Hence, Dhamdhare (2015) states that if the created, gathered, stored, and shared knowledge is not properly applied then the whole process would be in vain and for a knowledge to be properly applied, knowledge management processes should be properly communicated to it users. That is, knowledge should be put to affective and efficient utilization to fill a gap or need.

Knowledge Maintenance

Knowledge that had been successfully acquired, generated or created needs to be properly maintained for easy access and retrieval when required which is the essence of maintenance of knowledge. Therefore, Mohammad and Saeed (2011) refer to knowledge maintenance as the process of maintaining and utilization of knowledge in such a way that makes it accessible as at when needed. An institution or organization can keep it knowledge in the form of maps, procedures, methods or even keep it in specialized libraries.

Barriers to the Application of Knowledge Management

Several challenges hold back the application of knowledge management systems within organizations. Hackman *et al.* (2017), explained in his research that culture has been an ongoing

issue in the literature on knowledge management as it can activate or impede the knowledge management plan of a company. He added that culture is about ideals, principles, history and traditions that represent an organization's deeper roots.

Ujwary-Gil (2017) in her study aimed at analysing the barriers to knowledge management notes that lack of reward and motivation for seeking and sharing knowledge, lack of awareness of where the core of knowledge of an organization is, organizational culture responsible for promoting individual results to knowledge sharing, limited resource, unfriendly nature of the technological system among others are some factors that hinders knowledge sharing in organizations. Moreover, lack of monitoring or managing KM systems and focusing on an individual rather than a team approach are also some barriers to the implementation of knowledge management as proposed by Dooley (2013).

Furthermore, Frost (2012), gave some knowledge management casual shortcomings that could be an obstacle to the successful application of knowledge management to include; lack of performance indicators and tangible benefits; insufficient leadership support; inadequate preparation, development, communication and evaluation; inadequate skills of knowledge managers and employees; difficulties with organizational culture and inadequate organizational capacity. On the contrary, barriers to the implementation of knowledge management had been classified into; technological barriers, content barriers, barriers in routines and procedures, barriers in organization and barriers in personnel as stated by Odor (2018).

Conclusively, Kasimu *et al.* (2013c), outlined some of the main challenges faced in the implementation of knowledge management in construction companies to include; availability of time and resources, problems with organizational culture, insufficient standard work processes and inadequate funding.

Strategies to Improve Knowledge Management Application

Knowledge management aims at looking for best practices in all business activities and providing better support to its clients. Hence, it is to this end that Kasimu *et al.* (2013c) suggests in their study that practical strategies that will facilitate the practice of knowledge management should be developed in civil engineering construction firms. This can be achieved by creating awareness of knowledge management and its benefits in the civil engineering construction firms through coaching, mentoring, seminars and workshops. Kasimu *et al.* (2013c) added that in order to promote the application and practice of knowledge management, top management of civil engineering construction firms will support and encourage practitioners by displaying dedication to knowledge management practice through social interaction during the brief phase of the project and at the site conference. In addition, the government should develop favorable policies for civil engineering construction firms to encourage knowledge management practices, especially in infrastructure such as ICT facilities, technical resources and funds.

However, Hackman *et al.* (2017), found out in their research that Professionals agreed that creativity, the use of knowledge storage systems, the use of knowledge management methods, awareness-raising and sufficient financial resources were among the steps that could be put in place to resolve the challenges faced. They also suggested that management maintain sufficient channels for information sharing and also try to incorporate creativity in knowledge management within the enterprise, the company's ability to innovate is a major requirement for sustainable

performance improvement. Therefore, management should also use information management frameworks and build appropriate knowledge storage systems. Conclusively, for companies to remain competitive on the global market, understanding and advocacy on the benefits of knowledge management should be created.

RESEARCH METHODOLOGY

This study adopted the quantitative research approach. The structured questionnaire employed to gather information for the study was designed using the five-point Likert's Scale format. Descriptive statistics comprising of Relative Importance Index (RII) and Mean Item Score (MIS) were employed to analyse the data collected in order to achieve the research objectives. The use of RII and MIS for the analysis of data in this study is based on the formula depicted in Equation 3.1 and 3.2 respectively.

$$RII = \frac{\sum W}{A \times N} \dots\dots\dots (3.1)$$

Where;

Σ = Summation, W = the weights of every one of the factors given by respondents and it was in the range of (1 - 5), (A=5) the largest value of weight (i.e Highest factor) and finally N refers to the Total number respondents.

$$MIS = \frac{\sum W}{N} \dots\dots\dots (3.2)$$

Where: Σ = Summation, W = Weight, and N = Total number respondents

The decision rule employed for the RII and MIS analysis is summarized in Table 1.

Table 1: Decision Rule for Data Analysis

Cut-Off Point			Interpretation			
RII	MIS	Level of Awareness	Level of Application	Level of Agreement	Level of Effectiveness	
5 0.81 - 1.00	4.51 - 5.00	Strongly aware	Strongly Applied	Strongly Agree	Very Effective	
4 0.61 - 0.80	3.51 - 4.50	Aware	Applied	Agree	Effective	
3 0.41 - 0.60	2.51 - 3.50	Undecided	Undecided	Undecided	Undecided	
2 0.21 - 0.40	1.51 - 2.50	Not Aware	Not Applied	Disagree	Ineffective	
1 0.00 - 0.20	1.00 - 1.50	Strongly Unaware	Strongly Unapplied	Strongly Disagree	Very Ineffective	

Source: Adapted and Modified from Shittu *et al.* (2015).

RESULTS AND DISCUSSION

This section describes and presents the analysis and interpretation of research data. The research which adopts a primarily sourced data using a well-structured questionnaire had been analysed below:

Results and discussion on level of awareness of Knowledge Management systems

Objective one which highlights the six categories of knowledge management systems was analysed using the mean item score. The categories which identified five (5) factors under each heading had been analysed and illustrated in Tables 2 – 8.

Table 2: Level of Awareness of Knowledge Acquisition

S/No.	Knowledge Acquisition	Mean Score	Ranking	Decision
1.	Experienced staff supervises new staff within the firm	4.90	1 st	Strongly Aware
2.	Employee education	4.25	2 nd	Aware
3.	Periodic meetings are held within the firm	3.77	3 rd	Aware
4.	Firm places emphasis on lesson learnt on projects	2.89	4 th	Undecided
5.	Research into new technologies	2.52	5 th	Undecided
	Group Mean	3.67		Aware

Source: Researcher's Field Survey (2019).

Table 2 illustrates respondent's level of awareness of knowledge acquisition, and the results identified that they are aware of "experienced staff supervises new staff within the firm", "Employee education" and "Periodic meetings being held within the firm" with the mean score of 4.90, 4.25 and 3.77 respectively. This is in line with the findings of Fadeke *et. al.* (2015) who asserted that experienced staff supervises new staff and firm places emphasis on lesson learnt on projects are the notable forms of knowledge acquisition within construction organizations.

Table 3: Level of Awareness of Knowledge Creation

S/No.	Knowledge Creation	MIS	Ranking	Decision
1.	Encouragement of work-related ideas and suggestions	4.70	1 st	Strongly Aware
2.	Use of existing knowledge to generate new knowledge	4.46	2 nd	Aware
3.	Implementation of meaningful ideas brought by staff	3.86	3 rd	Aware
4.	Identifying best practices for future use	3.20	4 th	Undecided
5.	Innovating/embedding new ideas	2.24	5 th	Not Aware
	Group Mean	3.69		Aware

Source: Researcher's Field Survey (2019).

Table 3 measured the level of awareness of the respondents on knowledge creation, and the results dignified that they are aware of "encouragement of work-related ideas and suggestions", "use of existing knowledge to generate new knowledge" and "implementation of meaningful ideas brought by staff" with the MIS of 4.70, 4.46, and 3.86 respectively, as the notable form of knowledge creation in construction firms. This conforms to the study of Fadeke *et. al.* (2015) where they found that work related ideas are encouraged in firms. This means that encouragement of work-related ideas provided by staff is a good form of creating knowledge and hence, should be upheld.

Table 4: Level of Awareness of Knowledge Storage

S/No.	Knowledge Storage	MIS	Ranking	Decision
1.	Knowledge should be kept in external storage device	4.52	1 st	Strongly Aware
2.	Data and Information should be selected and organized before storage	4.00	2 nd	Aware
3.	Knowledge should be stored through electronic means	3.38	3 rd	Undecided
4.	Knowledge should be stored in form of written documentation	3.23	4 th	Undecided
5.	Knowledge should be stored in human memory	2.48	5 th	Undecided
Group Mean		3.52		Aware

Source: Researcher's Field Survey (2019).

Table 4 which shows the respondent's level of awareness on knowledge storage identified "Knowledge should be kept in external storage device" and "Data and Information should be selected and organized before storage" with the MIS of 4.52 and 4.00 respectively, as the notable means of storing knowledge within construction firms. This is in line with the findings of Choi (2005) and Fadeke *et. al.* (2015), that relatively little information remains in the minds of humans. Therefore, this means that human memory is not a reliable form of knowledge storage.

Table 5: Level of Awareness of Knowledge Sharing

S/No.	Knowledge Sharing	MIS	Ranking	Decision
1.	Site meetings and seminars	4.51	1 st	Strongly Aware
2.	Internal training courses	4.38	2 nd	Aware
3.	Project briefing and interview sessions	3.20	3 rd	Undecided
4.	Making accessible to all knowledge gained from previous projects	3.18	4 th	Undecided
5.	Post monitoring of past projects	2.99	5 th	Undecided
Group Mean		3.65		Undecided

Source: Researcher's Field Survey (2019).

Table 5 illustrates the level of awareness of the respondents on knowledge sharing and the results showed that "Site meetings and seminars" and "Internal training courses" are the most notable form of sharing knowledge within construction firms having the MIS of 4.51 and 4.38 respectively. This conforms to the findings of Kasimu *et. al.* (2013c), that face to face interaction, site meetings, project briefing and interview session as well as internal training courses are the most prevalent forms of knowledge sharing in construction firms.

Table 6: Level of Awareness of Knowledge Utilization

S/No.	Knowledge Utilization	MIS	Ranking	Decision
1.	Solving most problems encountered using ideas gained from previous projects	4.51	1 st	Strongly Aware
2.	Application of knowledge in developing new service	4.23	2 nd	Aware
3.	Encouraged transfer of experience to subsequent project	3.46	3 rd	Undecided
4.	Integration of knowledge with work performed	3.32	4 th	Undecided

5.	Proper communication of knowledge to the users	3.03	5 th	Undecided
	Group Mean	3.71		Aware

Source: Researcher's Field Survey (2019).

Table 6 which illustrates the level of awareness of knowledge utilization showed that “solving most problems encountered using ideas gained from previous projects” and “application of knowledge in developing new service” with the MIS of 4.51 and 4.23 respectively are the notable form of utilizing knowledge in construction firms. This contradicts with the findings of Fadeke *et. al.* (2015), where they found that application of knowledge in developing new services is least present in construction organizations.

Table 7: Level of Awareness of Knowledge Maintenance

S/No.	Knowledge Maintenance	MIS	Ranking	Decision
1.	Assigning a specific staff, the responsibility of regular update of knowledge	4.56	1 st	Strongly Aware
2.	Keeping knowledge in specialized libraries	4.35	2 nd	Aware
3.	Deleting knowledge no longer useful to an organization	3.45	3 rd	Undecided
4.	Assigning a specific staff, the responsibility of maintaining the applicability of knowledge	3.11	4 th	Undecided
5.	Cataloguing and classification of knowledge within an organization	1.86	5 th	Not Aware
	Group Mean	3.47		Undecided

Source: Researcher's Field Survey (2019).

Table 7 shows the respondent's level of awareness of knowledge maintenance and the results identified “assigning a specific staff the responsibility of regular update of knowledge” and “keeping knowledge in specialized libraries” with the MIS of 4.56 and 4.35 respectively as the notable forms of maintaining knowledge in construction organizations. This is consistent with the findings of Mohammad and Saeed (2011), that maintaining knowledge in specialized libraries is important in order to make knowledge accessible as at when needed.

Table 8: Categories of Knowledge Management Systems

S/No.	Knowledge Management Systems	Group Mean	Ranking	Decision
1.	Knowledge Utilization	3.71	1 st	Aware
2.	Knowledge Creation	3.69	2 nd	Aware
3.	Knowledge Acquisition	3.67	3 rd	Aware
4.	Knowledge Sharing	3.65	4 th	Aware
5.	Knowledge Storage	3.52	5 th	Aware
6.	Knowledge Maintenance	3.47	6 th	Undecided
	Group Mean	3.62		Aware

Source: Researcher's Field Survey (2019).

Table 8 which highlights the summary of the various categories of knowledge management systems as seen in table 2-7 shows that the respondents are aware of knowledge utilization with the group mean of 3.71, knowledge creation with the group mean of 3.69, knowledge acquisition with the group mean of 3.67, knowledge sharing with the group mean of 3.65 and knowledge storage with the group mean of 3.52. while the least ranked system is knowledge maintenance

with the group mean of 3.47. This is in line with the findings of Oke *et. al.* (2013), which shows that at one time or another, many construction workers have learned of knowledge management systems and some have them in place in their organizations.

Results and discussion on level of application of Knowledge Management systems

The results of the MIS analysis on the level of application of knowledge management systems are presented in Table 9.

Table 9: Level of Application of Knowledge Management Systems

S/No.	Knowledge Management Systems	Mean Score	Ranking	Decision
1.	Knowledge Sharing	3.52	1 st	Applied
2.	Knowledge Storage	3.41	2 nd	Undecided
3.	Knowledge Utilization	3.24	3 rd	Undecided
4.	Knowledge Acquisition	2.79	4 th	Undecided
5.	Knowledge Creation	2.65	5 th	Undecided
6.	Knowledge Maintenance	2.54	6 th	Undecided
	Group Mean	3.02		Undecided

Source: Researcher's Field Survey (2019).

Table 9 which highlights the level of application of knowledge management systems shows that only knowledge sharing with a mean score of 3.52 had been applied in their organizations, but are unsure about their firm's level of application of knowledge storage, knowledge utilization, knowledge acquisition, knowledge creation and knowledge maintenance with the mean score of 3.41, 3.24, 2.79, 2.65, and 2.54 respectively. This corroborates with the study of Kasimu *et. al.* (2013a) that if the knowledge and experiences of the construction professionals are not shared among the employees for re-use, then the knowledge of engineers and experts represents a major loss for contractors in the construction firms.

Results and discussion on barriers that hinder effective application of Knowledge Management systems

The results of the barriers that hinder Effective application of knowledge management systems are shown in Table 10.

Table 10: Barriers that Hinder the Effective Application of Knowledge Management Systems

S/No.	Barriers	RII	Ranking	Decision
1.	Lack of effective policy for applying KM	0.94	1 st	Strongly Agree
2.	Lack of awareness of potential benefits of KM	0.92	2 nd	Strongly Agree
3.	Lack of top management support	0.91	3 rd	Strongly Agree
4.	Poor Information Technology (IT) infrastructure	0.77	4 th	Agree
5.	Lack of proper technical expertise	0.73	5 th	Agree
6.	Availability of time and resources	0.72	6 th	Agree
7.	Lack of trust among employees	0.65	7 th	Agree
8.	Lack of cooperation among construction professionals	0.61	8 th	Agree
9.	Problems with organizational culture	0.49	9 th	Undecided

10.	Difficulty locating and capturing knowledge	0.47	10 th	Undecided
	Group Mean	0.72		Agree

Source: Researcher's Field Survey (2019).

Table 10 highlights the barriers that hinder the effective application of knowledge management systems in construction firms and it was found that; “lack of effective policy for applying knowledge management”, “lack of awareness of potential benefits of knowledge management” and “lack of top management support” with the RII of 0.94, 0.92 and 0.91 respectively are the major barriers that hinders the effective application of knowledge management in construction firms.

Other barriers include; poor information technology (IT) infrastructure (RII=0.77), lack of proper technical expertise (RII=0.73), availability of time and resources (RII=0.72), lack of trust among employees (RII=0.65) and lack of cooperation among construction professionals (RII=0.61). This is in line with the proposition of Hackman *et. al.* (2015), who found that lack of available knowledge management systems, lack of leadership support, lack of awareness of knowledge management practices are the barriers hindering the successful application of knowledge management in construction firms.

Results and discussion on strategies for effective Knowledge Management application

Table 11 presents the results of the strategies for effective knowledge Management application.

Table 11: Workable Strategies that will lead to the Effective Application of Knowledge Management Systems

S/No.	Workable Strategies	RII	Ranking	Decision
1.	Application of Information Technology (IT)	0.95	1 st	Very Effective
2.	Appointing a knowledge manager	0.94	2 nd	Very Effective
3.	Creating awareness of knowledge management and its benefits	0.90	3 rd	Very Effective
4.	Top management support	0.79	4 th	Effective
5.	Innovation	0.76	5 th	Effective
6.	Brainstorming sessions	0.70	6 th	Effective
7.	Training and education plans	0.61	7 th	Effective
8.	Consultancy	0.54	8 th	Undecided
9.	Adequate financial resources	0.50	9 th	Undecided
10.	Favorable government policies	0.39	10 th	Ineffective
	Group Mean	0.71		Effective

Source: Researcher's Field Survey (2019).

It can be seen from Table 11 that the respondents agree with application of information technology (IT) with RII of 0.95, appointing a knowledge manager with RII of 0.94, and creating awareness of knowledge management and its benefits with RII of 0.90 as the most effective strategies that will lead to the effective application of knowledge management in construction firms.

Other effective strategies that will lead to the successful application of knowledge management system in construction firms include: “top management support”, “innovation”, “brainstorming sessions”, and “training and education plans” with the RII of 0.79, 0.76, 0.70, and 0.61

respectively. This conforms to the findings of Forcado *et. al.* (2013), that Information Communication Technology (ICT) tools, training and education plans as well as appointing a knowledge manager are the effective tools for improving knowledge management.

CONCLUSIONS

This research describes the main problems and approaches associated with the use of knowledge management systems in construction firms and hence, brought up the following conclusions:

- i. Professionals are more aware of knowledge utilization, creation, acquisition, sharing and storage than knowledge maintenance.
- ii. Among the six (6) categories of knowledge management systems, only knowledge sharing had been relatively applied in construction firms.
- iii. Lack of effective policy for applying knowledge management, lack of awareness of potential benefits of knowledge management and lack of top management support are the major barrier that hinders the successful application of knowledge management systems in construction firms.
- iv. Application of information technology (IT), appointing a knowledge manager and creating awareness of knowledge management and its benefits are the most effective strategy that will lead to the successful application of knowledge management systems in construction firms.
- v. Generally, it was concluded that most professionals are aware of knowledge management systems but their organizations are yet to formally apply knowledge management into their organizational system.

In view of the above conclusions, the following recommendations are made:

- i. Organizations should acquire tools and technologies necessary to support it employees and processes involved in knowledge management.
- ii. Construction firms should implement policies that will foster the application of knowledge management systems and carryout knowledge mapping to identify best practices related to their areas of operations and inculcate such practice into their organizational activities.
- iii. Appointing a knowledge manager specifically for the regular update of organizational knowledge.
- iv. Construction firms should improve on their information technology (IT) methods of collaboration between on-site supervisors and office staff, such as video conferencing and the use of mobile applications.
- v. Finally, firms should set up reward systems through which members will be motivated to create, acquire, store, share, utilize and maintain knowledge for common goal and to increase organization's competitive advantage.

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APPROPRIATENESS OF THE METHODS USED BY BUILDING CONTRACTORS FOR ALLOCATING OVERHEAD COST IN NIGERIA

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ABSTRACT

Every contractor desire to remain in business and making profit. But this is rarely achieved due to several factors amongst which, is the allocating and managing of overhead costs. The overhead cost is an important driver of the construction cost constituting up to 30% of the total cost of the project and is derived using the Traditional method (Job-cost and General ledger) and Activity Based Costing method (ABC). The ABC method is said to have advantages over the Traditional method in that it helps to prevent cost distortion and minimize wastages, but it is a relatively new cost accounting method to many contractors. The paper aimed at assessing the appropriateness of the methods used by building contractors for allocating overhead cost in Nigeria the data for this paper was generated using questionnaire by adopting purposive sampling technique. The population consists of building construction contractors classified by Federal Ministry of Land, Housing and Urban Development in the categories of registration A, B, C & D. The total number of contractors that renewed their registration were 60 which was considered as the study population; 2 out of every 12 were considered to arrive at a sample size of 10. The result of the study indicated that the 30% Contractors are unaware of of ABC, and such did not apply it! 20% supported it while 10% were undecided. This implied that ABC is not fully accepted. The paper therefore recommended that construction cost experts should create more awareness on ABC to contractors and other stakeholders.

Keywords: Contractors, Overhead Cost, Job Cost, General Ledger and Activity Based Costing

INTRODUCTION

According to Magellanes (2015), overhead is a very significant cost driver in engineering, manufacturing and construction. Indirect labour, employee benefits, the costs of managing facilities and the cost of capital equipment are important drivers of total cost and can result in a total per-hour cost per employee that is two or three times the employee's hourly wage rate as such, it is an area for rationalizing to reduce production cost.

It is very important that all the items of building costs are accurately estimated and adequately provided for as this form the basis on which a highly competitive tender submission is made. According to Adnan, (2008) the financial components of construction item consist of three main parts; the direct cost, indirect cost (overhead costs) and profit margin. Paul (2015), identified two types of overhead costs; overhead costs chargeable to a specific job operation and general overhead costs that are not chargeable to a specific operation. Project Overhead (OH) costs are called jobsite overhead or general condition OH (Dagostino, 1989). Project OH costs comprise the contractor's expenses in managing the project at the job site. It is the cost specific to a project, but not specific to a trade or work item (Cluenseck, 1991; Taylor, 1994)

According to Susan (1999) OH costs are those general expenses incurred during the normal costs of operating a business. At times these costs may be called general and administrative fringe benefit costs, overhead or payroll burden. According to Frein (1980), project administration gears to provide administrative services for specific project involved; the costs and services are directly related to the project and are not performed to the benefit of the company as a whole or for the benefit of other projects. These administrative services are accounting, purchasing, warehousing, personnel, safety and payroll. Assaf *et al.* (1999, 2001) in Adnan *et al.* (2008) stated that these components include supervision, equipment, construction financing, contingency insurance taxes & bonds as the main component of the indirect cost. Eksteen and Rosenberg (2002) in Adnan *et al.* (2008) added other components such as communication travelling, human resources, financial auditing, asset ownerships, subscription legal fees, depreciation, bank & financing charges, corporate insurances and professional fees.

Overhead can be measured using Traditional method (Job-cost & General ledger) and Activity Based Costing (ABC). ABC is the method of measuring the cost and performance of activities on cost objects. It assigns cost to activities based on their use of resources and cost-to-cost objects based on their use of activities. ABC recognizes the causal relationship of cost drivers to activities (James, 2007).

The Nigerian contractors are more conversant with the Traditional method of overhead cost allocation. Kim & Ballard (2001), and Holland and Hobson (1999) in Kim and Ballard (2002) reported that, traditional construction overhead uses resources-based costing and volume-based allocation. Kim and Ballard (2002) criticized the traditional overhead cost and proposed a new costing method referred to Activity Based Costing (ABC). However, in Nigeria the problem of current practice regarding overhead cost assignment is that the firms do not know real cost for each work division and those for each participant such as subcontractors because either they do not assign overhead cost or they use a uniform cost driver (that is direct labour cost) for assignment of overhead. Hence, this study assesses the appropriateness of the methods used by building contractors for allocating overhead cost in Nigeria. The data for this was generated using questionnaire by adopting purposive sampling technique

LITERATURE REVIEW

Traditional Method of Overhead Cost Allocation

Overhead cost allocation is one of the most misunderstood concepts contractors face in running their business (Fredode, 2006). Generally, two methods are used to allocate overhead cost in construction today. The first method often referred to as 'Job-Cost' method is simple to use and understand but often less accurate. It uses a single predetermined rate multiplied by job costs to determine overhead cost. The hard part of it, is to come up with this predetermined rate, which involves estimating the percentage of the actual costs that represent overhead (based on the actual past overhead cost) to arrive at a single rate that applies across all jobs. The second method of overhead cost allocation is 'General Ledger' which is more complex, yet more accurate in determining true overhead cost; instead of using an estimated rate. This method is based on tracking actual overhead cost just as actual jobs are tracked. A percentage of these costs are

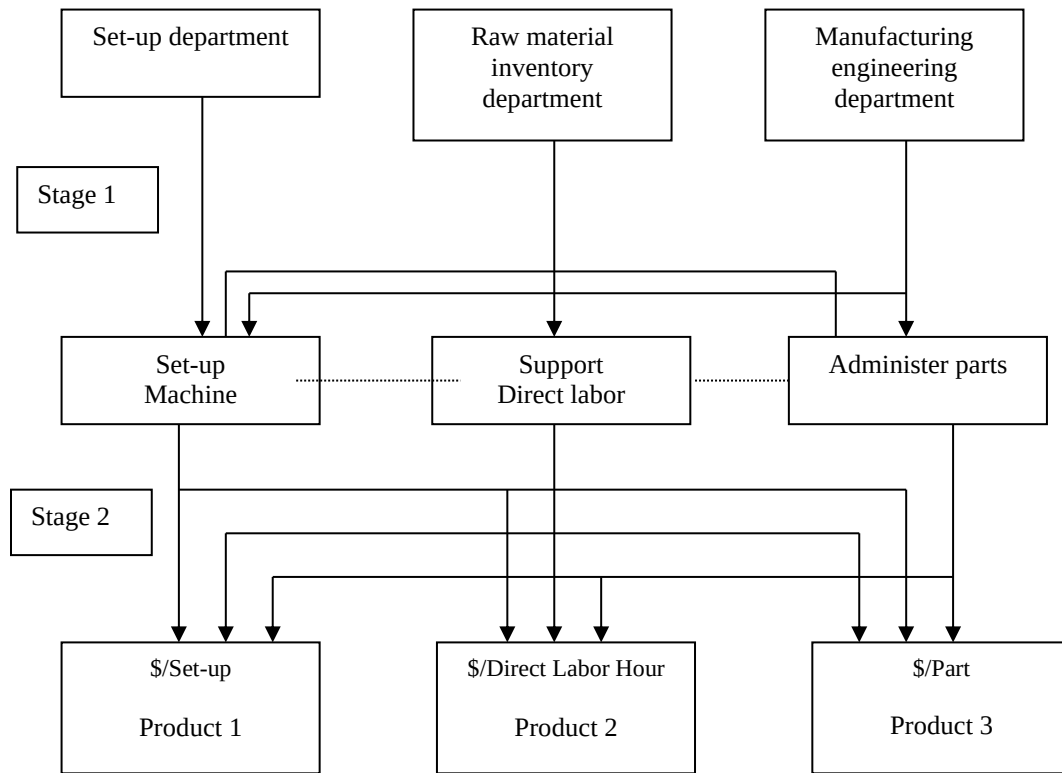
allocated to individual jobs based on each job's percentage of total actual cost. The general ledger method allows more complex formula to accommodate weighting of overhead costs, based on which type of costs are more relevant to the contractors (Fred, 2006).

Activity Based Costing (ABC) Method of Overhead Cost Allocation ABC is a relatively new cost accounting method that relies on the concept of relative cost to the activities that causes it (Assaf *et al.*, 2001). Cost allocation is a practice of incorporating indirect cost into the product cost used to satisfy managers in pricing their products because indirect costs were in general, much lower than current levels. This implies that the result of cost allocation would not significantly affect the final bid. Product costs usually consist primarily of direct material and labour costs. Today OH costs constitute up to 30 percent of the production costs and this figure is even on the rise, which makes cost allocation an invalid approach simply because extremely important decisions are based on distorted cost information. Furthermore, if substantial advancements take place in an industry, then the costing system must also incorporate these advancements if it is to provide valuable information to decision makers. One of the substantial changes in today's production is that increased proportions of total costs do not change with volume but rather exist as shared costs (Drury, 1990 cited in Mohammed, 1997). Traditional cost accounting has been criticized for cost distortion and the lack of relevance during the last 20 years (Johnson & Kaplan, 1987). A traditional system reports where and by whom money is spent on, but fails to report the cost of activities and processes (Miller, 1996). Many organizations, including petroleum and semiconductor companies in the manufacturing industry, have adopted the new costing method, ABC. There are two purposes of ABC. The first is to prevent cost distortion. Cost distortion occurs because traditional costing combines all indirect costs into a single cost pool. This pool is allocated on the basis of some resource common to all of the company's products, typically direct labour. Cost distortion is prevented in ABC by adopting multiple cost pools (activities) and cost drivers. The second purpose is to minimize waste or non-value-adding activities by providing a process view. This objective can be achieved by activity analysis and (or) the function of monitoring activities (Kim & Ballard, 2002).

The ABC as an alternative accounting method is premised on simply obtaining better understanding of cost behaviour by tracing activities causing costs, especially indirect costs, which help in accurately pricing products. Under ABC, costs are either short-term or long-term variable costs. Short-term variable costs are volume related while long-term variable costs only vary with the extent to which the activity is performed. Moreover, this variation is limited and slowly obtained. For example, head office cost for a construction contractor is really a long-term variable cost which slowly changes even if the contractor is not working at full capacity. Furthermore, the change in this cost is limited unless there is a vital change in workload (Drury, 1990).

ABC tries to obtain greater understanding of cost behaviour to be able to accurately determine product costs. It does so by understanding the forces behind costs, which are called cost drivers. A cost driver is defined as the activity or transaction, which significantly determines the magnitude of the cost. Therefore, if head office costs are driven, presumably, by marketing, new projects pricing, support site operations, accounting, etc. These activities would then be the cost drives for head office costs. ABC suggests that an accurate and fair recovery of this indirect cost is possible if cost is assigned to different projects based on these cost drives by knowing how much of each activity is directed to a particular project. Cost drivers are thus, used as a cost assigning base instead of traditional allocation bases and it is from that concept ABC gets its

strength. Needless to mention that short-term variable costs are more easily assigned to product total cost using volume related cost drivers such as material or man- hours consumed. The allocation of indirect costs (OH costs) as suggested by Copper and Kaplan (1991) in Mohammed (1997) ABC is shown in Figure 1.



Stage 1: Determine what activities company resources perform

Stage 2: Attribute costs to products based on their use of resources

Figure 1: Assignment process for OH costs during Activity Based Costing – ABC (Copper and Kaplan, 1991, p 270) in (Mohammed 1997)

The major distinction between ABC and traditional costing system is that ABC claims that volume related cost drivers are not necessarily the correct way to incorporate long-term variable costs, which are OH costs (Copper, 1988 and Drury, 1990 cited in Assaf, 2001). The reason is that ABC is a more relevant approach for costing products than traditional costing systems, simply because it forces deeper traceability of costs to products. The main factors here are activities and their associated drivers. The logic behind the ABC approach is if a product does not use an activity, then the product should not absorb any of that activity's cost (Raffish, 1991). However, implementing ABC needs more detailed insight into OH costs and how they are spent,

which consumes more resources, especially in the beginning. However, the problem of excessive OH costs gets more aggressive as the benefits of ABC become greater.

According to Copper and Kaplan, (cited in Assaf 1999), introducing ABC system results in far more accurate product costing. However, the use of ABC system in construction is not yet documented and may have some limitations due to the fact that in the construction industry, construction costs are determined before the production process starts, which means that almost all costs are only predicted. Second, each construction project is unique and thus has different production arrangement, which cause different cost components. Third, company OH costs significantly vary from time to time depending on many factors and the number of projects which is not known when project costing is performed. Fourth, there are, sometimes, many cost drivers for the same OH cost. These lead to inconsistency in the amount of burden OH costs each project has to handle. In spite of that, ABC system may be used to reduce the severity of the problem by concentrating on major company OH costs and try to overcome obstacles in the way to implement ABC in construction. This important approach will be examined in the survey so that it can be better evaluated.

METHODOLOGY

The data was generated using questionnaire by adopting purposive sampling technique. This is a non-probabilistic sampling procedure which involves picking typical population elements to make up a sample size (Rubin, 1983). It is also a technique that do not need underlying theories or set a number of participants, the researcher decides what need to known and set out to find the people who can and willing to provide the information by virtue of knowledge and experience (Bernard 2002). In this case, the population consists of building construction contractors classified by Federal Ministry of Land, Housing and Urban Development in the categories of registration A, B, C & D. The total number of contractor's firms that renewed their registration were 60 which was considered as the study population; 2 out of every 12 were considered due to three years of experience in managing and allocating overhead cost and arrived a total sample size of 10. The questionnaire was designed to indicate the contractor's views or perception they have regarding the overhead allocation (Using the right allocation method, Accurate allocation based on cost pools and Activity based costing (ABC)) Using scale 1 – 5, where 1 represent strongly agree, 5 represent strongly disagree. Important effect”.

Questionnaires were administered to the sampled contractors and the data collected from the respondents were analysed using a relative importance index (Likert scale). ABC is a relatively new cost accounting method, which relies on the concept of relating, cost to the activities causing them. The essence of a survey is to tap from respondents' experience, in order to gauge their perception.

Table1: The appropriateness of the methods used by building contractors for allocating overhead cost

Factors related to allocation	Strongly agreed	Agreed	Neutral	Disagreed	Strongly disagreed	Total
Using the right allocation method	05 50%	02 20%	00 00%	02 20%	01 10%	10 100%
Accurate allocation based on cost pools	04 40%	01 10%	01 10%	02 20%	02 20%	10 100%
Activity based costing (ABC)	02 20%	02 20%	01 10%	02 20%	03 30%	10 100%

5= Strongly disagree 4 = Disagreed 3 = Neutral 2= Agreed 1 = Strongly agreed

Sources: Field Survey (2015)

The result in Table 1 in respect to the ABC allocation method shows that, 20% of the respondents strongly agreed with use of ABC a while 30% strongly oppose it or they are unaware of it, and such did not apply it. In discussing the concept many contractors have the view that although the ABC method of cost allocation is valid, it may be difficult to apply in the construction industry because Firm resources are continuously performing many activities in a manner which makes tractability very difficult

Table 2: Contractors Reason for the Choice of a Particular Allocation Method

S/N	Reason why a particular allocation method is used	Frequency	Percentage
I	Project is similar in nature	01	10%
Ii	Firm overhead is a time related expenditure	05	50%
Iii	Firm overhead is related to direct costs	02	20%
Iv	Easy to apply	02	20%
Total		10	100%

Sources: Field Survey, (2015)

The result in Table 2 shows motivations behind using a particular allocation method, which is dependent on the nature of company and projects. From the table it is clear that 50% of the contractors perceived overhead costs as a function of time expenses, while 20% of the respondents indicated that overhead costs is closely related to the estimated direct cost of the project and thus direct costs are used as an allocation base. Moreover, 10% of the respondents indicated that projects are similar in nature; it is easy to depend on the number of projects as a base for calculating what each project has to recover. Another 20% of the respondents indicated that they preferred using a method with ease of application. However, direct cost which were the project site indication were used as allocation base because it is easy to estimate whereas estimating time needed to finish the project, is costly because it needs expert planners who set activities production rate, scheduling resources and other steps which are time consuming and costly at bidding stage.

CONCLUSIONS

Although many writers have advocated the use of ABC because of its accuracy, relevant approaches for costing procedures, activities and their drivers, the finding of this study showed that most professionally registered Contractors in Abuja, Nigeria oppose it or they are unaware of it, and such did not apply the ABC method. This is because of its time related expenditure. The study therefore recommends serious enlightenment campaign by construction cost experts to educate contractors on positive values of ABC as a better overhead costing method for the future.

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INNOVATION DRIVERS AND BARRIERS IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

The aim of the study is to assess innovation drivers and barriers in the Nigerian construction industry. The specific objectives are to: examine the drivers and barriers; identify means to establish innovation drivers; and proffer means to overcome innovation barriers in the Nigerian construction industry. Structured questionnaires were administered to experienced professionals which includes; Project Managers, Architects, Quantity Surveyors, Builders and Engineers of the sampled construction firms within Abuja and registered with the Federation of Construction Industry (FOCI). The data obtained were subjected to descriptive and inferential analyses using tables and RII (Relative Importance Index). The major drivers of innovation from the study are client innovative demand, productivity increase, design trend, subsidies for innovative application and materials and improve effectiveness while the main barriers to innovation are lack of understanding of the benefits of innovation, cost of innovation and perception that the industry is doing well without innovation. Innovation has been found to be driven by the actions of clients and challenges thrown up by emergent crises on construction projects. The main barriers to innovation from the study are lack of understanding of the benefit of innovation, cost of innovation and perception that the industry is doing well without innovation. The construction industry will function better and improve the built environment when more of innovative drivers are put into play allowing little or no barrier to hinder the efficiency and effectiveness of innovation.

Keywords: barrier, construction, driver, improvement, innovation.

INTRODUCTION

Construction industry plays an important role towards the social and economic development of countries worldwide (Abdullateef and Seong, 2017). The industry promotes social progress by generating employment for a large number of people. It provides basic infrastructure for the efficient functioning of the society (Ogunbayo *et al.*, 2010). Moreover, the construction industry has been criticized because of its low productivity and quality in comparison with other industries. One of the main reasons for this situation is because the industry suffers from poor adoption of innovation (Winch, 2003). Innovation can be described as the process of transforming an idea into a sellable good or service, or it could be the outcome of improvement on an existing goods or service (Benmansour and Hogg, 2012). It can also be described as an idea, or a technique or a process, which may be new or old that is applied to the production of goods or services in a distinct way, thereby adding value to a system, process or product (Ozorhon *et al.*, 2010). However, it is very essential to seek for improvement in all areas of construction activities as it contributes extremely to the Gross Domestic Product (GDP) of most developed and developing countries. The industry has the potential of improving its size, market share and profitability, and innovation holds the key to that effect. Damanpour and Schneider (2010) added that innovation is very vital to achieve competitive advantage and to ensure survival of firms in the industry. According to Blayse and Manley (2010) the higher the levels of innovation in the construction industry, the greater the likelihood that it will increase its contribution to economic growth. In addition, engineering and construction firms in the industry need to innovate in order to win, improve productivity and quality of projects. In order to manage

innovation, we have to understand the industry as a whole and how innovation affect the Nigerian construction industry, how a new idea will have a value-added impact on firms in the industry. This motivates to study the major innovation drivers and barriers in the Nigeria construction industry and means to establish innovation drivers and overcome innovation barriers in the construction industry. The specific objectives of this study are to: examine the drivers and barriers to innovation in Nigerian construction industry; identify means to establish innovation drivers in the Nigerian construction industry; and proffer means to overcome innovation barriers in the Nigerian construction industry. Construction industry has faced increasing sophistication, which is driven by societal demands and environmental pressures for safe, high-quality, and sustainable construction (Napoleon and John, 2016). Against this backdrop of challenges, construction industry face serious pressure to innovate (Napoleon and John, 2016). Due to lack of known research related to the innovation performance of construction sector in literature, this research hereby fills the noticeable gap by focusing on drivers and barriers of innovation in the construction industry.

Historical overview of innovation discourse

The word innovation entered English texts in the mid-1500s from the Latin verb ‘innovare’ meaning renew, alter or make new (Abadi, 2014). Innovation history as it is regarded today (i.e. a success factor for businesses) has been through a progressive process throughout classical economic history. According to Abadi (2014) innovation was a deviant behaviour and considered as a strong barrier to social, religious and political norms. Innovation was a desirable behaviour only if it could sustain the status quo. Any changes outside the norms and interests of the corporate body, the state of religion or church were classed as deviance and the term innovation would be used to describe that behaviour. Even for practical technological developments, the term innovation would not be considered to describe the action. The Oxford English Dictionary from 1500s to 1800s has negative quotations from institution of Christian religious contexts to Shakespeare and law dictionaries to scientific articles (Abadi, 2014). In the 19th century, innovation changed from a taboo and deviant social behaviour into something positive. In 1939, Joseph Schumpeter initiated a new understanding in his book ‘Business Cycles’, of innovation as a driving force in economic growth in the United States in particular and in the West more generally.

Innovation in the construction industry

The contribution of the construction sector to the growth of the economy cannot be overstated. The performance of the sector has significant implications on the economy as a whole. Yet, the sector has often been criticised for delivering products and services which fall short in quality and fail to meet client expectation of price certainty and assured delivery (Lu and Sexton, 2012). This has prompted many calls for performance improvement (Egan, 2011; Fairclough, 2010; Latham, 2014). Innovation has been identified as an important means for improved performance in a rapidly changing business environment (García and Calantone, 2012). In the construction professional services environment, successfully creating and managing knowledge provides an important means of creating value although this value creation has been called into question by clients (Lu and Sexton, 2012). The need for improvement is also being driven by the quest for more flexibility that enables firms to respond to conflicting expectations and demands from clients (Koch and Bendixen, 2010). Innovation provides a means for firms to differentiate their services in order to stay ahead of competition. Profit maximisation has also been identified as an

important driving force behind efforts at innovation by construction firms (Lim and Ofori, 2014). The need for more innovation is further underscored by the fact that firms that engage in innovation tend to out-perform those that do not (NESTA, 2009).

Drivers of Innovation in the Construction Industry

Specifically, the factors that drive innovation in the construction industry are many, Bossink (2015) classified them into four distinct categories namely: environmental concerns, technological knowhow, knowledge sharing and boundary spanning. These four distinct categories were further subdivided by (Owolabi *et al.*, 2019) into the following drivers of innovation in the Nigerian construction industry: Clients with innovative demands, developments in ICT, design trends, productivity increase, reduction in cost, improved effectiveness, environmental sustainability, government regulation, subsidies for innovative application and materials, competitive advantage, improved quality, environmental sustainability, stimulation of research, programmes promoting, product evaluating institution, market trends and opportunities, empowerment of innovation champions, creation of knowledge network, changing business environment, technology advances, recession aftermath, government incentives, programmes promoting access to technology, empowerment of innovation leaders, governmental guarantee for innovative firm and innovation stimulating regulation

Barriers to innovation in the Nigeria construction industry

According to Benmansour and Hogg (2012), certain factors have been identified from literature as hindrances to innovation in the construction industry, they are highlighted as follows: lack of understanding of benefit of innovation, perception that the industry is doing well without innovation, cost of innovation, belief that innovation is risky, short term thinking, lack of resource/capacity, government regulation, lack of skillful brainstorm facilitation, lack of focus, lack of support, lots of idea, no delivery to market, cultural issues, politics, constantly shifting priority, lack of shared vision, lack of collaboration, lack of spare-time to develop new ideas, lack of urgency, stagnating mind, no clear process, not adopting emerging technology, unwillingness to acknowledge and learn from past, risk aversion, lack of leadership, type of organization structure and no creative thinking.

Means to establish innovation drivers in the Nigerian construction industry

Tolga *et al.* (2013) identified the following means to establish innovation drivers in his research: Performance, risk & knowledge management; integration around the product and service, flexible 'performance based' form of standard, information sharing & cooperation, management to advocate innovative ideas, comprehensive reward and incentive system, professional qualification and training, continuous re-examine the desires of clients, hiring new graduates and introducing them to new technologies, critical management and technical support, collective learning & knowledge creation, social collaboration & networking, creation of collaborative arrangements with industry initiated research with emphasis on performance and sustainability and manufacturers and suppliers should educate contractors on the benefits of modern available materials.

Means to overcome innovation barriers in the Nigerian construction industry

Tolga *et al.* (2013) also identified the following means to overcome innovation barriers in his research: subsidising innovations, regulations, improved communications, information, integration and training, support during innovation process, understand & discuss the legitimacy of innovative practice, continuous learning, organizational learning & knowledge management, cultivate an innovation culture, enhancing technical capabilities and encouraging employee ideas, identification of clear benefits of the use of ICT, enabling interactive environment and IT-related applications with short learning curves.

RESEARCH METHODOLOGY

This paper adopts the use of quantitative data obtained with structured questionnaire. The questionnaire was administered to experienced professionals which includes; Project Managers, Architects, Quantity Surveyors, Builders and Engineers of the sampled construction firms who have acquired a minimum of 5 years working experience in the construction industry. The sample units for this study were drawn from the list of registered construction firms with the Federation of Construction Industry (FOCI) in Abuja. Since the population size is small, the sample size for the study was taken as the population size which is the number of the construction firms registered with FOCI in Abuja (25). From each of the sample unit, five experience professionals were selected with the use of random selection table. The total numbers of One Hundred and Twenty-Five (125) copies of questionnaires were administered to the respondents, out of which 89 copies were retrieved giving a response rate of 71%. The data obtained were subjected to both descriptive statistics using tables to present results and inferential statistics using RII (Relative importance index) to rank in order of importance.

$$RII = \frac{\sum W}{A \times N} \text{ ----- (1)}$$

Where: Σ = Summation, W = the weights of every one of the factors given by respondents and it was in the range of (1 - 5), (A=5) the largest value of weight (i.e. Highest factor) and finally N refers to the Total number of respondents.

Decision Rule for Data Analysis:

RII value within 0.81 – 1.00 is asses to be very Important

RII value within 0.61 – 0.80 is asses to be Important

RII value within 0.41 – 0.60 is asses to be fairly Important

RII value within 0.21 – 0.40 is asses to be less Important

RII value within 0.00 – 0.20 is asses to be least Important

Source: Shittu *et al.*, (2015)

RESULTS AND DISCUSSION

This study gathers information about the respondents. It includes the respondent's construction firm, designation of respondent in the organisation, respondent years of experience in the construction industry, and their familiarity with innovation.

Table1 shows that out of 89 respondents, 48(54%) works with Small scale construction firms, while 41(46%) works with medium scale construction firms in Abuja.

Table 1: Classification of Respondents Firms

	Frequency	Percentage
Small Scale Construction Firm	41	46.1

Medium Scale Construction Firm	48	53.9
Total	89	100.0

Table 2 shows that 11(12%) of the respondents were Architects, 24(27%) were Engineers, 21(24%) were Quantity Surveyors, 20(22%) were Builders, 13(15%) were Project Managers. This shows that the majority of the respondent are Engineers.

Table 2: Designation of Respondents

	Frequency	Percentage
Architect	11	12
Engineer	24	27
Quantity Surveyor	21	24
Builder	20	22
Project Manager	13	15
Total	89	100

Table 3 shows that 25(28%), 38(42%), 20(23%), 5(6%), and 1(1%) were within the range of 1-5yrs, 6-10yrs, 11-15yrs, 16-20yrs, and above 21 years of experience in construction industry respectively.

Table 3: Respondents Years of Experience

	Frequency	Percentage
1 – 5yrs	25	28
6 – 10yrs	38	42
11 – 15yrs	20	23
16 – 20yrs	5	6
21yrs and above	1	1
Total	89	100

Table 4 shows that 9(10%) has very low familiarity with innovation, 20(22%) has low familiarity with innovation, 21(24%) were averagely familiar with innovation, 35(39%) have high familiarity with innovation, while 4(5%) have very high familiarity with innovation.

Table 4: Respondents Familiarity with Innovation

	Frequency	Percentage
Very Low	9	10
Low	20	22
Average	21	24
High	35	39
Very High	4	5
Total	89	100

Table 5 shows five (4) very important drivers of innovation in the Nigerian construction industry ranging from client with innovative demand (RII = 0.83), productivity increase (RII = 0.83), design trend (RII = 0.82), subsidies for innovative application and materials (RII = 0.82) and improved effectiveness (RII = 0.81). Other drivers of innovation in the Nigerian construction industry which are Market Trends and Opportunities, Competitive Advantage, Development in

ICT, Improved Quality, Changing Business Environment, Empowerment of innovation champions, government regulation, Environmental sustainability, Stimulation of research, Market pull, Creation of Knowledge network and Recession aftermath with RII of 0.78, 0.77, 0.76, 0.76, 0.76, 0.74, 0.71, 0.70, 0.70, 0.69, 0.69, 0.65 and 0.64 respectively are shown to be important. Government guarantee for innovative firm, Programmes Promoting Access to Technology, Empowerment of Innovation Leaders, Government Incentives, Innovation Stimulating Regulation, Product Evaluating Institution, Programmes promoting and Cost Reduction with RII of 0.60, 0.59, 0.59, 0.58, 0.55, 0.53, 0.47, and 0.43 respectively are shown to be fairly important. Averagely all the identified drivers of innovation in the Nigerian construction industry are important with average RII of 0.68.

Table 5: Drivers of Innovation in the Nigerian Construction Industry

S/No.	Drivers of Innovation	RII	Rank	Decision
1	Clients with innovative demand	0.83	1st	Very Important
2	Productivity Increase	0.83	2nd	Very Important
3	Design Trends	0.82	3rd	Very Important
4	Subsides for Innovative Application and Materials	0.82	4th	Very Important
5	Improved Effectiveness	0.81	5th	Very Important
6	Technology advances	0.78	6th	Important
7	Market Trends and Opportunities	0.77	7th	Important
8	Competitive Advantage	0.76	8th	Important
9	Development in ICT	0.76	9th	Important
10	Improved Quality	0.76	10th	Important
11	Changing Business Environment	0.74	11th	Important
12	Empowerment of Innovation Champions	0.71	12th	Important
13	Government Regulation	0.70	13th	Important
14	Environmental Sustainability	0.70	14th	Important
15	Stimulation of Research	0.69	15th	Important
16	Market Pull	0.69	16th	Important
17	Creation of Knowledge Network	0.65	17th	Important
18	Recession Aftermath	0.64	18th	Important
19	Governmental Guarantee for Innovative Firm	0.60	19th	Fairly Important
20	Programmes Promoting Access to Technology	0.59	20th	Fairly Important
21	Empowerment of Innovation Leaders	0.59	21st	Fairly Important
22	Government Incentives	0.58	22nd	Fairly Important
23	Innovation Stimulating Regulation	0.55	23rd	Fairly Important
24	Product Evaluating Institution	0.53	24th	Fairly Important
25	Programmes promoting	0.47	25th	Fairly Important
26	Cost Reduction	0.43	26th	Fairly Important
	Average RII	0.68		Important

Table 6 shows three (3) very important barriers to innovation in the Nigerian construction industry, which includes Lack of understanding of the benefit of Innovation (RII of 0.84), Cost of Innovation (RII = 0.83), Perception that the industry is doing well without innovation with (RII of 0.81). The remaining listed barrier to innovation in the Nigerian construction industry are shown to be important with RII of 0.80, 0.80, 0.79, 0.79, 0.79, 0.78, 0.76, 0.76, 0.76, 0.75, 0.73, 0.72, 0.70, 0.70, 0.69, 0.68, 0.68, 0.67, 0.65, 0.65, 0.63, 0.61, and 0.61 respectively.

Averagely all the identified barriers to innovation in the Nigerian construction industry are important with average RII of 0.73.

Table 6: Barriers to Innovation in the Nigerian Construction Industry

S/No	Barriers to Innovation	RII	Rank	Decision
1	Lack of understanding of the benefit of innovation	0.84	1 st	Very Important
2	Cost of innovation	0.83	2 nd	Very Important
3	Perception that the industry is doing well without innovation	0.81	3 rd	Very Important
4	Risk Aversion	0.80	4 th	Important
5	Lack of Resource/Capacity	0.80	5 th	Important
6	Short Term Thinking	0.79	6 th	Important
7	Type of Organisation Structure	0.79	7 th	Important
8	Lack of Skillful brainstorm facilitation	0.79	8 th	Important
9	Government Regulations	0.78	9 th	Important
10	Belief that innovation is risky	0.76	10 th	Important
11	Unwillingness to acknowledge and learn from past	0.76	11 th	Important
12	No Clear Process	0.76	12 th	Important
13	Not adopting emerging technology	0.75	13 th	Important
14	Lack of Shared Vision	0.73	14 th	Important
15	Lack of Leadership	0.72	15 th	Important
16	Lack of Collaboration	0.70	16 th	Important
17	Stagnating Mind	0.70	17 th	Important
18	Lack of Urgency	0.69	18 th	Important
19	Lack of Spare-Time to develop new Ideas	0.68	19 th	Important
20	Politics	0.68	20 th	Important
21	Constantly shifting Priority	0.67	21 st	Important
22	No Creative thinking	0.65	22 nd	Important
23	Cultural Issues	0.65	23 rd	Important
24	Lack of Support	0.63	24 th	Important
25	Lots of Idea, no delivery to market	0.61	25 th	Important
26	Lack of Focus	0.61	26 th	Important
Average RII		0.73		Important

DISCUSSION OF RESULTS

Clients play an important role in driving innovation. They can exert pressure on the design and construction team to adopt innovative designs and construction methods so that they can have value for their money. The respondents ranked clients with innovative demand as the most important driver of innovation in the construction industry.

The most important barrier to innovation as perceived by the respondents was a lack of understanding of the benefits of innovation. An understanding of the benefits of innovation is a strong motivation for innovation without which striving for innovation will be nothing but an illusion. Cost of innovation was ranked as the second most important barrier to innovation. Innovation will require some level of expertise, absence of which might hinder innovation as described by (Ogunbayo *et al.*, 2010). Perception that the industry is doing well without innovation was ranked as the third most important barrier to innovation. This is not surprising because once there is a lack of understanding of the benefits of innovation in the first instance, the potentials of innovation for improving the size, market share and profitability cannot be

understood. Hence, stakeholders will believe that the industry is doing well without innovation. The implication of findings in the study encourages construction professional to innovate, and also enable them meet up with modern trends in the aspect of construction, which in turn increase the level of efficiency and effectiveness of the Nigerian Construction Industry towards service delivery. Nevertheless, innovation barriers aforementioned have constrained construction professionals from adopting modern technology in the industry.

CONCLUSION AND RECOMMENDATIONS

The construction industry in Nigeria is a vibrant market comprising of foreign and indigenous players. The industry can increase its size, market share and profitability by adopting innovative designs and construction methods. The drivers and barriers to innovation were assessed in this study. The major drivers of innovation from the study were clients with innovative demand, productivity increase, design trends, Subsidies for Innovative application and materials and improved effectiveness. Innovation has been found to be driven by the actions of clients and challenges thrown up by emergent crises on construction projects. For firms to improve their innovation performance in response to these drivers, the study indicates that the most important strategy is to focus on relationships-building. The learning required for effective innovation is maximised via enhanced relationships and shared understandings, which give rise to knowledge multiplier effect and the development of collaborative advantage. The main barriers to innovation as perceived by the respondents from the study are lack of understanding of the benefits of innovation, cost of innovation and Perception that the industry is doing well without innovation. These barriers need to be revised and readjusted in order to overcome innovation hindrances by construction firms, so as to encourage firms to actively innovate continuously and consistently.

Based on this study the following essential recommendations are made

- i. Nigerian government should provide favourable policies that will enable construction firms to innovate.
- ii. Construction firms should endeavour to send their employees to attend workshops, seminars and other training programs that will enlighten them on new ideas, modern technologies and how to apply them. This will benefit the construction firms and the construction industry as whole.

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IMPACT OF STAKEHOLDERS ON PUBLIC PRIVATE PARTNERSHIP PROJECTS DELIVERY IN NIGERIA

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ABSTRACT

After few years of implementation of public private partnership (PPP) procurement option, there is still no appreciable progress in exploring this method to develop the critical public infrastructure. This study is aimed at assessing the impact of major stakeholders on the management of infrastructural projects in Nigeria. An interview process was used among the experts managing the PPP projects in the Nigeria and the data was analyzed using content analysis. The findings showed that government, financiers and the project management team are the most critical stakeholders that can impact on the success of the PPP infrastructure projects. This result is expected to guide the participants in managing the process.

Keywords: developing economy, project delivery, public infrastructure, public private partnership, stakeholder management.

INTRODUCTION

Construction projects are being executed with many stakeholders having many stakes and interests (Nash *et al.*, 2010). Their interests, level of influence and power varies. Project Management Institute (PMI) Standard Committee defined stakeholders as individuals and organizations who are actively involved in the project, or whose interests may be affected by the execution of the project or by a successful project (Persson and Olander, 2004). Therefore, a stakeholder has the potentials to be either a threat or a benefit to the project. Construction stakeholders are those groups and individuals that are affected by the outcome of the projects and they must be involved in the process to increase the level of collaboration (Bourne, 2010). Construction projects are being carried out in a very complex built environment and delivered in uncertain situation (Aapaoja and Haapasalo, 2014).

However, a good management of the stakeholders could lead to an outstanding project delivery (Mishra and Mishra, 2013). The involvement of stakeholders at the early stage of construction process helps increase productivity, avoid risk and eliminate rework on the project (Baharaddin *et al.*, 2018). The management of stakeholders is an essential part of the project management process (Olander, 2006). The introduction of public private partnership (PPP) method of procurement to deliver public projects in developing countries came with the hope of improving the infrastructure and economic growth. In Nigeria, public opposition to PPP projects is prevalent (Amadi, 2018) and this contributes to the low level of PPP projects implementation for infrastructural projects. However, the power and influence being held by different stakeholders could affect the outcome of PPP projects. In view of this, the objective of this study is to identify the major stakeholders and their influence on PPP projects outcome.

PPP STAKEHOLDERS

The concept of stakeholder emanated from the word “stake” which means interest that shows that other parties have interest in the enterprise (El Abboubi and Cornet, 2012). The idea of stakeholders has been known for a long time but the systemized stakeholder approach was developed in 1980s with the work of R. Edward Freeman (Peric *et al.*, 2014). This work was initiated to assist the managers through a developed framework to be responsive to the quantity and kinds of change that are occurring in business environment.

Mishra and Mishra (2013) applied the stakeholder theory to the information systems and technology. They were able to trace the origin of the theory to management literature which showed that the idea of stakeholders started with the Great Depression of United States between 1929 and 1941. At this period, the General Electric Company identified four major stakeholders as shareholders, employees, customers and the general public. The theory of stakeholder helps in the process of identifying those that are key to the success of a project and the way to manage them (Mishra and Mishra, 2013).

There are three approaches to stakeholder theory: instrumental, normative and descriptive (Colle, 2005). An instrumental approach describes the stakeholders as a path to improve corporate performance. The descriptive approach aims at improving the relationships between various stakeholder groups through the studies and analyses of the interactions. Then, the normative approach states that there is an ethical obligation on the part of managers to the stakeholders. The stakeholders to a firm were identified by Freeman in 1984 as government, competitors, customers, employees, civil society, suppliers and shareholders (Mishra and Mishra, 2013). This was also broadly classified earlier by as primary and secondary stakeholders by Freeman (Colle, 2005). The primary stakeholders are employees, stockholders, customers, suppliers and key government agencies. While the secondary stakeholders are public interests’ groups, protest groups, local communities, government agencies, trade associations, competitors, unions and the press.

Twenty-seven stakeholders were classified by Cleland on construction projects as at 1999 (Olander, 2006). They are project owners, client organization, project management team, customer user, suppliers, employees and financiers as the internal stakeholders. So, the external stakeholders identified are governments (local and national), social organizations, political organizations, local communities, general public, environmentalists, interest groups, real estate owners, nearby residents, trade and industry, social services, media and anyone who has stake in the project. These stakeholders are classified in accordance with three factors: legitimacy, power and urgency (Austen *et al.*, 2008). Twelve stakeholders were identified by Aapaoja and Haapasalo (2014) as customer, end-user, main contractor, sub-contractor, property management, main designer, other designer, public authorities, materials supplier, local resident and neighbors, construction consultant and sponsor.

RESEARCH METHODS

This study adopted a qualitative research approach and the interview process was used. The interview was conducted among the experts in public and private sectors that are actively involved in PPP projects implementation in Nigeria. The Infrastructure Concession Regulatory Commission (ICRC) of Nigeria published on its website the list of PPP projects in the country. As at 2019, there were 140 PPP projects under development and concept stage while 46 PPP

projects were in the implementation stage (ICRC, 2020). A purposive sampling technique was used to identify experts that were involved in the management of PPP projects in Nigeria. Twenty experts were identified and contacted for the study but only ten of them were available for the interview. The major questions asked are: (i) profile of the interviewees (ii) identifying major internal and external stakeholders on the PPP projects (iii) ranking their level of impact on project delivery.

However, ten public institutions participating in the management of PPP procurement process in Nigeria were involved. Letters were sent to the organizations requesting for permission to conduct interview with a key staff in their respective organisations. Then, follow up was made to those letters and only six institutions accepted to participate. Three interviews were later conducted while other three organisations responded to the interview questions through e-mails and hand written answers. For the private sector, five companies that were involved in PPP projects for infrastructural development in Nigeria and five commercial banks that were involved in financing and providing consultancy services for PPP projects were identified. Invitation letters to participate in interview sections were sent to all ten private institutions identified. Only four companies agreed and participated in the interview data collection process.

A semi-structured interview procedure was adopted where the respondents were requested to response to various study questions stated in the interview guide. The interview questions were included in the interview guide for both public and private sector. The interview questions were to address the objectives for both the public and private sectors participants. The qualitative data obtained from interview were analyzed through content analysis procedures.

However, the targeted public sector respondents for the interview sessions were the experienced public servants at the senior management level who had participated in the management of PPP procurement (Table 1). One of the interviewees (A1) was from the Federal regulatory agency for procurement under PPP arrangement and he had spent over 26 years in the construction industry. Two interviewees (A2 and A4) were from the Federal ministry/agency with construction experiences of between 28 years and 29 years. Other two interviewees (A3 and A5) were from the State ministry/corporation with 30 years and 19 years of construction experiences respectively.

The last interviewee (A6) was a PPP specialist working in the State PPP department with about 19 years in the construction industry. The targeted respondents from the private sector for the interviews were practitioners with experience and active participation in the implementation of PPP projects in Nigeria. A total of four interviews were conducted for the private sector. All the interviewees were working with the Special Purpose Vehicle companies undertaking projects under PPP arrangement in Nigeria. Two of the interviewees (B1 and B2) were heads of Units in their respective organisations. The interviewee B3 was a General Manager while the interviewee B4 was a senior officer in his company. Most of them started their construction work experiences with PPP projects.

Table 1: List of Interviewees

Code	Position and Organization	PPP Experience	Construction Experience
A1	Head of Unit, Regulatory Agency	Providing guidelines	26 years
A2	Director, PPP Unit of Federal Ministry	Coordinating projects	29 years
A3	Head of Department, State Corporation	Managing projects	30 years
P4	Deputy General Manager, Federal Agency	Managing projects	28 years
A5	PPP Analyst, State Ministry	Supervising projects	19 years
A6	Specialist Project Manager, State PPP Unit	Projects Advisor	19 years
B1	Head, PPP Unit, Special Purpose Company	Road project	10 years
B2	Head, Legal Unit, Special Purpose Company	Road project	10 years
B3	General Manager, Special Purpose Company	Airport Terminal project	9 years
B4	Senior Officer, Special Purpose Company	Airport Terminal project	12 years

(Source: Author, 2020)

RESULTS

This section presents the results of the interview conducted on the public sector participants managing the PPP projects. The results of this study showed the critical stakeholders in the management of the PPP project life cycle and the key participants are very important to the delivery process. The respondents are very experience people in the management of the projects under PPP and their opinions are very useful to this study. Their construction experiences range from nine to thirty years and they had participated in the critical aspects of the process. They have been managing, co-ordinating and advising on the PPP projects implementation and deliveries. The findings from the engagement of these experts on the stakeholder's management of the delivery process are presented below.

Identifying PPP Stakeholders

The study identified twenty stakeholders that are important to the delivery of PPP projects (Table 2). They are project owners, client organisation, project management team, customer user, suppliers, employees, financiers, government, social organisations, political organisations, local communities, general public, environmentalists, interest groups, real estate owners, nearby residents, trade associations, social services, media and any other interested party. These variables were later ranked by the interviewees to show the level of impact of the stakeholders on the PPP projects.

Influence of Stakeholders on PPP Projects

The results showed that five most important stakeholders on the PPP projects delivery are government, financiers, project management team, employees and client organisation with weighted averages of 2.20, 2.25, 4.17, 4.20 and 5.00 respectively. The other stakeholders ranked and their weighted averages are: customer user (5.20), local communities (5.50), general public (6.00), suppliers (6.40), interest groups (6.75), social organisations (7.00), project owners (7.00), nearby residents (7.60), political organisations (8.83) and trade associations (9.50). However,

the least important stakeholders are environmentalists (10.25), media (10.67), real estate owners (11.00), social services (11.57) and any interested party (12.00).

Table 2: Identifying Stakeholders

Stakeholders	Interviewees										Total Responses
	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	
Project Owners					√						1
Client organisation		√	√	√	√		√	√	√	√	8
Project Management Team	√	√		√		√		√		√	6
Customer User			√		√		√		√	√	5
Suppliers	√	√		√			√		√		5
Employees	√	√	√	√	√	√	√	√	√	√	10
Financiers	√	√	√	√	√	√	√	√	√	√	10
Government	√	√	√	√	√	√	√	√	√	√	10
Social organisations		√	√		√		√	√	√		6
Political organisations	√	√	√	√					√	√	6
Local communities			√	√		√		√			4
General public	√	√	√	√	√	√	√	√	√	√	10
Environmentalists		√	√	√			√				4
Interest groups	√					√			√	√	4
Real estate owners		√	√	√		√					4
Nearby residents	√				√		√	√	√		5
Trade associations		√		√	√	√					4
Social services		√	√	√	√	√	√			√	7
Media	√	√		√		√	√	√			6
Any interested party						√					1

(Source: Author, 2020)

The results showed government involvement and intervention is most critical for the successful implementation of the infrastructure projects using PPP as procurement option. This ranked as number one among the stakeholders that impact on the PPP process. This is followed by financiers as second most important stakeholder and this showed that the availability of funds is very critical to implementation of PPP projects. The financial institutions within the country must be capable of supporting and providing long term funding for the system.

However, the results also showed that real estate owners, social services within the project's vicinity and any other interested party have very little impact as stakeholders on the management and delivery of PPP projects for infrastructure in the country.

Table 3: Level of Stakeholders' Impact on PPP Project Delivery

Stakeholders	Interviewees										Weighted Average	Rank
	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4		
Project Owners					7						7.00	12
Client organisation		1	3	5	6		4	6	9	6	5.00	5
Project Management Team	3	2		4		6		5		5	4.17	3
Customer User			4		5		5		8	4	5.20	6
Suppliers	4	6		9			6		7		6.40	9
Employees	5	5	6	3	3	5	3	3	6	3	4.20	4
Financiers	1	4	5	1	2	4	1	1	5	1	2.50	2
Government	2	3	1	2	1	3	2	2	4	2	2.20	1
Social organisations		9	8		4		7	4	10		7.00	11
Political organisations	8	10	9	8					11	7	8.83	14
Local communities			7	7		1		7			5.50	7
General public	6	11	2	6	8	2	8	8	1	8	6.00	8
Environmentalists		12	10	10			9				10.25	16
Interest groups	9					7			2	9	6.75	10
Real estate owners		13	11	11		9					11.00	18
Nearby residents	7				9		10	9	3		7.60	13
Trade associations		8		12	10	8					9.50	15
Social services		14	12	13	11	10	11			10	11.57	19
Media	10	7		14		11	12	10			10.67	17
Any interested party						12					12.00	20

(Source: Author, 2020)

CONCLUSION AND RECOMMENDATIONS

The study was able to identify the key stakeholders that are critical to the management and implementation of PPP projects in a developing economy. The three main stakeholders are the government, financiers and project management team. This outcome could guide the public officers in decision making process for the delivery of infrastructures and managing the whole process of projects delivery.

The private sector willing to participate in the public projects through PPP are also to take the parameters as a guide to undertake such projects in the interest of the public while maintaining return for investment. This study is a preliminary stage of the research process in the stakeholder's management on PPP projects for infrastructure in Nigeria. The other aspects of the study shall utilize the quantitative research approach which will involve more respondents and experts.

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ASSESSMENT OF HEALTH AND SAFETY TOOLS USED ON CONSTRUCTION PROJECTS IN LAGOS STATE, NIGERIA

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ABSTRACT

Health and safety tools are equipment that protect the human body from chemical, physical, electrical, infectious and biological hazards during construction process. Hence the attitude of construction workers towards the usage of safety tools determines the frequency of injury to be sustained. The purpose of the paper is to assess the health and safety tools used on construction site. A total number of 140 questionnaire were distributed among artisans. The research work was based on construction activities carried out on twenty (20) construction sites. The data collected were analyzed using factor analysis, mean score and standard deviation. The result shows that safety boots, safety gloves and breathing protective wears were the most utilized health and safety tools on construction site by artisans. Four factors were extracted from the factor analysis. The study concluded that various identified health and safety tools were moderately used by construction workers on construction site. The study recommends that in order to enhance the usage of health and safety tools, health and safety personnel should sensitize construction workers on the dangers of not complying with health and safety measures on construction site.

Keywords: Construction site, Construction workers, health and safety, tools

INTRODUCTION

Construction workers attitude towards the use of health and safety tools has been explored from different perspectives. Al-Kilani (2011) described that construction workers sustain injuries on some part such as hand, leg, skin, eyes and other part of the body which is a result of not using personal protective equipment (PPE) on site. According to Fauzania, Aryanti, Dalil and Putri (2018), health and safety tools are mostly used in large construction projects and most of the construction workers do not comply to the use of health and safety tools which are as a result of no provision of this tools by the construction companies. Mamin, Dey and Das (2019) corroborate that most construction workers do not comply to the use of Personal Protective Equipment (PPEs) in construction sites. Eyiah, Kheni and Quartey (2019) opined that most of construction site operatives and site managers lack adequate knowledge about the use and maintenance of PPEs. Construction workers find it hard to use PPEs as a result of discomfort when wearing them or due to their first experience in using this equipment such as eye goggles hard hats, hand gloves, protective overall, safety boot, safety harness (Eyiah *et al.*, 2019). Vitharana, Subashi and Silva (2015) identified that workers' dislike to the use of PPEs on construction sites to be one of the causes of poor health and safety practices. Ahmad, Balkhyour and Rehan (2018) noted that most PPE equipment are badly managed, poor and are inadequate among workers. Williams, Razil and Mohd (2017) therefore noted that the non-compliance to the use of PPEs has endangered construction workers to hazard and has effect on their safety. However, Ismail, Doostdar, and Harum (2012) noted that knowledge of workers on how to use the right equipment or tools of PPE would reduce risks on site.

Okoye, Ezeokonkwo, and Ezeokoli (2016) opined that good compliance level of construction workers to health and safety rules increases their performance in the construction companies thereby reducing the accident on site on site. Hassan, Basha and Hanfi (2007) stated that construction workers non compliance to health and safety measures increases the rate of accident on construction sites and compliance to health and safety measures increases the productivity of construction industry. Unfortunately, many construction companies do not follow strict health and safety measures. Thus, construction workers compliance to health and safety measures should be addressed to reduce the rate of hazard on construction site. This problem therefore calls for a self-examination on the reliability of our health and safety techniques. If these safety precautions are effective, there would have been drastic reduction in the rate of hazard which have claim the lives of many people. The focus of this study therefore is to assess various health and safety tools used on construction projects in Lagos State, Nigeria with an objective to know the level of usage of the various health and safety tools identified.

LITERATURE REVIEW

Health and Safety Measures in Construction Industry

According to Muiriru and Mulinge (2014), health and safety tools are equipment's that protects the human body from chemical, physical, electrical, infections and biological hazards which includes helmets, eyes goggles, hard hats, safety boots. Vitharana et al., (2015), identified some of the health and safety tools such as gloves, hard hat, safety wears, safety boots. Laryea and Mensah (2010), identified PPE equipment as helmet, safety wear, eye protection and earmuffs. Akinradewo and Arijeloye, (2019) stated some of the health and safety tools includes first aid box, dust mask, eyes protection, safety boots, safety gloves, clover rails. Although Slips, trips and falls are an ever-present hazard within most workplaces and safety footwear can play its part in preventing injury, particularly from slips, by featuring slip resistant. Kobayashia, Hashizumec, Hobarac, Anzaia, Nakajimaa and Mishimab *et al.* (2019) defined safety boot as a tool designed to protect the users from accident that might occur while caring out their special duties. Vitharana *et al.* (2015) noted that wearing of safety boot on construction site reduce injuries that might occur on site. Safety boot can be classified into pullover and shoe boot and consist steel sole, steel toe cap, steel shanks to enable easy movement of workers on certain height. Also, Eyes and face protective i.e. eyes google, face goggle and face shield are for protection against any physical hazard such as flying objects, protection against ultraviolet during welding, chemical hazards such as dust either from cutting of objects like asbestos, tiles etc. A face goggles should be available and provided for construction workers. A face goggle and a face shield are not recommended for use unless it is needed. Example of a case of grinding wind cuttings that involves flying particles or corrosive materials.

Personal Protective Equipment (PPE)

The construction environment is mostly noisy due to the use of industrial equipment around the working stations some of these ear protections includes earmuffs, ear plugs. Tavakolizadeh, Kianmehr, Yalmeh , and Bahalgardi, (2019) described earmuffs as one of the PPEs used for the protection of the ear auricles and the prevention of sound waves entering the ear. These sound waves can cause a mental or a physical complication to the human body. Muggleton, (2019) stated that noise from these nearby machines and equipment cause damage permanently to the workers if appropriate protection for the ear is not provided by the employer. Earmuffs protect the ear from noise that can damage the ear in areas where there is high volume of grinding

machines, drilling machines, piling, jack hammer, etc. Also, Protective clothing and wears protect the body against for protection against chemical in either a solid or in a liquid state, a protective wear must be durable and protect the human body against any form of hazard. Watson, Troynikov and Lingard (2019) opined that protective wears should provide protection to the workers and enhance easy access for kneeling, bending, stretching, and breathing which must cover the whole body from the torso to neck, the leg to the ankles, the arms to the wrist and the fabrics should be easy to wash. There are different designs and materials suitable for making of protective wears depending on the nature of job been carried out, some of the materials are made up of Tyvek or Nomex, butyl rubber, neoprene, and PVC to protect the body against toxic materials like acid. All protective wears must be properly seamed and have a sealed zipper to protect against vapors. But hard hat is aimed at protecting the hazard of hard object falling from height which can cause damage or fracture to the human brain or skull and, can serve as a protection against a corrosive or molten metal, electric shock and burns from hot splashes. Hernandez (2015), further described hard hat as a rigid plastic shell that prevent knocks and electric shock on the head. It consists of a suspension system attached to the inside with different connections that serve as absorber and enhance easy movement to the ear without damage to the human head. According to Ogundipe (2017), safety helmet consists of a reinforced rim, a rain gutter and a rear gutter. Helmet have a safety visor that can be easily pushed if required.

The PPE hand gloves protects workers from the risk of hazards from cuts chemical effects, electric shocks. Asumeng, Asamani, Afful and Agyemang (2015) explained protective gloves as an equipment that decrease the exposure of the skin to any form of microorganisms and prevent exposure to biological hazards. A protective hand gloves must have ability to resist slippery and be able to use and reuse. A protective hand gloves must not be hard on the skin that is why they are made up of materials like cotton, nylon, latex or leather because of their touch to the human skin. Although care must be taken while carrying out some construction works like fixing of machines parts, cutting of tools do not allow the use of gloves. However, some of the construction work challenges is working at height. There are many chances of falling at those height if maximum care is not taken. Therefore, health and safety regulations therefore workers should therefore adopt the use of safety belt while climbing height and there should be used with an appropriate scaffold and guardrails for a suitable movement, breathing protective wear is used to control the airborne and respiratory system of workers due to airborne contamination from chemicals and dust. An escape pack should be used with an air purifying system while using a protective wear.

RESEARCH METHODOLOGY

This section explains the method of data collection for the study and the method used in analysing the data obtained from field work. Questionnaires were administered to artisans on construction site in order to assess various health and safety tools used on construction site within the study area. The target population for the study includes 20 construction sites involved in construction projects but located in Lagos State, Nigeria. The sample frame for the study includes construction workers such as carpenters, plumbers, welders, painters, tiler, electricians, and bricklayers involved in construction projects. Since there are no registered data for workers in the construction industry, the sample were adapted from the study of Diugwu, Baba and Egila (2012). Cochran's formula 1997 was used to get the randomly selected questionnaires which

were distributed. Total number of 140 questionnaire was distributed among the 20 construction sites. Table 1 shows the sample size of respondents.

Table 1: Research size of respondents

S/N	Respondents	Sample Frame	Sample size
1	Carpenter	23	20
2	Plumber	21	20
3	Bricklayer	47	20
4	Painter	21	20
5	Welder	38	20
6	Electrician	20	20
7	Tiler	24	20
	Total	194	140

Source: Researcher analysis (2018)

A well-structured questionnaire with close-ended questions was designed based on the health and safety tools identified from reviewed literature with the aim of assessing the health and safety tool used on construction projects. Two sections were provided with the first planned to elicit information regarding personal data of the respondent and their organization. The second section was constructed to obtain information regarding the opinion of the respondents on the level of health and safety tools used on construction site. 5-point Likert scale was adopted in seeking their opinion on the level of usage of each tool identified. Due to inability to reach some of the listed contractors and professionals, convenience sampling was adopted as the sampling technique for the study. A total of 140 questionnaires - representing the sample size - were administered from which 90 questionnaire was retrieved and 80 was valid due to double ticking and omission of some part of the questionnaire by the respondent. 80 questionnaires were used for the analysis (representing 57.14% of the sample). Cronbach's alpha (α) was computed to test the reliability of the 5-point Likert. Results of the analysis indicates a value of 0.788. Since the degree of reliability of the instrument is more perfect as the value tends towards 1.0 (Moser and Kalton, 1999), it can be concluded that the instruments used for this research are significantly consistent and reliable. For the analysis, mean item score (MIS), standard deviation and Factor analysis was computed from the Likert scale and the values were employed to determine the level of usage and rank of the identified variables.

DATA ANALYSIS AND PRESENTATION

Background Information

The first section of the questionnaire was designed to provide background information of the respondents such as the gender, years of construction experience, age range, category of work, level of education and the occupations of respondents while the other sections were designed to collect data for the objectives of this research.

The sample size of 140 questionnaire was distributed among the artisans, 90 questionnaires was retrieved and 80 was valid due to double ticking and omission of some part of the questionnaire by the respondent. 80 questionnaires were used for the analysis (representing 57.14% of the sample). The statistical analysis of the data obtained was analyse using statistical package for social sciences (SPSS), Table 2 shows the characteristics of various respondents used for the studies.

Table 2: Characteristics of respondent

Factors	Variables	Frequency	Percent %
Gender	Male	80	100.0
	Female	0	0
	Total	80	100
Years of Construction Experience	0-5	18	22.5
	6-10	30	37.5
	11-15	16	20.0
	16-20	6	7.5
	20-24	6	7.5
	25 And Above	4	5.0
	Total	80	100.0
Age Range	20-25	18	22.5
	26-30	19	23.8
	31-35	17	21.3
	36-40	10	12.5
	41-45	5	6.3
	46 And Above	11	13.8
	Total	80	100.0
Categories of Work	Skilled Labour	65	81.3
	Semi- Skilled Labour	15	18.8
	Total	80	100.0
Highest Level of Education	Primary School	14	17.5
	Secondary School	22	27.5
	NCE	7	8.8
	ND	21	26.3
	No Formal Education	5	6.3
	Others	11	13.8
	Total	80	100.0
Occupation	Plumber	10	12.5
	Bricklayer	18	22.5
	Painter	8	10.0
	Carpenter	10	12.5
	Electrician	14	17.5
	Welder	13	16.3
	Tilers	7	8.8
	Total	80	100.0

Authors field work (2018)

Table 2 revealed that 80 numbers of male filled the questionnaire while zero number of females filled the questionnaire. This show that due to the nature of work, it's mostly dominated by the male rather than male and female. Table 2 also indicates the years of construction experience of the respondent. 22.5% of the respondent have between 0-5years experience in the construction

industry, 37.5% have between 6-10 years in the construction industry, 20% of the respondent have between 11-15 years of experience, 7.5% of the respondent have between 16-20 years of experience, 7.5% of the respondent have between 20-24 years of experience and 5% of the respondent have more than 25 years of experience in the construction industry. Table 2 reveals the age range of the respondent. 22.5% of the respondent are within the age range of 20-25 years, 23.8% are within the age range of 26-30 years, 21.3% are within the age range of 31-35 years of age, 12.5% are within the age range of 36-40 years of age, 6.3% are within the range of 41-45 years and 13.8% of the respondents are 46 years and above.

Table 2 also shows the category of work of the respondents. 81.3% of the respondent are skilled workers and 18.8% of the respondent are unskilled worker. Table 2 also shows the level of education of the respondents. The result depicts that 17.5% of the respondent attended primary school, 27.5% are secondary school holder, 8.8% are NCE holder, 26.3% are ND holder, 6.3% have no formal education and about 13.8% have various level of education not listed under this such as; technical school. Finally. Table 2 represent the occupation of the respondent. The result shows that 12.5% of the respondent are plumber, 22.5% are bricklayers, 10% are painter, 12.5% are carpenters, 17.5% are electricians, 16.3% are welder and 8.8% of the respondent are tiler.

Level of usage of health and safety tools

Table 3 depicts the level of usage of health and safety tools. The tools with the highest level of usage is safety boot with the mean score value of 3.90 followed by safety gloves and breathing protective wears with the mean score of 3.79 and 3.79 respectively. While the tools with the lowest level of usage are eyes cover, earmuffs and earplugs with the mean score of 2.75, 2.73 and 2.35. They are critically low due to their mean score that falls under a 2 point.

Table 3: Usage of Health and Safety Tools

Tools	Mean	Rank
Safety boots	3.90	1
Safety gloves	3.79	2
Breathing protective wears	3.79	2
Ladders	3.78	4
First aid box	3.69	5
Protective wears	3.64	6
Hard hat	3.44	7
Eye goggles	3.43	8
Scaffolds fall protection and guard rails	3.36	9
Safety belt	3.21	10
Safety and warning signs	2.91	11
First aid training	2.85	12
Fire safety training	2.83	13
Eye cover	2.75	14
Earmuffs	2.73	15
Ear plugs	2.35	16

Authors field work (2018)

Factor Analysis for Level of usage of health and safety tools among Construction Workers

Table 4 represents Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO). A general rule of thumb is that a KMO value should be greater than 0.5 for a satisfactory factor analysis to proceed. By observing the above results, the KMO is 0.789, therefore factor analysis can be used.

Table 4: KMO Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.789
Bartlett's Test of Sphericity	Approx. Chi-Square	513.555
	Df	120
	Sig.	.000

Authors field work (2018)

Bartlett's Test of Sphericity was also carried out to show if there is a relationship between the variables. A p value < 0.05 indicates that it makes sense to continue with the factor analysis. Since the $p < 0.001$ it can be concluded that there are relationships between the variables. Variance Table The principal component analysis shows that only four factors have eigenvalues greater than 1 as shown in the Eigenvalue total column. Component 1 of the measures have the highest eigenvalue value of 5.284 which accounts for 33.027 per cent of the cumulative variance, followed by 2.319 loaded factor on 14.492, 1.221 loaded 7.630 The criteria for the measure selection in Eigenvalues is greater than 1, therefore the fourth factor 1.048 explain a cumulative load of 61.696 per cent of the variance of the data. The degree of freedom DF of Kaiser-Meyer-Olkin component for the level of usage of health and safety tools is 120.

Table 5: Rotated Component Matrix

Factors	Component				Extraction
	1	2	3	4	
First aid training	.851				.540
Eye cover	.770				.508
Safety and warning signs	.734				.380
Fire safety training	.721				.583
Safety boots	.410				.708
Ear plugs		.819			.703
Earmuffs		.753			.807
Scaffolds fall protection and guard rails		.731			.703
Eye goggles		.632			.755
Protective wears			.728		.454
Safety belt			.664		.602
First aid box			.566		.689
Ladders			.507		.593
Breathing protective wears			.494		.688
Safety gloves				.673	.365
Hard hat				.584	.792

Extraction method: principal component analysis

Rotation method: varimax with Kaiser normalization.

Authors field work (2018)

Table 5 above shows the rotation converged in 4 iterations. Rotation has shown that each of the variables load onto four different factors. The name given to each of the factors is listed below; **Factor 1** is named safety and training tools. The factor accounts for 33.027 and consist of variables such as first aid training with load factor of 0.851, eye cover with load factor of 0.770, safety and warning loading 0.734, fire safety training with loading factor of 0.721 and safety boots with load factor of 0.753.

Factor 2 is named ear and eye safety tools. The factor accounts for 14.492 and consist of variables such as ear plugs which load heavily on the tools with a load factor of 0.819, earmuffs with a load factor of 0.753, scaffolds fall protection and guard rails with a load factor of 0.732 and eye goggle with load factor of 0.632

Factor 3 is names safety wears and welfare tools. The total factor load account for 7.630 and consist variable such as protective wears with the highest load factor of 0.728, safety belt to have the second highest load factor with 0.664, first aid box with load factor of 0.566, ladders with load factor of 0,507 and breathing protective wears with the lowest load factor which is 0.494

Factor 4 is named hand and head safety tools. The total factor load account for 6.547 which consist of safety boot with its highest load factor of 0.673 and hard hat have a load factor of 0,584. Thus, for the analysis of regression these four factors were used based on a need to regress the dependent variable against the independent variables.

Table 6: Reduced Component for level of usage of health and safety tools among Construction workers

Factors	Variables	factor loading
Safety and Training tools	First aid training	0.851
	Eye cover	0.770
	Safety and warning signs	0.734
	Fire safety training	0.721
	Safety boots	0.410
Ear and Eye safety tools	Ear plugs	0.819
	Earmuffs	0.753
	Scaffolds fall protection and guard rails	0.731
	Eye goggles	0.632
safety wears and safety tools	Protective wears	0.728
	Safety belt	0.664
	First aid box	0.566
	Ladders	0.507
	Breathing protective wears	0.494
Head and Hand safety tools	Safety gloves	0.673
	Hard Hat	0.584

Authors field work (2018)

DISCUSSION OF FINDINGS

Considering the level of usage of health and safety tools by the construction workers during the stages of construction, information retrieved shows there is a wide difference from the level of usage of some safety tools to others having higher score than the other. Use of safety boots, safety gloves, and breathing protective wears, have moderate mean score of 3.90, 3.79 and 3.79 respectively and usage of safety tools such as Ear plugs, Earmuffs, Eye cover and fire safety training have the lowest mean score of 2.35, 2.73, 2.75, and 2.83 respectively. Akinradewo and Arijeloye (2019) findings revealed that eye protection has a low usage among construction workers. Agreeing with the work of (Al-Kilani, 2011), injuries are sustained by construction workers as a result of not using their equipment rightly. This therefore shows that the level of usage of health and safety tools among construction workers is moderate and low has less priority is given to the usage of some of the tools. In support of this, Mamin *et al.* (2019) stated that most construction workers do not comply to the use of Personal Protective Equipment (PPEs) on construction sites. From the construction sites visited, some of the construction workers attested their level of knowledge to the health and safety tools but do not comply to the use of some tools due to the discomforts when using some of them but they are rather convenient to the use of safety boot, and safety wears. The study of Waziri, Hamma, Adama and Kadai (2018) agreed with this that the health and safety tools commonly used among construction workers are reflective vest, hard hat and safety boots and this are due to the nature of their work.

CONCLUSION AND RECOMMENDATION

The paper draw conclusion from the finding by identifying the level of usage of the following health and safety tools among construction workers which are: safety boots, safety gloves, breathing protective wears, ladders, protective wears, first aid box and protective wears have moderate level of usage. Likewise, in a decline manner, this study found out that hard hat, eye goggles, scaffolds fall protection and guard rails, safety belt, safety and warning signs, first aid training, fire safety training, eye cover, earmuffs, and ear plugs have low level of usage among construction workers. Also factor analysis was carried out and four factors were extracted namely Safety and Training tools, Ear and Eye safety tools, safety wears and safety tools and Head and Hand safety tools. The paper therefore recommends that construction workers should be sensitized on the importance of safety on site. Also, trainings and workshop should be organized by health and safety organization to orientate workers on the need and the benefits attributed to complying with health and safety measures.

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APPRAISAL OF THE LEVEL OF AWARENESS ON HEALTH AND SAFETY MEASURES AMONG CONSTRUCTION WORKERS IN LAGOS STATE, NIGERIA

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ABSTRACT

Health and Safety is an area that is concerned with ensuring the safety, health and welfare of construction work. In addition, employer or client is saddled with the responsibility of implementing health and safety law and regulation as well as providing a safe working environment for the workers and ensure strict obedience to safety practices. The aim of this paper is to assess the level of awareness and compliance of health and safety measures among construction workers in Lagos State, Nigeria. This study was achieved through a questionnaire survey method, administered to construction workers which includes; carpenters, plumbers, bricklayers, painters, welders, electricians and the tillers using statistical software (SPSS 23.0) Statistical Package for Social Sciences which encompasses tool such as mean, frequency, percentile, standard deviation and ranking. The findings of the study indicate that there is high level of awareness on the need to frequently examine of scaffolds before use on site is high (4.71) while the level of participation in health and safety education or workshop is low (3.06). The study shows that the level of awareness on Regular usage of safety signs and signals, and safety posters on site and Participation in health and safety education or workshop is very low among the construction professionals. Based on the aforementioned, there is need to increase the level of awareness on other forms of health & safety measures available to construction projects.

Keywords: Construction, Environment, Employer, Health and Safety, Regulation.

INTRODUCTION

Health and Safety is an area that is concerned with ensuring the safety, health and welfare of construction works engaged in work (Idubor & Oisamoje, 2013). According to International Labour Organisation (ILO) (2008), employers, workers and stakeholders are to contribute in securing a safe working environment. In addition, Famakin & Fawehinmi, (2012) noted that the employer or client is saddled with the responsibility of implementing health and safety laws and regulations as well as providing a safe working environment for the workers and ensure strict obedience to safety practices. Muiruri and Mulinge (2014) opined that in most developing counties, the practices of competitive tendering thereby awarding of most public contract to the lowest bidder induces contractor to drive their bidding cost low which have effect on the health and safety. Okolie and Okoye (2013) opined that the level of compliance of the construction industry to health and safety regulations in developing country is below expectation. Nigeria as a developing country has not been putting into practice these rules that guides both employer and workers due to no existing functional legislation to effect (Okolie and Okoye, 2013). Siyanbola, Adewale and Siyanbola (2014) corroborate that the record of death and injuries on construction site can be reduced when there are an effective and efficient laws that guides the construction workers. Considering the contribution of health and safety to the economy, there is a need to investigate the issues of health and safety in construction. It will be of great advantage to the, organizations and stakeholders in the construction industry and federal Government to

engage in processes that reduce the rate of happenings in the sector. Hence, this study aims at investigating the level of construction workers awareness to health and safety measures on construction site in the study area.

LITERATURE REVIEW

The Construction Industry

Employers are saddle with the responsibility of protecting the safety and health of all members of the organization from injuries, ill health, diseases and incidents at work. ILO (2001) stated that all practices of occupational health and safety should be consulted and participated fully by workers and all representatives on sites. Alli (2008), assert that employers can contribute to reducing the number of accident and are responsible for ; Training for managers, supervisors and personnel officers, conducting survey on working equipment, keeping of records, prepearing adequate warding, interpreting the data gathered during health and safety survey, preparing adequate control measures, suggesting prequations where danger exist, conducting epidemological studies to reveal the presence of occupational related illness or injury, and educating workers and the community at large on basic occupational health and safety.

According to Muiruri *et al.* (2014), some of the safety measures to be taken into considerations include; health and safety warnings, first aid kits and accident reporting, proper site layout, use of correct personal protecting equipment, health and safety training on construction site, and welfare awareness. According to Agbede, Manu, Agbede, and Mahamadu (2012), some of the health and safety measures to be carried out on construction site include; carrying out site health and safety inspection regularly, training programme for site workers, carrying out site health and safety inspection regularly, preparation of health and safety plan for every construction projects, provision of sanitation and welfare facilities on construction site (toilets), site inductions for workers providing health and safety supervisor on site. Vitharana, Subashi and Silva (2015) opine that most construction workers fail to comply with the health and safety practices. The health and safety measures stated include: conducting training facilities, availability of safety equipment, awareness of health and safety regulation, appointment of safety officers on site, implementation of safety management etc. Ogundipe, Owolabi, Olanipekun, Olaniran, Akuete and Fagbenle (2018) also stated some health and safety measures to be conducted on construction site which involves; daily safety briefing, availability of welfare facilities, training of staffs and workers, engaging safety managers on site, safety guidelines on sites, the use of personal protective equipment e.t.c. Thus, some of these health and safety practices stated above will serve as a guide in caring out the research work.

Safety Measures

According to Alston & Millikin,(2016) Personal Protective Equipment (PPEs) prevent exposure of employee to chemical and physical hazards. Muiruri *et al.* (2014) corroborate that PPEs equipment are protecting clothing, helmets, protecting clothing, or other equipment proposed to protect the body from damage from heats, chemicals, electric hazards, infections. According to Ahmad, Sattar and Nawaz (2016), PPEs serve as blockade between a worker and hazard in a working environment. In construction sites, the PPE required include respiratory protection, face protection, eyes protection, head and body and fall protection from mechanism, Foot and leg protection. However, Protective equipment and clothing should comply with the standards set

by the competent authority. The employer should therefore provide their workers with the appropriate means to enable them to use the individual protective equipment effectively. Asumeng, Asamani, Afful, and Agyemang (2015) noted that while considering the use of PPE, it must be based on the type of environment and the the assessment of risk involed. Vitharana, Subashi and Silva (2015) identified some of the PPE equipment such as; gloves, hard hats and eye goggles. Laryea and Mensah (2010) identified some of the PPEs to be hard hats/helmet, safety boots/footwear, protective clothing's, gloves, and eye protection. Wright, Adhikari, Yin, Vogel, Smallwood and Shah (2019) described some of the PPE to be safety shoes, gloves, safety googles, hardhat, earmuffs/earplugs.

Site Planning

According to Al- Kilani (2011), health and safety planning is carried out to prevent unintended events and accients on construction site are unplanned events that occur on site. A badly planned and untidy site is the underlying cause of many accidents on construction site due to restrictions in space. There are many accidents due to falling over materials which have been left underlaying, stepping on metals or on nails projecting from timbers. Dodo, Mansir, Buhari, Manzuma, and Andrew (2011) affirm that the aim of health and safety plan is to increase the level of construction workers menal, phisical and social well-beign. Fakele, Quezon, Yolente and Macarubbo (2016) noted that a safety check can be carried out by the worker to ensure a safe working environment before the start of an operation and a corrective action plan to look into any unsafe situation that can lead to hazards of any workers. Kabir (2015) assert that the health and safety plan is aimed at promoting the degree of construction workers mental, physical and social wellbeing. It involves protecting workers from any hazard adverse to human health. Thus, adequate planning by personnel during site layout should considered for a safe working premises.

Health and Safety Training on Site

According to Mamin, Dey and Das (2019) health and safety trainings can be referred to as a means of ensuring safety at work and preventing workers from any form of injury. These training lies on how the workers understand dangers and believe that safety measures are useful. Alston *et al.* (2016), described health and safety training as a means of passing knowledge and teaching skills to perform work successfully and safely. Harries (2012) corroborate that inductions and trainings conducted for new recruits or workers on construction sites gives them awareness on the likely hazards that might occur and how to avoid or prevent the rate of accidents from happening. Skeeper and Mbohwa (2016) stated that workers need to be properly trained in the use of different safety equipment. Occupational safety and health administration OSHA (2016) noted that health and safety trainings are organized for workers to understand how the program of works is carried out and to understand each responsibility assigned to each under their program of works. Existing workers and new recruits need to be instructed in the safety aspects of their work and kept under close supervision to ensure that they have fully understood the dangers and how to avoid them. This instruction passed must be supported by use of effective materials and practical training method, information about potential hazards and control. Harries (2012) opined that some specific training for employees make them perform their duties effectively. Some of these activities in construction site that needs special trainings include first aids training, overhead crane operation, inspecting of scaffold, forklift truck driving, and health and safety inspection. Skipa (2011), noted that health and safety trainings can be carried out by showing

videos, a television broadcast, or by an internet-based resources which is usually conducted by the health and safety members, supervisors, managers and the employer. Specific training materials should be developed by employers to assist in poorly protected sectors, and emphasis should be placed on the training of trainers. (Alli, 2008)

Health and Safety Warning Signs

Safety signs and signals are one of the means of communicating health and safety information to workers. These includes the use of directories, signboard's, posters or pictures, acoustics design (e. g fire alarms), warning signs, sign for fire exist, firefighting equipment (e. g fire extinguishers). It is therefore important all safety signals and sign should be easy to understand by both skilled and unskilled workers. All signboards used in the workplace should be placed where accessible, large and clear, easy to interpret. Too many signboards in a workplace should be avoided in a proximity, because they can only be effective when seen and understood.

First Aid Kits and Accident Reporting

According to Muiruri *et al.* (2014), first aid and rescue equipment should be made available in every construction site because of the risk associated with them. The type of first aid equipment needed depends on the number of employees and the size of the site. However, blanket and a stretcher should be provided but on a large site with over 200 employees, adequate equipment should be provided with trained personnel to see to the health of their workers. Skipa (2011) stated that organizations and firms should oversee and evaluate their safety effort as well as keep records of any form of hazard on site which should be audited periodically. Niel, Bennie, and Cheung (2013) assert that health and safety report on accident should be reported by organization and construction company to the stakeholders. In an occasion of accident on site, facts and causes of the accident should be looked into and actions should be taken to avoid subsequent accident in the future

RESEARCH METHODOLOGY

Analyzing and data in a form that aim to put together relevance of the purpose for the economy, hence Data was collected using a well-structured questionnaire and the method employed in the analysis of data include mean ranking, percentage and relative index. The (5) five-point likert scale method of designing questionnaires was adopted. It was categorized as follow: "very high, high, moderate, low and very low", however the research is focused on the level of awareness and compliance on health and safety measures among construction workers in Lagos State, Nigeria. However, 20 construction sites located in Lagos State involved in construction projects were visited due to the easy access to data collection and construction projects located at those areas and firms located which involve skilled workers. The sample frame was limited to construction workers such as carpenters, plumbers, welders, painters, tiler, electricians, and bricklayers involved in construction activities in the selected sites, since there are no registered data for workers in the construction industry, the sample was adapted from the study of Diugwu, Baba, and Egila (2012). Table 1 represents the sample frame of respondents used for the study.

Table 1: Sample frame

Workers	Total frame
Carpenter	23
Plumber	21
Bricklayer	47
Painter	21
Welder	38
Electrician	20
Tiler	24
Total	194

Source: Researchers' Analysis (2019)

Thus, questionnaires were distributed among construction workers who are involved in the construction industry. Cochran's formula 1997 was used to get the randomly selected questionnaires which were distributed. Total number of 140 questionnaire was distributed among the 20 construction sites. 1 head of operation for each department or trade of work

$$n = \frac{Z^2 pq}{(e)^2}$$

Where,

Z =Confidence level 95% = 1.96, P= estimated proportion 40%, q = 1-P.

e = level of precision which is $\pm 10\%$.

Table 2 represents the sample frame of respondents used for the study.

Table 2: Number of construction projects

Workers	Numbers of construction projects
Carpenter	20
Plumber	20
Bricklayer	20
Painter	20
Welder	20
Electrician	20
Tiler	20
Total	140

Source: Researchers' Analysis (2019)

Random sampling technique was selected due to the scope of the research and to ensure that all members of the population have equal opportunity of been selected in the study. The questionnaire for the research work was a multiple-choice type with different tables and checkboxes. The questionnaire has 4 sections. Section A consist of the background information about the respondent, section B consist of question about level of awareness and compliance to health and safety measures on construction site. The primary data collection was adopted. The questionnaire was distributed and self-administered to the construction workers on site to have personal relationship with the workers. Mean ranking and factor analysis were used to analyse the result with the aid of statistical package for social sciences (SPSS 22). The questionnaire was structured by using a five-point Likert scale to measure a range of opinions from strongly Disagree, disagree, undecided, agree and strongly agree (on 5 to 1point scale).

DATA PRESENTATION AND ANALYSIS

Background Information

The first section of the questionnaire was designed to provide background information of the respondents such as the gender, years of construction experience, age range, category of work, level of education and the occupations of respondents while the other sections were designed to collect data for the objectives of this research.

The sample size of 140 questionnaire was distributed among the artisans, 90questionnaire was retrieved and 80 was valid due to double ticking and omission of some part of the questionnaire by the respondent. 80 questionnaires were used for the analysis (representing 57.14% of the sample). The statistical analysis of the data obtained was analyse using statistical package for social sciences (SPSS), the characteristics of respondent was computed and presented in Table 3

Table 3: Characteristics of respondent

Factors	Variables	Frequency	Percent %
Gender	Male	80	100.0
	Female	0	0
	Total	80	100
Years of Construction Experience	0-5	18	22.5
	6-10	30	37.5
	11-15	16	20.0
	16-20	6	7.5
	20-24	6	7.5
	25 And Above	4	5.0
	Total	80	100.0
Age Range	20-25	18	22.5
	26-30	19	23.8
	31-35	17	21.3
	36-40	10	12.5
	41-45	5	6.3
	46 And Above	11	13.8
	Total	80	100.0
Categories of Work	Skilled Labour	65	81.3
	Semi- Skilled Labour	15	18.8
	Total	80	100.0
Highest Level of Education	Primary School	14	17.5
	Secondary School	22	27.5
	NCE	7	8.8
	ND	21	26.3
	No Formal Education	5	6.3
	Others	11	13.8
	Total	80	100.0
Occupation	Plumber	10	12.5
	Bricklayer	18	22.5
	Painter	8	10.0
	Carpenter	10	12.5
	Electrician	14	17.5
	Welder	13	16.3
	Tilers	7	8.8
	Total	80	100.0

Authors field work (2018)

Table 3 reveal that 80 numbers of male filled the questionnaire while zero number of females filled the questionnaire. This show that due to the nature of work, it's mostly dominated by the male rather than male and female. Table 3 also indicates the years of construction experience of the respondent. 22.5% of the respondent have between 0-5years experience in the construction industry, 37.5% have between 6-10 years in the construction industry, 20% of the respondent have between 11-15years of experience, 7.5% of the respondent have between 16-20 years of experience, 7.5% of the respondent have between 20-24 years of experience and 5% of the respondent have more than 25years of experience in the construction industry. Table 3 reveals the age range of the respondent. 22.5% of the respondent are within the age range of 20-25 years, 23.8% are within the age range of 26-30 years, 21.3% are within the age range of 31-35 years of age, 12.5% are within the age range of 36-40 years of age, 6.3% are within the range of 41-45 years and 13.8% of the respondents are 46 years and above.

Table 3 also shows the category of work of the respondents. 81.3% of the respondent are skilled workers and 18.8% of the respondent are unskilled worker. Table 3 also shows the level of education of the respondents. The result depicts that 17.5% of the respondent attended primary school, 27.5% are secondary school holder, 8.8% are NCE holder, 26.3% are ND holder, 6.3% have no formal education and about 13.8% have various level of education not listed under this such as; technical school. Finally, table 3 represent the occupation of the respondent. The result shows that 12.5% of the respondent are plumber, 22.5% are bricklayers, 10% are painter, 12.5% are carpenters, 17.5% are electricians, 16.3% are welder and 8.8% of the respondent are tiler.

Level of Awareness of Construction Workers to Health and Safety Measures

From table 4 the benchmark of ranking the highest number of measures is 4.70 above and the lowest benchmark is anything lower than 3.0 it can be deduced that examining of scaffold before use have the highest level of awareness with the mean score of 4.71, and a standard deviation of 6.42 followed by keeping of construction site, and report of unhealthy behavior and accident to safety personnel on site with the mean score of 4.60 and 3.94 respectively. The three lowest measures with the low level of awareness are use of net in exposed high-rise building, use of safety signs and signals and participation in health and safety education with the mean score of 3.38, 3.38 and 3.06 respectively.

Table 4: level of awareness of construction workers to health and safety measures.

H&S Measures	Mean	Std. Deviation	Rank
Frequent examining of scaffolds before use on site	4.71	6.42	1
Keeping construction site clean and free from harm regularly	4.60	6.46	2
Reporting of any unhealthy behavior and accidents to safety personnel on site	3.94	1.11	3
Use of personal protective equipment	3.91	.94	4
Handling machines with care and following manuals for operating	3.88	4.71	5
Regular orientation on the avoidance of hard drugs or acholic drinks on site	3.75	1.58	6
Adequate provision of health and safety trainings on site	3.64	1.23	7
Attendance of health and safety meetings	3.45	1.26	8
Provision of regular first aid and welfare facilities	3.45	1.08	9

Training of workers on related jobs and the use of tools and equipment.	3.44	1.07	10
Adequate Involvement in safety inspection on site	3.41	.99	11
Use of net in exposed high-rise building regularly	3.38	1.27	12
Regular usage of safety signs and signals, and safety posters on site	3.38	1.19	13
Participation in health and safety education or workshop	3.06	1.32	14

Authors field work (2018)

Factor Analysis Method on Level of Awareness

Factor analysis is included in the SPSS as a technique for reduction of data. It narrows down the listed variables and reduce it into smaller or summarized factor. The reduced factor is classified into groups of similar variables. Factor analysis consist of Kaiser-Meyer Olkin, theory, test of Barllettes and the correlation matix

Table 5: KMO Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.775
Approx. Chi-Square		288.064
Bartlett's Test of Sphericity	Df	91
	Sig.	.000

Authors field work (2018)

Table 5 shows the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) which was calculated using correlation and partial correlation to the whether the variable in the sample are adequate to correlate. A general rule of thumb is that a KMO value should be greater than 0.5 for a satisfactory factor analysis to proceed. By observing the above results, the KMO is 0.775, therefore factor analysis can be used. The degree of freedom DF of Kaiser-Meyer-Olkin measure is 91. Bartlett's Test of Sphericity was also carried out to show if there is a relationship between the variables. A p value < 0.05 indicates that it makes sense to continue with the factor analysis. Since the $p < 0.001$ it can be concluded that there are relationships between the variables

Table 6: Table of Variance for Level of Awareness

Comp onent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulat ive %	Total	% of Variance	Cumulati ve %	Total	% of Variance	Cumulati ve %
1	4.291	30.650	30.650	4.291	30.650	30.650	2.764	19.742	19.742
2	1.406	10.046	40.696	1.406	10.046	40.696	2.037	14.553	34.295
3	1.169	8.348	49.044	1.169	8.348	49.044	1.737	12.410	46.704
4	1.147	8.191	57.235	1.147	8.191	57.235	1.474	10.531	57.235
5	.994	7.100	64.335						
6	.921	6.578	70.914						
7	.849	6.061	76.974						
8	.672	4.798	81.772						
9	.598	4.268	86.041						
10	.524	3.745	89.785						
11	.447	3.193	92.978						
12	.406	2.900	95.878						

13	.311	2.219	98.097
14	.266	1.903	100.000

Authors field work (2018)

Table 6 shows that only four factors have eigenvalues greater than 1 as shown in the Eigenvalue total column. Component 1 of the measures have the highest eigenvalue value of 4.291 which accounts for 30.650 per cent of the cumulative variance. The criteria for the measure selection in Eigenvalues are greater than 1, therefore the four measure can explain a cumulative of 57.322 per cent of the variance of the data.

Table 7: Rotation component matrix compressed into four for level of awareness

Factors	Component				Extraction
	1	2	3	4	
Adequate provision of health and safety trainings on site	.842				.751
Adequate Involvement in safety inspection on site	.835				.687
Regular usage of safety signs and signals, and safety posters on site	.645				.293
Provision of regular first aid and welfare facilities	.631				.386
Handling machines with care and following manuals for operating		.667			.735
Use of personal protective equipment		.638			.618
Use of net in exposed high-rise building regularly		.535			.705
Training of workers on related jobs and the use of tools and equipment.		.483			.542
Reporting of any unhealthy behavior and accidents to safety personnel on site		.477			.738
Participation in health and safety education or workshop		.413			.614
Frequent examining of scaffolds before use on site			.775		.460
Attendance of health and safety meetings			.651		.515
Regular orientation on the avoidance of hard drugs or acholic drinks on site				.848	.447
Keeping construction site clean and free from harm regularly				.503	.522

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

Authors field work (2018)

Table 7 above shows the rotation converged in 4 iterations. Rotation has shown that each of the variables load onto four different factors. The name given to each of the factors is listed below; Factor 1 is grouped under and named site measures. The factor accounts for 30.65% and contains variables such as adequate provision of health and safety training on site with the highest load factor of 0.842, adequate involvement in safety inspections on site with load factor of 0.835, regular usage of safety signs and signals, and safety posters on site with a load factor of 0.645 and provision of regular first aid and welfare facilities with a load factor 0.631

Factor 2 is grouped and named personal measures which account for 10.046 and consist three variables such as handling machines with care and following manuals for operating with the highest loading component 2 which represents 0.667, use of personal protective equipment

loads heavily with 0.638, use of net in exposed high-rise building regularly with load factor of 0.535

Factor 3 is grouped and named safety trainings and meetings accounts for 8.3% with two variable components. Frequent examining of scaffolds before use has a load factor of 0.775 which is ranked high and attendance of health and safety meetings with a load factor of 0.651. Factor 4 is grouped under health measures. it accounts for 8.19% and have two variable component such as regular orientation on avoidance of hard drugs or alcoholic drinks on site with a load factor 0.848 and keeping construction sites clean and free harm from harm regularly have a load factor 0.503. However, Table 8 shows the reduced component of construction workers to health and safety measures.

Table 8: Reduced Component Awareness of Construction Workers to H&S measures

Factors	Variables	Factor Loading
Site measures	Adequate provision of health and safety trainings on site	0.842
	Adequate Involvement in safety inspection on site	0.835
	Regular usage of safety signs and signals, and safety posters on site	0.645
	Provision of regular first aid and welfare facilities	0.631
Personal measures	Handling machines with care and following manuals for operating	0.667
	Use of personal protective equipment	0.638
	Use of net in exposed high-rise building regularly	0.535
	Training of workers on related jobs and the use of tools and equipment.	0.483
	Reporting of any unhealthy behavior and accidents to safety personnel on site	0.477
Frequent trainings	Participation in health and safety education or workshop	0.413
	Frequent examining of scaffolds before use on site	0.775
	Attendance of health and safety meetings	0.651
Health measures	Regular orientation on the avoidance of hard drugs or acholic drinks on site	0.848
	Keeping construction site clean and free from harm regularly	0.503

Extraction Method: Principal Component Analysis

Authors field work (2018)

DISCUSSION OF FINDINGS

The study revealed the level of awareness of construction workers to health and safety measures on construction sites. From the survey, the mean score was ranked to have a 4.0 upward for high level of awareness. This then infer that an average number of the respondent are aware of health and safety measures. Waziri, Hamna-adama and Kadai (2018) in agreement to this stated that construction workers are very much aware of different health and safety measures on site. This agrees with the work of kumar and Basar (2018) that safety awareness among professionals and workers on site reduces the rate of accident directly or indirectly and thereby reduces the cost of project. However, just as it has been opined in Fauzania, Aryanti, Dalil and Putri (2018) the awareness of health and safety among construction workers does not certain their compliance. Many of the construction workers are aware of the health and safety measures but fails to comply these measures on construction sites. Therefore, Hassan, Basha, and Hanafi (2007), establishes

that the onstruction workers level of awareness and perception towards their health and safety and their working evenvironment promotes a better condition in construction.

CONCLUSION AND RECOMMENDATION

The foregoing concludes that the level of awareness on health and safety is on the average by examining the following; construction workers are aware of frequent examining of scaffolds before use on site, keeping construction site clean and free from harm regularly and reporting of any unhealthy behavior and accidents to safety personnel on site as a major health and safety measures among other listed measures. Also from the factor analysis done, four factors were extracted namely: site measures (Adequate provision of health and safety trainings on site, Adequate Involvement in safety inspection on site, Regular usage of safety signs and signals, and safety posters on site and Provision of regular first aid and welfare facilities), personal measures (Handling machines with care and following manuals for operating, Use of personal protective equipment, Use of net in exposed high-rise building regularly, Training of workers on related jobs and the use of tools and equipment, Reporting of any unhealthy behavior and accidents to safety personnel on site and Participation in health and safety education or workshop), frequent training (Frequent examining of scaffolds before use on site and Attendance of health and safety meetings) and health measures (Regular orientation on the avoidance of hard drugs or acholic drinks on site and Keeping construction site clean and free from harm regularly).

However, from the conclusion drawn, it is recommended that there should be a safety personnel on all construction sites to monitor workers on their compliance measures on construction activities. Construction workers should be made to participate in health and safety education before commencing on any construction activity, and there should be regular usage of safety signs and signals on construction site

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DEVELOPMENT OF FORENSIC FRAMEWORK FOR POST CONTRACT CONSTRUCTION COST

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ABSTRACT

The need to ensure economical and transparent cost delivery of construction project is a major challenge in the construction industry. This study addressed this challenge by postulating a framework for carrying out forensic analysis of post contract construction cost (FAPCCC). The study identified the rightful initiator(s) of FAPCCC, identified and evaluated the prerequisites that necessitates FAPCCC, validated procedure for carrying out FAPCCC and postulated a procedural framework for carrying out FAPCCC. Quantitative methodology was adopted. Structured questionnaire randomly distributed using google form to various categories of Quantity Surveyors targeting the six geopolitical zones of Nigeria via online due to Covid-19 pandemic, formed the basis for data collection. Forty-five (45) responded and the obtained data presented in tables, were analysed using frequency distribution and percentage. Analysed data were discussed in comparison with extant literature and conclusion drawn. The findings of the study revealed that the client, project manager and project financier like Tetfund could initiate FAPCCC. Prerequisites for FAPCCC include suspected fraud, suspected collusion and final account exceeded the initial budget without increase in scope of project, Timing for FAPCCC is dependent on each initiator but most respondents forty-one (41) out of forty-five (45) favoured carrying out FAPCCC after each interim valuation by consultant Quantity Surveying firms. Possible stages in carrying out FAPCCC were identified and validated through the responses obtained from the target population. A flexible payment method (negotiation) proved to be most preferred as payment approach to forensic analysts and culprits should be responsible for the payment. The study concluded that the FAPCCC clause should be included in letter of commissioning of consultants and award letter to the contractor to discourage illegal activities that undermine financial probity of construction projects. The postulated framework would guide engaged professional Quantity Surveyors to carry out effective FAPCCC.

Keywords: construction cost, construction project, forensic framework, post contract

INTRODUCTION

The need to carry out forensic auditing is peculiar to accounting profession wherein an investigation is being carried out to uncover fraudulent acts, misappropriation as a basis for prosecution in the law court (Fasua *et al.*, 2016). The intent is to ensure probity in the operations of financial organizations (Fasua *et al.*, 2016 cited Brown, 1962; Zimbelman and Albretch, 2012). Since quantity surveyors are saddled with financial probity of construction works (NIQS, 2020) the National Executive Council (NEC) 2017-2019 senate of the Nigerian Institute of Quantity (NIQS) advocated for forensic framework to uncover suspected fraudulent acts among construction stakeholders. Previous studies, Ojo (2019) cited Ajanlekoko (2017) agreed that prominent factors causing high cost of construction projects in Nigeria are due to financial misappropriation leading to corruption, kickback syndrome and quackery. Ojo (2019) in agreement with Ajanlekoko (2017) recommended the engagement of ombudsman as independent assessor of cost of construction. Forensic auditing is to a large extent discourage or uncovered fraudulent acts in organizations (Usman *et al.*, 2015). Previous studies (Fasua *et al.*,

2016) considered basic issues in forensic accounting and auditing and found that forensic accounting and auditing are intertwined, and that both require expertised knowledge and that professional accountants can carry out both audit exercises as well engage in preparation and presentation of financial statements at different categories. Usman *et al.* (2015) evaluated contract auditing practice in Nigerian building construction projects and discovered that the level of engagement of contract auditing practice at post contract stage is supreme and that inclusion of contract auditing as part of requirements of construction contract is expedient. This study tends to build on the work of Usman *et al.* (2015) and bridged the existing knowledge gap by developing a framework for carrying out forensic analysis of post contract construction cost. The questions that the study addressed include: Who initiates and carry out forensic analysis? what should form the basis for carrying out the analysis? when should the process starts and ends? how should the process be carried out? These questions of who, when, what and how are what the study anchored on. For adequate responses to the questions raised, the study developed forensic framework for post contract construction cost which was achieved through the following objectives:

- i. To identify the initiator(s) of forensic analysis of post contract construction cost (FAPCCC) and the forensic analyst;
- ii. To identify and evaluate the prerequisites for carrying out (FAPCCC);
- iii. To recommend procedure for carrying out (FAPCCC);
- iv. To develop a procedural framework to carryout (FAPCCC).

OVERVIEW OF FORENSIC AUDITING

Many definitions had been propounded for the term forensic. Common definitions are: forensic is “the use of scientific knowledge to legal problems in a court of law” (Singleton and Singleton, 2010). According to Zysman (2004), “forensic accounting involves the combination of accounting, auditing and investigative skills”. Crumbley (2006) simply puts forensic accounting as accounting that is suitable for legal review offering the highest level of assurance and including the now generally accepted connotation of having been arrived at in a scientific fashion. In Coenen (2005) point of view “forensic accounting involves the application of accounting concepts and techniques. It demands reporting, where the accountability or the fraud is established and the report is considered as evidence in the court of law or in the administrative”.

Kehinde *et al.* (2016) defined forensic audit as “an investigation of evidence regarding an assertion or reporting to determine its assurance to established criteria carried out in a manner suitable to the court”. In essence, it is a procedure to lawfully establish the accuracy of accounting transactions in harmony with acceptable various standard of accounting, auditing and legal requirements and ultimately find out if any fraud has taken place. Usually, it is a practice for the management of financial organizations to schedule auditing annually. Besides the periodic call for auditing, many factors that triggered FA (Hopwood *et al.*, 2013) include criminal investigation, investors cum partnership disputes, individual injury claims/motor vehicle accident, commercial disruption, fraud investigation, marital disputes that leads to a divorce, professional negligence among others.

Institute of company secretaries of India (2019) postulated the following steps as basis for carrying out forensic audit: “Begin the case (respond to complaint, etc.); evaluate the allegations or suspicions; conduct due diligence background checks; complete the internal stage of the investigation; check for predication and get organized; begin the external investigation; prove

illicit Payments; obtain the cooperation of an inside witness; interview the primary subject and prepare the final report.

According to Home Study Centre (2020), benefits of forensic audit include: Means of minimizing losses; improved efficiency; reduced exploitation risk; avoidance of legal problems and improved brand reputation and authority.

RESEARCH METHOD

The research adopted positivistic approach. The research unit comprised of Quantity Surveyors (Qs) from various sector of practice namely; Academic, consulting firms, contracting firms and governmental organizations in the six-geopolitical zones of Nigeria. Quantity Surveyors are saddled with financial probity of construction projects, hence the reason for considering them as the target population. The choice of the entire geopolitical zones was to allow for representation from each of the zones thereby enriched the outcome of the study. A random sampling technique was adopted for distribution and retrieval of structured questionnaire as an instrument for data collection using online google form. This data collection method was preferred due to covid-19 pandemic that limited movement, prevalent of insurgency and banditry in many parts of the country, hence hindered one on one contact with the respondents. Data collected were analysed using frequency distribution and percentage through the aid of Microsoft excel and the results presented in tables. The results were discussed and inferences were drawn to reach conclusion. The questionnaire was structured into four (4) sections namely: Background information of the respondents which provided insights into the geo-political location of the respondent, professional qualification, sector of practice and years of practice in the construction industry; section two (2) addressed the initiator and prerequisites that necessitate carrying out forensic analysis of post contract cost; section three (3) validated the yardsticks for carrying out forensic analysis of post contract cost obtained from extant literature and section four (4) provided validated procedure for carrying out forensic analysis for post contract cost. *Objective one (1): To identify the initiator(s) of forensic analysis of post contract construction cost (FAPCCC)* was achieved by subjecting the primary data obtained from section two (2) of the questionnaire to frequency distribution. The respondents were asked to indicate the level of their agreement with the identified potential initiator(s) and result presented in frequency table. *Objective two (2): To identify and evaluate the prerequisites for carrying out (FAPCCC)*. The respondents were asked to indicate the level of their agreement with the prerequisites or factors that could necessitate carrying out forensic analysis of post contract cost using Likert's scale of (1-5). Scale 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree. *Objective three (3): To recommends procedure for carrying out (FAPCCC)*. This was partly addressed by the structure questionnaire wherein the factors identified in objectives two (2) presented in sequence and respondents were asked to indicate their level of agreement using Likert's scale as earlier explained and *Objective four (4): To develop a procedural framework to carryout (FAPCCC)*. A conceptual framework was formulated using both prerequisites or factors that mandate FAPCC and the process identified and validated.

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

This section presents step by step analysis and discussion of the objectives of the study preceded by the background information of the respondents.

Table 1. Background Information of the Respondents

<i>Geo-political zones</i>	<i>Frequency</i>	<i>Percentage</i>
North-West	6	13
North-East	0	0
North-Central	11	25
South-West	25	56
South-East	2	4
South-South	1	2
<i>Professional Qualification</i>	<i>Frequency</i>	<i>Percentage</i>
Probationer Members (Prob.NIQS)	13	29
Associate Members (MNIQS)	30	67
Fellows (FNIQS)	2	4
<i>Years of Experience</i>	<i>Frequency</i>	<i>Percentage</i>
<5	4	9
6 – 10	16	36
11 – 15	15	33
16 – 20	5	11
21 and Above	5	11
Total	45	100%

Source: Field Survey, 2020

The study solicited responses from the Quantity Surveyors from six geopolitical zones but only five (5) out of the six (6) zones were represented. This could be as a result of using online google form as a tool for data collection due to covid-19 pandemic that restricted one on one contact, hence discouraged self-administration of the questionnaire. The choice of zoning is to enriched the study by providing varieties of positions on the research subject on which a deductive conclusion can be based. South-West has the highest representation due to the concentration of Quantity Surveyors and Quantity Surveyors firms (QSRBN, 2020). Professional Qualifications of respondents were considered to ascertain the reliability of the collected data. Associates members and fellows of Nigerian Institute of Quantity Surveyors (NIQS) represent 71% of the respondents the rest being probationers. It posited that most of the respondents' must have gained cognate experience for at least eight (8) years which could be considered as enough to contribute to the subject area. The years of experience of the respondents' revealed that most of the respondents had experience of at least six (6) years in the building industry which amounted to 91% of the population surveyed. The demographic factors considered indicate to a large extent the dependability of the evaluated data as indicated in the tables and discussions of the objectives of the study.

OBJECTIVES ONE: Initiator(s) of Forensic Analysis of Post Contract Construction Cost

Table 2. Initiator(s) of FAPCCC

Initiator(s)	Level of Agreement					(N)
	(5)	(4)	(3)	(2)	(1)	
1. Client	22	16	5	1	1	45
2. Project Manager	17	15	10	2	1	45
3. Project Financier Aside the client	21	21	2	0	1	45

Key: 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree

Source: Field Survey, 2020

A holistic evaluation of Table 2 indicates the possible initiator(s) of FAPCCC. The respondents were asked to indicate level of their agreement with the supposition that client, project manager or project financier aside the client could initiate FAPCCC. From their responses, client was adjudged to be an initiator of FAPCCC with thirty-eight (38) out of forty-five (45) in support. Same position was taken by the respondents as regards the project manager. Thirty-two (32) out of forty-five (45) were in support of project manager calling for FAPCCC. Forty-two (2) out of forty-five (45) opined that for the project financier aside the client e.g Tetfund to be an initiator of FAPCCC.

Taping from the common practice in many corporate organizations, the management initiates the carrying out of forensic auditing (Kehinde et al. 2016). The client, project manager and financier other than the client are also saddled with managerial responsibility to ensure the project is delivered to cost to optimal value for money. Some clients' organizations have crop of construction professionals performing project management functions. Higher institutions (Universities and Polytechnics) have physical planning units or department that represents the management interest; hence they could recommend FAPCCC to the management if need be.

OBJECTIVES TWO: Identification of Prerequisites that Necessitate Carrying out Forensic Analysis of Post Contract Construction Cost

Table 3. Prerequisites that Necessitate Carrying out FAPCCC

Factors	Level of Agreement					(N)
	(5)	(4)	(3)	(2)	(1)	
1. Suspected fraud	22	19	1	3	0	45
2. Suspected collusion	17	22	3	3	0	45
3. Final account exceeded initial budget	22	16	6	1	0	45

Key: 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree

Source: Field Survey, 2020

Table 3 presents the prerequisites that could call for FAPCCC. Three (3) possible causative factors were identified and subjected to evaluation. Suspected fraud which include misrepresentation of information was asserted by forty-one (41) respondents as possible red light that calls for FAPCCC. In the same direction, suspected collusion and final account exceeded initial budget were also adduced to be prerequisites for carrying out FAPCCC. Thirty-nine (39) and thirty-eight (38) supported both stands respectively. The prerequisites for carrying out of FAPCCC agree with that of the study conducted by Kehinde et al. (2016) that opined financial fraud as a major pointer with the following variants; misappropriation of assets, corruption and

financial statement fraud. In the same direction (Fasua and Osifo, 2016) asserted that individual, collusion of top managers, organized crime groups could be victims of financial frauds.

Table 4. Timing for Carrying out FAPCCC

<i>Timing</i>	<i>Level of Agreement</i>					
	(5)	(4)	(3)	(2)	(1)	(N)
1. After each interim valuation	22	19	1	3	0	45
2. Milestones	17	22	3	3	0	45
3. Anytime during the project as deem fit	22	16	6	1	0	45
4. After practical completion	22	16	6	1	0	45
5. Determination of contract	22	16	6	1	0	45

Key: 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree

Source: Field Survey, 2020

Table 4 indicates the timing for carrying out FAPCCC. The respondents were asked to express the best time to call for FAPCCC for a construction projects and to do this in terms of level of agreement as indicated in the key to table 4. For after each interim valuation, twenty-two (22) indicated strongly agree and nineteen (19) agreed cumulating to forty-one (41) out of forty-five respondents. The possible implication of this is that the client or the culprit may have to pay repeatedly for carrying out FAPCCC after each interim valuation which may be done severally during the project execution stage. For the milestone approach, seventeen (17) indicated strongly agree and sixteen (16) agree totalling thirty-three (33) out of forty-five (45) that filled the questionnaire. The choice of milestone approach is contingent on the fact that some construction projects works are valued based on milestones covered by the contractor. Incidentally, the other timing factors which are: anytime during the project as deem fit, after practical completion and determination of contract all have similar responses. Twenty-two (22) pitched with strongly agree and sixteen (16) each decided to go for agree. What could be deduced from all the responses is that, the timing for carrying out FAPCCC could be determine by clients' choice, project manager and financier, and that could be no fast rule as to definite timing. An examination of financial auditing in organization favours periodic (end of the accounting year). However, occasions could call for auditing other than the conventional timing if fraud is suspected. This align with carrying out FAPCCC anytime as deemed fit as revealed by the respondents.

Table 5. Commissioning for Carrying out FAPCCC

<i>Forensic Auditor</i>	<i>Level of Agreement</i>					
	(5)	(4)	(3)	(2)	(1)	(N)
1. Any consultant Qs firms	22	19	1	3	0	45
2. Recommended Qs firms by NIQS/QSRBN	17	22	3	3	0	45
3. Collaboration of consultants' Qs firms	22	16	6	1	0	45
4. Any individual Qualified Qs	22	16	6	1	0	45

Key: 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree

Source: Field Survey, 2020

Table 5 reveals the categories of professional Quantity Surveyors that could be engaged to carry out FAPCCC. While the respondents agreed that all identified categories could be engaged, consultants Quantity Surveying firms seem to be mostly favoured as the most appropriate categories of Quantity Surveyors to be commissioned to carry out FAPCCC. Previous studies

(Usman *et al.*, 2015; Fasuel *et al.*, 2016) disclosed that most companies or organizations, engage auditing firms to carry out end of the year auditing and reporting and most cases engages a forensic specialist to carry out a forensic auditing to uncover suspicious or alleged misappropriation. In all, the engagement of a specialised firms stands out. In the same vein, Qs consultancy firms seem to be mostly favoured by the respondents. Cooperate organizations and institutions may likely prefer the option of Qs firms for carrying out FAPCCC because of perceived pedigree of such firms.

Table 6. Inclusion of FAPCCC Clause in Letter of Award and Commissioning

	<i>Level of Agreement</i>					<i>(N)</i>
	<i>(5)</i>	<i>(4)</i>	<i>(3)</i>	<i>(2)</i>	<i>(1)</i>	
1. Letter of Award	22	16	3	3	1	45
2. Letter of Commissioning	18	22	3	1	1	45

Key: 5=Strongly Agree, 4=Agree, 3=Uncertain 2=Disagree, 1=Strongly Disagree

Source: Field Survey, 2020

Table 6 indicates the respondents positions as to inclusion of FAPCCC clause in the letters of award and commissioning that indicates that the FAPCCC could be initiated at any time during the project execution. Supposedly, this is to serve as deterrent for any intended misdeed at both pre and post contract stages. For letter of award, twenty (22) strongly agreed and sixteen (16) agreed totalling thirty-eight (38) that are in agreement with inclusion. This posited that, majority are in support of the inclusion FAPCCC clause in the letter of award. For the letter of commissioning for the consultants, eighteen (18) strongly agreed and twenty-two (22) agreed, amounted to forty (40) out of the total forty-five (45) respondents.

Table 7. Remuneration of Forensic Analyst

<i>Modalities</i>	<i>Frequency</i>
1. Negotiation	20
2. As deem fit by the engaged entity	6
3. NIQS Scale of fees	19

Source: Field Survey, 2020

Table 7 shows the divergent views of the respondents as to the modalities of remuneration of forensic analyst. Twenty (20) abide with negotiation approach, six (6) went for as deem fit by engaged entity and nineteen (19) preferred using NIQS scale of fees as basis for payment for the services rendered by forensic analyst. Though, most of the respondents preferred negotiated approach, the posits that each engaged entity is at large to charge as deem fit. The scale of fees produced by NIQS at this time may not adequately cater for this supposedly evolving aspect of Quantity Surveyors services. Most of the respondents agreed that the culprit should be mandated to pay for the remuneration of the forensic analyst, forty (40) respondents were in agreement. When inquired whether forensic analysis is an innovation in Quantity Surveying profession, forty-one (41) out of the forty-five (45) respondents concurred.

OBJECTIVES THREE: Establishing Procedure for Carrying Out (FAPCCCC)

The study identified vital components that could be essential in carrying out FAPCCCC. Some of these components were obtained from literature and some are suggestive. To establish the procedure, the study recommends a sequence for carrying out FAPCCCC. The postulated phases by the study was subjected to validation process. Respondents were asked to express the extent of their agreement with the postulated phases of FAPCCCC clockwise commencing from initiation and followed by commissioning, evidential, decision to or not to proceed, planning stage, information gathering and processing, reporting and decision to prosecution or not stage. Nineteen (19) strongly agree and twenty-one (21) agree totalling forty (40) out of the forty-five (45) respondents. This implies that 89% agreement validated the process to be acceptable and could be adopted as conceptual framework for carrying out FAPCCCC. The study therefore postulates the procedural conceptual framework as indicated in figure 1.0.

OBJECTIVES FOUR: Developing A Framework to Carryout Forensic Analysis of Post Contract Construction Cost



Figure 1:0. Forensic Framework for Post Contract Construction Cost (FFPCCCC)
Field Survey (2020)

INITIATION PHASE

This phase addresses the research question of who initiates the carrying out of FAPCCCC. The study revealed that any of, the client, project manager or financier if not the client can kick starts the process.

COMMISSIONING PHASE

In this phase, the initiator(s) send an official correspondence to a selected entity which in most cases as indicated in the study, a Qs firms either selected by the initiator(s) or recommended and the choose of an independent professionally qualified Quantity Surveyor is not left out. The written firm or individual as the case maybe, shall communicate back accepting or rejecting the offer. If rejected another firms or entity could be contacted.

EVIDENTIAL PHASE

The commissioned entity seeks to unravel suspected fraud, collusion and to ascertain cost over-run without increase in scope of work. If any of the above or other factors as deemed fit by the entity to warrant the continuation of forensic analysis.

DECISION TO OR NOT TO PROCEED PHASE

The determinants to proceed or stop at this stage depend solely on the discovery at evidential stage. If any of the factor(s) identified to necessitates is/are found, then the process progresses to the next stage which is planning stage, but if none of these factors presents itself, then, the process ends here.

PLANNING PHASE

The planning stage provides the outline on the time frame to complete the forensic analysis and report back to the initiator. These include, what, when, who and how to carry out the work.

INFORMATION GATHERING AND PROCESSING PHASE

This phase provides details information about the extent of misdeed that warrant FAPCCC. The nature, when, how, who is responsible for the misdeed would be unfolded. The documents that could provide evidence of any of the prerequisites to warrant FAPCCC include: Contract award letter, Contract documents, Interim valuations, Architect or engineer's instructions, extract of site meetings etc

REPORTING PHASE

The reporting phase provides the details of the FAPCCC for the use of the initiator to make decisions to or not to prosecute. The content of the report is subjective depending on the factor that lead to carrying out FAPCCC and other factors that may be peculiar to the client organization or the entity consulted to carry out the FAPCCC. The work of the consulted Qs firm or an independent Qs ends here if the decision is not to prosecute.

DECISION TO PROSECUTE OR NOT

At this phase, the initiator decides to or not to prosecute the culprits. The decision depends on the following inexhaustive factors: Relationship of the perpetrator(s) and the initiator, extend of the misdeed, intention, regularity etc. The FAPCCC process end at this stage. But if the client chooses to prosecute the offender, the forensic analyst can be engaged to provide credence to the report in the law court as an expert witness.

CONCLUSION AND RECOMMENDATION

This study developed forensic framework for post contract construction cost. The study identified the client, project manager and financier other than the client as initiators of FAPCCC. Prerequisites for carrying out FAPCCC include suspected fraud, suspected collusion and when the final account exceeds initial budgets without increase in scope of the project. Most of the respondents align with carrying out FAPCCC after each interim valuation but also agreed with other options of milestones, as deem fit, when the project is determined and after practical completion. In essence, any of the timing can be adopted as when FAPCCC should be carried out. The categories of Quantity Surveyors agreed upon to carry out FAPCCC include consultant Qs firms (either chosen by the initiator or recommended by professional or regulatory body e.g NIQS or QSRBN), collaboration of Qs firms and any professionally qualified Qs. Most of the respondents asserted that inclusion of FAPCCC clause in letter of commissioning and award could discourage intended misdeed. The options for remuneration of forensic analysts involve negotiation as the most preferred, follow by using NIQS scale of fees and the one least considered is as deem fit by the engaged entity. The culprit shall be accountable for payment of the engaged forensic analyst. Forensic analysis is considered by the majority of the respondents as a new innovation in the field of Quantity Surveying. The study thereby postulated a procedural conceptual framework for carrying out FAPCCC after validation of the stages considered as the basis for the framework. Due to Covid-19, the number of respondents for this study is relatively small compared to the number of Quantity Surveyors in Nigeria. A larger study population could provide robust responses which could enhance the reliability of the outcome of the study. Further study could be carried out to investigate the suitability of FAPCCC for various procurement system.

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ASSESSMENT OF COMMUNICATION CHANNELS IN USE BY PROFESSIONALS ON CONSTRUCTION PROJECTS IN ABUJA, NIGERIA

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ABSTRACT

Poor communication management has been traced to be a major reason for project failure. This research assessed the communication channels in use by professionals in construction projects in Abuja, with a view to proposing strategies for improving communication management on projects. The main objectives were to identify communication channels in use by professionals on projects and propose strategies to improve communication management on projects. The quantitative research method (questionnaire) was adopted for the study. Results and findings indicated that the most important communication channels in use by professionals on construction projects are face to face/oral conversations, general meetings, written letters and memos, team discussion, formal written documents and maintenance training with RII values of 0.95, 0.92, 0.89, 0.87 and 0.85 respectively. Based on these findings it was concluded that the strategies outlined in this paper are relevant in improving communication management on projects. It was recommended that the use of the most effective communication channels is needed to minimize potential dispute and misunderstanding on the construction site and also, designing an appropriate communication channel for effective project execution should be considered by the project managers.

Keywords: Communication, communication channels, communication management, construction industry, construction projects.

INTRODUCTION

The construction industry plays an important role towards the social and economic development of countries worldwide (Abdullateef *et al.*, 2017). However, it is riddled with complexities and challenges. People from different cultures and professions collaborate in different manners to reach the main goal of project success (Yaser and Abdulrahman, 2018). One of the major challenges of a construction project is the poor communication management and project failure is directly linked to poor communication as it is considered as one the main challenges in the construction industry (Peter, 2016). Communication is a vital process that entails the transfer of information between the sender and the receiver through a medium, this process is considered successful when the receiver understands the message and supplies the sender with a timely and appropriate feedback (Fred, 2017). The process is dynamic, complex and comprised of multiple organizations and shareholders involvement. Effective communication management is sought throughout the project life cycle as its role in project success cannot be understated. Communication management skills are vital in order to achieve effective communication as technical skills and experience alone, are not sufficient process (Gunhan, 2012).

Communication management is the systematic planning, implementing, monitoring and revision of all the channels of communication within an organization and between organizations (Wikipedia, 2015). Communication management is a dynamic and continuous process that runs

throughout the project lifecycle and involves many stakeholders. Effective communication must be sought and attained due to its vital role which affects the project's outcome directly and which is a main pillar that leads a project to produce a successful outcome (Alberto, 2017). Its effectiveness during the project's lifecycle aids in achieving multiple objectives and targets successfully. Communication management plays fundamental role in the effectiveness of this process, because if a project participant lacks communication skills, he/she is likely to conduct an ineffective communication management process (Gunhan, 2012).

Communication management includes the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information. Project Management Institute (PMI) investigated communication management in organisation specifically in construction projects and found that by adopting effective communication during the construction of the project, it can help in meeting the stipulated goals and objective of the projects. Statistics have shown that over 50% of projects in Nigeria are unsuccessful due to inappropriate communication management system (Kasimu and Usman, 2013).

Some professionals may not be able to understand some aspects of a project if little information is available thus leading to project failure. Ineffective communication system leads to demotivated workforce, design errors, slowdown in the entire job and failure in production (Tipli and Ojeba, 2014).

Previous researches have been done in the area of communication and communication management such as: role of communication (Olaniran, 2015); issue of communication in the construction industry (Justus *et al.*, 2016); an overview of project communication management in construction industry projects (Hala *et al.*, 2017); challenges of communication (Ishaq, 2018); identification of causes and effects of poor communication in construction industry (Ismail *et al.*, 2018); causes and impact of poor communication in the construction industry (Ayman and Mamoud, 2018) role of communication in leading a successful international project (Le Bui, 2019) but their failure to propose improvement strategies to poor communication management considering the various communication channels in use by professionals in Nigeria is the noticeable gap that this research seeks to fill in order to address the research problem.

This study therefore assessed the channels of communication and their effect on communication management in the delivery of construction projects in Abuja, Nigeria with a view to proposing strategies for improving communication management on projects. The main objectives set to achieve the aim were to identify communication channels in use by professionals on projects; to examine causes of poor communication management on construction projects; and to propose strategies to improve communication management on projects.

LITERATURE REVIEW

This section gives a detailed review on the themes of the research based on the aim and objectives of the study.

Channels of Communication in the Construction Industry

The classic definition of a communication channel characterizes it as the technical (or formal) side of the communication process that allows us to transfer information from sender to receiver and vice versa (Reinsch *et al.*, 2016). A communication channel includes all the means for the creation and acceptance of a message, i.e. signs, language (including body language), codes, technical devices etc. A channel is a means of communication that an organization can either select to use or can decide not to use. A particular channel could be a preferred option in certain situations or totally ignored in other circumstances. Channels can be used separately or combined with each other. During a project, communication can occur in various directions depending on who is communicating. There is upward communication to management from your own organization and the customer's organization. Lateral communication takes place with customers and within project teams. Machinery needs to be put in place for further communication to take place, either down ward communication (from superior to sub-ordinate), horizontal communication (between colleagues) or upward communication (from sub-ordinates to superior).

Communication Channels in use by Professionals in Construction Projects

There are various ways and methods of communicating information in the construction industry. Although a vast majority of information is exchanged verbally and most data is exchanged in written format either as hard copy or electronically. Even if information is exchanged verbally such as through project meetings and instructions, this information is well documented and stored by means of drawings, contract documents addenda and specification (Maslej, 2006). Contracts are commonly issued when one entity passes down work to another: for example, when a client hires a consultant or designer, they form a contractual relationship by means of signed contract. Same is true when a consultant on behalf of the client (building owner) hires a general contractor to execute the work designed by the consultant. The contractor may wish to sub-contract some of his work to subcontractors in which case, again a contractual relationship is formed. Unfortunately, miscommunication is a common occurrence in construction where work is passed down from one entity to another (Maslej, 2006).

Amami and Beghini (2015) stated that although email is regarded by Weinstock (2013) as a useful communication technology, the ability to convey the meaning via body language, cadence and tone are lost, with the potential for content to be misconstrued. For these reasons, Cheng *et al.* (2014) and Hua *et al.* (2014) prefer face to face communication both at project award phase and construction phase. Reinsch *et al.* (2016) also made an Observation that most construction projects have been using some spectacular channels of communication to pass information on

site, and the most used communication channel according to him was said to be the face to face or oral communication.

For ease of further classification, the channels of communication in the construction industry are grouped and outlined below (Mehra, 2009).

- i. **Formal Writing:** This takes the form of project plan, project chapter, specifications, reports, and metrics.
- ii. **Formal Verbal:** Face to Face/ oral conversations, Presentation and speeches fall under this category.
- iii. **Informal Writing:** Examples of informal written methods of communication include memos, email, notes, etc.
- iv. **Informal Verbal:** Meetings stakeholders and conversations are categorized under informal verbal method.
- v. **Non-Verbal Messages:** These are conveyed through our facial expressions as well as our postures and gestures and account for about 55% of what is perceived and understood by others.
- vi. **Para Verbal Messages:** These include the tone, pitch, and pacing of our voice and account for about 38% of what is perceived and understood by others.

Causes of Poor Communication on Construction Projects

It was found that lack of communication and coordination between design participants of different background recorded higher relative impact to cost overrun in design phase of Egyptian construction industry. According to Yaser and Abdulrahman (2018), most construction projects have been affected by poor communication as a result of linguistic barriers, poor coordination and lack of training. Other causes of poor communication were outlined to be cultural barriers, use of an ineffective communication channel, lack of honesty, poor feedback, work pressure, difference in objectives, lack of knowledge, different level of education, difference in experience amongst others.

Strategies for Improving Communication/Communication Management in Construction Projects

According to Mehra (2009), overcoming communication issues require a vigilant observation and thoughts of potential barriers in a particular instance of communication. Strategies to overcome barriers will be different in different situations depending upon the type of barriers present. Following are some of the important general strategies that will be commonly useful in all the situations to overcome the barriers of communication: Taking the receiver more seriously, Crystal clear message, delivering messages skillfully, focusing on the receiver, using multiple

channels to communicate instead of relying on one channel, ensuring appropriate feedback and be aware of your own state of mind/emotions/attitude.

The following are strategies for improving communication management in construction projects: Daily meetings with team members, engaging in active listening, providing a good feedback system, having a standard method of communicating, ensuring that drawings are devoid of ambiguities, standardizing methods of exchanging project information, maximizing use of modern communication technology, roles of parties being clear and distinct, using procurement methods such as construction management as against the traditional method, offering technical communication training, avoiding communication in a noisy environment, the increased awareness of the potential for improving communication, making communication goal oriented, experimenting with communication alternatives, using diverse communication channels, listening and feedback techniques. Shut (1992) stated that communication network has to be developed within members of the project team by having a standard method of communication to ensure that the information necessary for decision making gets to where it may be wanted.

METHODOLOGY

The study adopted a survey design approach using quantitative data. Structured questionnaires were employed for data collection. The closed ended questionnaire format was adopted because the questions are basically short, requiring the respondent to provide 'yes' or 'no' response, or based on a five-point Likert's scale. Therefore, for the purpose of this work, the questionnaire was designed on a five-point Likert's scale format. The questionnaire contains four sections. The first section of the questionnaire covered the profile of respondents while the three other sections dealt with the research objectives respectively. The data for the study were obtained from questionnaires administered to the professionals of the construction firms considered for this study. The research population constitutes the Twenty-five firms (25) construction firms registered with the Federation of Construction Industry (FOCI) with Abuja's business address. Due to the fact that the population size was not large, this study took a census of the whole 25 construction firms registered with FOCI for data collection. This is in line with the assertion of Watson (2001) that if the population size is small (200 or less), then it is preferable to take a census of the total population. For this purpose, Architects, Builders and Quantity Surveyors of each of these firms were considered making a total of 75. Therefore 75 copies of questionnaire were administered.

In order to achieve the aim of this research the descriptive method of analyzing data was employed and this included the use of percentile, Relative Importance Index (RII) and Mean Item Score (MIS). The decision rules that were used for the RII and MIS in this study are given in this section and summarized in Table 1.

Table.1: Decision Rule for RII and MIS Analyses

Scale	Cut-Off Point		Interpretation	
	<i>RII</i>	<i>MIS</i>	<i>Level of Importance</i>	<i>Level of Effectiveness</i>
5	0.81 - 1.00	4.51 - 5.00	Very Important	Very Effective
4	0.61 - 0.80	3.51 - 4.50	Important	Effective
3	0.41 - 0.60	2.51 - 3.50	Fairly Important	Fairly Effective
2	0.21 - 0.40	1.51 - 2.50	Less Important	Less Effective
1	0.00 - 0.20	1.00 - 1.50	Not Important	Not Effective

Source: Adapted and Modified from Shittu *et al.* (2015)

Relative Importance Index

Relative Importance Index is being ranked from 0.00 to 1.00 and they all have their decision rule as shown in Table 1. The formula for Relative Importance Index (RII) is given as equation 1.

$$RII = \frac{\Sigma W}{A \times N} \dots\dots\dots (1)$$

Where: Σ = Summation, W = the weights of every one of the factors given by respondents and it was in the range of (1 - 5), (A=5) the largest value of weight (i.e. Highest factor) and finally N refers to the Total number respondents.

Mean Item Score

Mean Item Score is being ranked from 1.00 to 5.00 and they all have their decision rule as shown in Table 1. The formula for Mean item score (MIS) is presented as equation 2.

$$MIS = \frac{\Sigma W}{N} \dots\dots\dots (2)$$

Where: Σ = Summation, W = Weight, and N = Total number respondents

RESULTS AND DISCUSSION

This section presents and discusses the results of this study by linking the results to existing findings in the literature.

Respondents' Profile

This section presents the profile of respondents considered for data collection. These are presented in Figures 1-3. Figure 1 presents the profession of respondents.

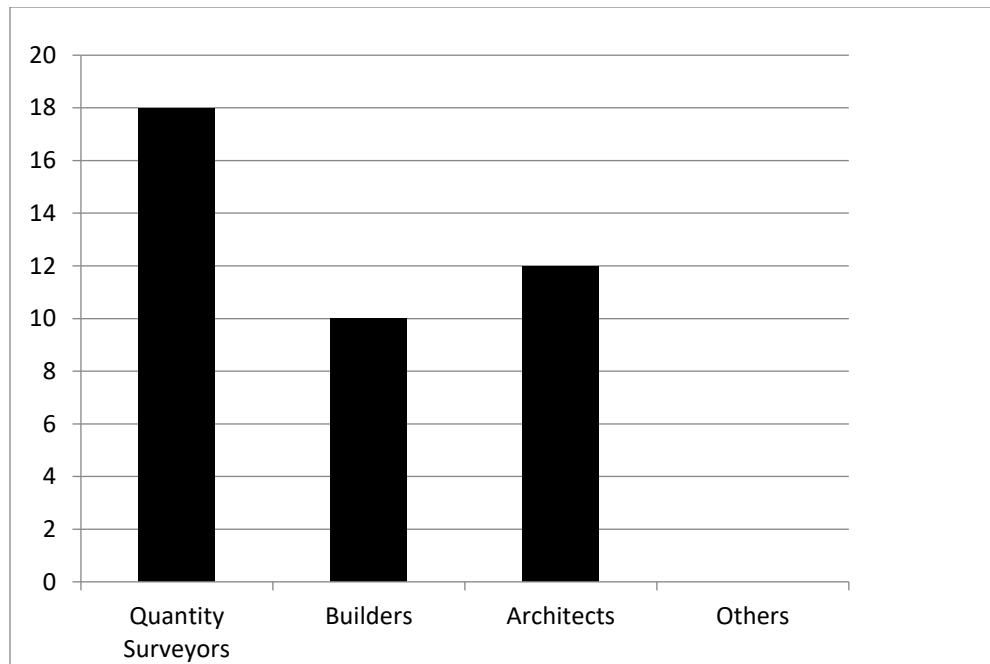


Figure 1: Profession of Respondents

Source: Research data, (2020)

Figure 1 shows the profession of the respondents that were administered the questionnaires. It is shown that majority of the professionals are Quantity Surveyors (18), while the next is Architects summing up to 12 in number. The least number of professionals are Builders totaling to ten (10) in number.

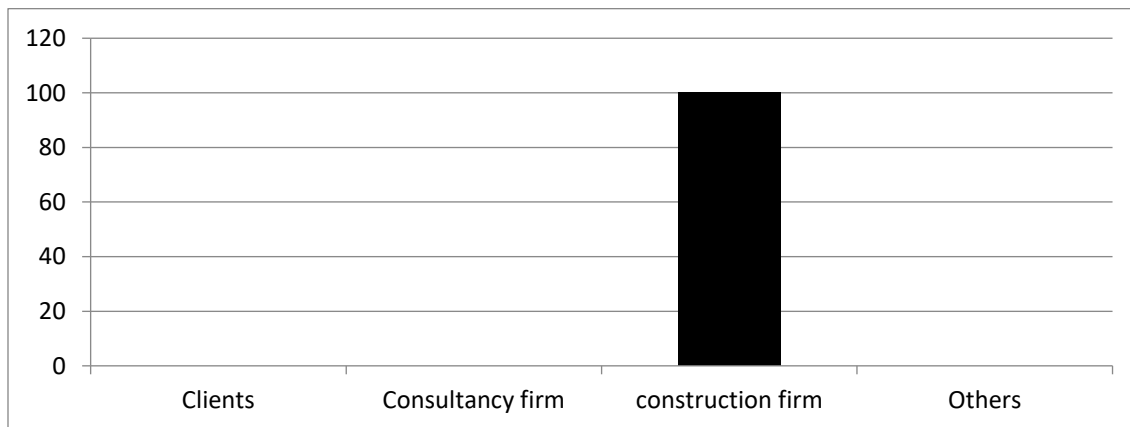


Figure 2: Type of Organisation

Source: Research data, (2020)

Figure 2 presents the type of organisation of respondents. It was indicated that all the respondents are from construction firms. This implies that the result will be useful for this study.

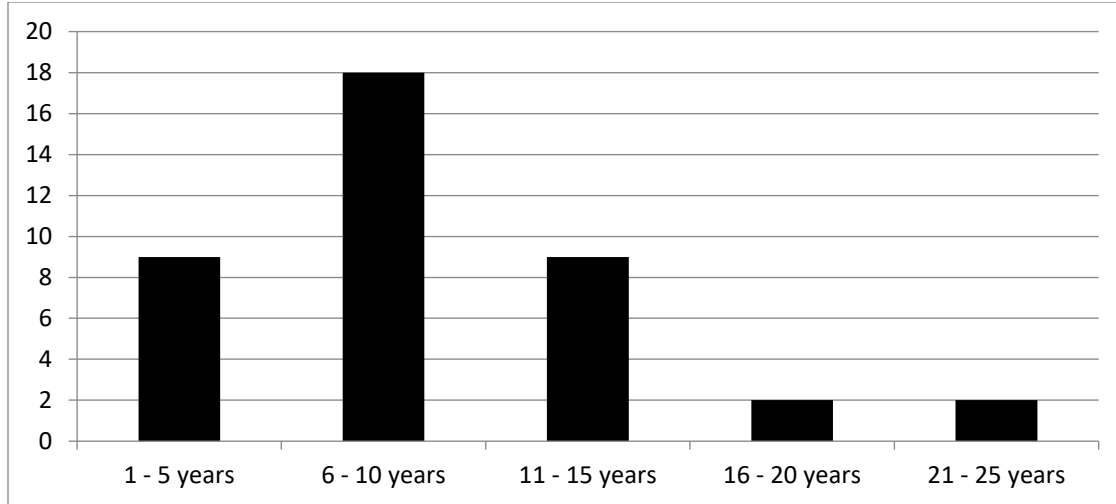


Figure 3: Years of Experience of Respondents

Source: Research data, (2020)

Figure 3 indicates the years of experience of respondents. It was revealed that majority of the respondents have between 6 and 10 years of experience (that is 18 professionals). Nine of the professionals have between 1 and 5 years and 11 – 15 years of experience respectively. Four of the respondents have years of experience ranging from 16 – 25 years. This implies that the respondents are experienced enough to provide reliable information required for the study.

Communication Channels in Use by Professionals on Construction Projects

Table 2 gives the RII results of the communication channels in use by professionals on construction projects

Table 2: Communication Channels in Use by Professionals on Construction Projects

S/No.	Communication Channels	RII	Rank	Decision
1	Face to face/Oral conversations	0.95	1st	Very important
2	General meetings	0.92	2nd	Very important
3	Written letters and memos	0.89	3rd	Very important
4	Team Discussion	0.87	4th	Very important
5	Formal Written documents	0.85	5th	Very important
6	Maintenance Training	0.83	6th	Very important
7	Public relations	0.79	7th	Important
8	Customer complaint system	0.76	8th	Important
9	Chats and messaging	0.75	9th	Important
10	Spread sheets	0.75	10th	Important
11	Notice board	0.72	11th	Important
12	Employee manual	0.72	12th	Important
13	Audio conferencing	0.69	13th	Important
14	Web site and blogs	0.69	13th	Important
15	Video conferencing	0.67	15th	Important
Average RII		0.79		Important

Source: Research's Analysis of Data (2020)

Table 2 shows that six of the 15 communication channels in use by professionals on construction projects identified are very important. These range from Face to face/Oral conversations (RII = 0.95) to Maintenance Training (RII = 0.83). The remaining nine communication channels in use by professionals on construction projects were revealed to be important. These range between Public Relations and Video Conferencing with RII of 0.79 and 0.67 respectively. On the average, all the identified communication channels in use by professionals on construction projects are important (Average RII = 0.79). These findings agree with earlier studies made by Amami and Beghini (2015) which stated that although email is regarded by Weinstock (2013) as a useful communication technology, the ability to convey the meaning via body language, cadence and tone are lost, with the potential for content to be misconstrued. For these reasons, Cheng *et al.* (2014) and Hua *et al.* (2014) prefer face to face communication both at project award phase and construction phase.

Causes of Poor Communication Management on Construction Projects

The results of the causes of poor communication management on construction projects is presented in Table 3.

Table 3: Causes of Poor Communication Management on Construction Projects

S/No.	Causes of Poor Communication	RII	Rank	Decision
1	Ineffective communication channel used	0.89	1 st	Very important
2	Poor feedback	0.89	2 nd	Very important
3	Poor coordination	0.88	3 rd	Very important
4	Linguistic barriers	0.82	4 th	Very important
5	Lack of training	0.82	5 th	Very important
6	Difference in objectives	0.79	6 th	Important
7	Lack of knowledge	0.79	7 th	Important
8	Unclear responsibilities	0.78	8 th	Important
9	Difference in experience	0.76	9 th	Important
10	Cultural barriers	0.74	10 th	Important
11	Different level of education	0.73	11 th	Important
12	Work pressure	0.72	12 th	Important
13	Unconscious message distortion	0.70	13 th	Important
14	Conscious message distortion	0.67	14 th	Important
15	The noise produced on site causing difficulty to hear each other clearly	0.61	15 th	Important
Average RII		0.77		Important

Source: Researcher's Analysis of Data (2020)

Table 3 indicates five very important causes of poor communication management on construction projects ranging from ineffective communication channel used (RII = 0.89) to Lack of training (RII = 0.82). The remaining ten causes of poor communication management on

construction projects are shown to be important. These range from “Difference in objectives” and “The noise produced on site causing difficulty to hear each other clearly” with RII of 0.79 and 0.61 respectively. Averagely all the identified causes of poor communication management on construction projects are important with average RII of 0.77. This aligns with what was highlighted by Yaser and Abdulrahman (2018) who stated that the main causes of poor communication on construction projects were poor channel of communication, linguistic barriers, poor coordination and lack of training.

Strategies for Improving Communication Management in Construction Projects

Table 4 presents the results of the strategies for improving communication management in construction projects.

Table 4: Strategies for Improving Communication Management in Construction Projects

S/No.	Strategies for Improving Communication	MIS	Rank	Decision
	Having a standard method of communicating	4.35	1 st	Effective
2	Daily meetings with team members	4.20	2 nd	Effective
3	Roles of all parties to be clear and distinct	4.18	3 rd	Effective
4	Standardizing methods of exchanging project information	4.15	4 th	Effective
5	Ensuring that drawings are devoid of ambiguities	4.13	5 th	Effective
6	Engaging in active listening	4.08	6 th	Effective
7	Providing a good feedback system.	4.05	7 th	Effective
8	Maximizing use of modern communication technology	3.88	8 th	Effective
9	Avoid communication in a noisy environment	3.65	9 th	Effective
10	Making communication goal oriented	3.48	10 th	Fairly Effective
11	Offering technical communication training	3.45	11 th	Fairly Effective
12	Using diverse communication channels, listening and feedback techniques	3.40	12 th	Fairly Effective
13	The increased awareness of the potential for improving communication	3.20	13 th	Fairly Effective
14	Using procurement methods such as construction management as against the traditional method	3.08	14 th	Fairly Effective
15	Experiment with communication alternatives	3.08	15 th	Fairly Effective
Average MIS		3.76		Effective

Source: Research data, (2020)

Table 4 shows that 9 of the 15 identified strategies for improving communication management in construction projects are effective. These range from “Having a standard method of communicating” (MIS = 4.35) to “Avoid communication in a noisy environment” (MIS = 3.65).

The nine strategies remaining are shown to be fairly effective with MIS ranging between 3.48 (Making communication goal oriented) and 3.08 (Experiment with communication alternatives). The average MIS observed was 3.76 which indicates that the identified strategies for improving communication management in construction projects are effective on the average. These findings align with the view of Shut (1992) that communication network has to be developed within members of the project team by having a standard method of communication to ensure that the information necessary for decision making gets to where it may be wanted.

CONCLUSION AND RECOMMENDATIONS

The study undertook an exploratory quantitative study which used structured questionnaire to collect data from professionals of construction firms registered with the Federation of Construction Industry (FOCI) in Abuja. The use of descriptive methods of analysis was employed to collect data from respondents. Findings from the study led to some vital conclusions towards addressing the problem of poor communication management in the delivery of construction projects in Abuja. These conclusions are stated in this section.

The most important communication channels in use by professionals on construction projects are Face to face/Oral conversations, General meetings, written letters and memos, Team Discussion, Formal Written documents and Maintenance Training. Ineffective communication channel used, Poor feedback, Poor coordination, Lack of honesty, Linguistic barriers and Lack of training are the most important causes of poor communication management on construction projects in Abuja. The identified strategies for improving communication management in construction projects in Abuja are effective. It is thus concluded that the channels of communication by professionals at construction sites in Abuja is effective with room for improvement and the strategies outlined in this paper are relevant in improving communication management on construction projects.

Based on the findings and conclusions of this study, it is recommended that project managers should employ the use of the most effective communication channels to minimise potential dispute, misunderstanding and project failures as a result of poor management of communication on project sites. In addition, professionals should adopt a standardized method of communicating on projects sites which will enhance project delivery also upward, downward and lateral communication channel should be encouraged and used effectively on site.

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INHIBITING FACTORS TO THE ADOPTION OF DIGITAL TECHNOLOGIES IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

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ABSTRACT

The clamor for the adoption of digital technologies in construction processes has received a wide audience in recent time as a result of the glaring and enormous benefits derived from its application. However, there are daunting challenges posed to the construction industry which deprives it from the infusion of digital technologies in its processes during construction project execution. This study attempts to unravel the hindering factors to the espousal of digital technologies in the South African construction industry. With the utilization of questionnaire survey, responses were elicited from construction professionals in Gauteng Province in South Africa. Through the use of appropriate methods of data analysis, the study revealed that the most significant challenges posed to the South African construction industry to the adoption of digital technologies are high price of digital technologies and resistance by stakeholders. Conclusively, the study proposed recommendations that will aid in the abatement of these inhibiting factors so as to propel the adoption of digital technologies utilization considering the overwhelming benefits derived from its application.

Keywords: construction industry, digital technologies, inhibiting factors, south Africa.

INTRODUCTION

The construction industry is still characterised with inefficiencies in its processes coupled with perennial issues such as delay in project delivery, cost overrun, underperforming projects, health and safety challenges amongst others (Aghimien *et al.*, 2018; Ikuabe and Oke, 2019; Mustapha *et al.*, 2013; Sultan and Kajewski, 2013). Despite the spirited efforts in trying to tackle the issues plaguing the construction over the years, not much has been attained in abating the challenges. Kamara *et al.* (2010) opined that the construction industry is the perfect candidate for an upgrade as a result the numerous problems still faced in the industry and the inefficiencies it is attributed with due to outdated methods and techniques still being deployed. Furthermore, Ballard (2012) observed that the issues plaguing the construction industry is due to the engaging processes involved in project delivery which is seemingly different from the monotonous system attributed with other sectors such as manufacturing.

The adoption of digital technologies by various industries has proven to be of tremendous benefits by bringing about optimisation of processes, enhanced service delivery, reduction in schedule of job outputs and cost saving (Aghimien *et al.*, 2018; Ikuabe *et al.*, 2020). Accordingly McKinsey (2016), noted that other industries such as banking, manufacturing and healthcare have inculcated various multidimensional methods in synchronizing digital technologies in their processes while the construction industry is still trailing behind. Some of the challenges earlier outlined that are still evident in the construction industry are as a result of its unwilling and inflexible nature in the espousal of digital technologies. The South African construction industry

has its fair share of the highlighted challenges battling most developing countries of the world. A lot has to be done more especially by developing countries in dealing with the daunting challenges attributed with the construction industry. According to Emuze and Smallwood (2011), among the comity of developing nations, the South African construction industry does not fall under the category of the least performers even though it is still faced with conventional challenges which serve as a hurdle in delivery processes. Hence, there should be tremendous encouragement of inculcating digital technologies in construction processes since it is still on a maturity level (Dall'omo, 2017).

The invention of a new product can happen in a short time, but its implementation might take longer than expected due to different factors surrounding the benefits and disadvantages of its implementation, yet the implementation of a new product is the fact that determines the pace of change of economic growth and the rate of change of productivity (Hall and Khan, 2002). Hampson (2018) noted that the construction industry is known for slow adoption of innovations. Based on this, the industry keeps missing out from leveraging on the competitive gains of technological innovations and the optimisation of construction delivery processes. All innovations face adoption, implementation and acceptance challenges. The full implementation depends on how the stakeholders that innovations were designed for react to them. For technological innovations, one key factor that propels the utilisation is the technical expertise of people exposed to the innovation. Implementing new digital technologies means training personnel to use these technologies. Moreover, the use of digital technologies is not yet taught by higher institutions thus demanding for organisations to train graduates on how to use digital technologies (Oke *et al.*, 2018). This can thus discourage organisations on adopting new digital technologies as it results in more expenses to train graduates.

El-Masaleh (2007) observed that among the challenges of adopting digital technologies for the construction industry are the financial cost of implementing new digital technologies, the maintenance cost of these digital technologies and the personnel training for being able to use it. Furthermore, Oladapo (2007) stated that the barriers facing the adoption of new technological innovations by construction professionals are centered on enough power supply (infrastructure), the price of digital technologies being high and not being accessible to all sizes of enterprises, cyber-security, expense of employing information technology staff, and fear of technology cutting on professional jobs. Dimick (2014) outlined that stakeholders are of the opinion that professional services would be limited with the deployment of digital technologies in the engagement of construction project delivery.

The South African construction industry is a very important sector to the economy of the nation; it is important that if efforts are to be made in tackling the perennial challenges confronting the industry, hence, adequate moves like the adoption and utilisation of technological innovations is paramount. Based on the backdrop of the limitless benefits of engaging technological innovations in construction processes, this study is motivated towards assessing the inhibiting factors towards the adopting of digital technologies for construction project delivery in the South African construction industry with a view to proffering recommendations that would propel its adoption for the overall increase in efficiencies and process optimisation of the industry.

RESEARCH METHODOLOGY

The study assessed the challenges faced in the adoption and utilisation of digital technologies for construction project delivery. A quantitative approach was deployed for the research using questionnaire as the research instrument for data collection, the choice stems out from the fact that it has the ability to cover a large pool of respondents within a limited time frame (Ackroyd and Hughes, 1981). The area of the study was Johannesburg in Gauteng Province of South Africa. The target population of the study comprised of construction professionals namely Architects, Quantity Surveyors, Construction Managers, Construction Project Managers and Engineers. The research instrument was made up of two sections, the former aimed at eliciting the background information on the respondents; while the latter enquired on the level of the respondents' agreement of the challenges facing the adoption and utilisation of digital technologies in the delivery of construction projects. A 5-point likert scale was used with 5 being strongly agree, 4 agree, 3 being neutral, 2 being disagree and 1 strongly disagree. The total number of questionnaires distributed was One-hundred and fifteen (115) while Ninety-two (92) were retrieved and deemed appropriate for analysis. Methods of data analysis used were percentage used for analysing the background information of the respondents; mean item score and standard deviation used for ranking the identified challenges; and one-sample t-test used for the identification of the significance level of the challenges. Furthermore, the reliability of the research instrument was ascertained with the use of Cronbach's alpha test which gave an alpha value of 0.899, which implies a high reliability of the research instrument (Tavakol and Dennick, 2011).

RESULTS AND DISCUSSION

Background Information

The demographic information of the respondents portrays that 46% are affiliated with contracting organisations while a total of 34% are employed with consulting outfits and 20% work with government establishments. Furthermore, 70% of the total number of respondents has working experience of 1-5years, 20% have 6-10years, 8% have 11-15years and 2% have more than 15years. Also, a total of 81% of the respondents affirmed that they have been privy to the use of digital technologies for construction project delivery, while 19% noted that they have not used any digital technology.

Hindering Factors to the Adoption of Digital Technologies

Following the review of extant literature, a total of 15 variables were identified as the possible hindrance to the adoption and utilisation of digital technologies for construction project delivery. One sample t-test was deployed as a method of data analysis in the determination of the significance of the identified variables based on the respondents' ratings. Based on the aforementioned, a null hypothesis was set which states that a variable is not important when the value of its mean is less than or equal to the population mean ($H_0: U \leq U_0$). While the alternate hypothesis stipulated that a variable is important when the value of its mean is greater than the population mean ($H_a: U > U_0$). The fixed population mean (U_0) was 3.50 and the significance level was set at 95% which is attributed to the conventional confidence level (Pallant, 2005). This implies that a variable is noted to be important when the value of its mean is above 3.50, and also attributed to be not important when the value of its mean is less than or equal to 3.50.

Table 1 portrays a two-tailed p-value indicating the significance of the identified challenges to the adoption and utilisation of digital technologies for construction project delivery.

Table 1: One-Sample Test

Hindering Factors	Test Value = 3.50					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					L	U
Increasing complexity nature of data	3.988	91	.000	.560	.2778	.8422
Fear of digital technologies	5.779	91	.000	.940	.6131	1.2669
High cost of digital technologies	7.462	91	.000	1.000	.7307	1.2693
Resistance to adopt new technologies within the industry	7.928	91	.000	.960	.7167	1.2033
Lack of facilities	6.950	91	.000	.880	.6255	1.1345
Lack of trained personnel	5.838	91	.000	.800	.5246	1.0754
Power supply shortage	2.419	91	.019	.320	.0541	.5859
Data security and privacy issues	4.748	91	.000	.620	.3576	.8824
Lack of awareness on digital technologies	7.468	91	.000	.940	.6870	1.1930
Lack of awareness of benefits	7.523	91	.000	.860	.6303	1.0897
Lack of guidance	6.348	91	.000	.760	.5194	1.0006
Problem of interoperability	7.847	91	.000	.920	.6844	1.1556
Lack of understanding of digital technologies	8.381	91	.000	.940	.7146	1.1654
Client worries profitability	6.682	91	.000	.840	.5874	1.0926
Delay in decision making	6.833	91	.000	.900	.6353	1.1647

Note: L=Lower, U=Upper

As shown in Table 2, it is evident that all the identified challenges of the adoption and utilisation of digital technologies for construction project delivery in South Africa all have a mean value well above the cut-off point (3.50) except one which is power supply shortage with a mean value of 3.20. Also, it is indicated that the p-values of the identified challenges at 95% confidence level are all significant by having p-values below 0.05 excluding power supply shortage. Thus, implying that among all the identified challenges, all appears to be important and significant except the challenge of power supply shortage. The results projects that the most challenging factors inhibiting the adoption of digital technologies for construction projects are high price of digital technologies ($MIS=4.00$, $sig.=0.000$), resistance to adopt new technologies within the industry ($MIS=3.96$, $sig.=0.000$), lack of understanding of digital technologies ($MIS=3.94$, $sig.=0.000$), and lack of awareness on digital technologies ($MIS=3.94$, $sig.=000$).

The findings of the study show that the price of digital technologies is a significant factor in the adoption and utilisation of the various digital technologies for the delivery of construction projects in South Africa. This is buttressed by El-Masaleh (2007) who noted that digital technologies are still far from the reach of construction stakeholders due to exorbitant costs

attached to their purchase and maintenance. It is worthy to note that with high prices attached to several digital technologies, contractors and key stakeholders involved in construction project delivery would be reluctant in committing funds into such enterprise. Furthermore, it is revealed that the resistance in the adoption of digital technologies by construction stakeholders is a viable factor hindering its adoption. Dimick (2014) noted that there is palpable reluctance among various stakeholders with respect to the adoption of digital technologies. This is also affirmed by Oladapo (2007) who noted that it is believed that the adoption and utilisation of digital technologies in construction processes would lead to loss of jobs, hence, the averseness and foot dragging for its adoption. Among the identified challenges, the study indicates that only power supply shortage is not important and also appears to be insignificant. This is not far from the fact that power supply in South Africa is considered to be viable, as the country boasts of one of the best power service delivery in comparison with other African countries, hence, should not be considered as a major challenge to the adoption of digital technologies for construction processes.

Table 2: Summary of t-test showing the rankings of the challenges of the adoption of digital technologies

Hindering Factors	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)	Rank
High cost of digital technologies	4.00	.94761	.13401	.000	1
Resistance to adopt new technologies within the industry	3.96	.85619	.12108	.000	2
Lack of understanding of digital technologies	3.94	.79308	.11216	.000	3
Lack of awareness on digital technologies	3.94	.89008	.12588	.000	3
Fear of digital technologies	3.94	1.15016	.16266	.000	3
Problem of interoperability	3.92	.82906	.11725	.000	6
Delay in decision making	3.90	.93131	.13171	.000	7
Lack of training facilities	3.88	.89534	.12662	.000	8
Lack of awareness of benefits	3.86	.80837	.11432	.000	9
Client worries profitability	3.84	.88893	.12571	.000	10
Lack of trained personnel	3.80	.96890	.13702	.000	11
Lack of guidance	3.76	.84660	.11973	.000	12
Data security and privacy issues	3.62	.92339	.13059	.000	13
Increasing complexity nature of data	3.56	.99304	.14044	.000	14
Power supply shortage	3.32	.93547	.13230	.019	15

CONCLUSION

The study empirically assessed the inhibiting factors to the adoption of digital technologies in the delivery of construction projects in South Africa. A review of extant literature was carried out which led to the identification of the factors. The findings of the study indicated that the most significant factors hindering the adoption of digital technologies is the high cost of purchase and maintenance, and resistance to adopt new technologies among stakeholders in the industry. It is pertinent to note that there are numerous inherent benefits when digital technologies are involved in the processes of construction project delivery. Hence, it should be highly encouraged among

stakeholders in the industry. Furthermore, government can help by making provisions of subsidised payment systems which will encourage the drive for the utilisation of the various digital technologies since it is being heralded that the costs are on the high side. Also, sensitisation programmes should always be carried out by professional bodies and other relevant bodies with the construction industry so as keep construction professionals abreast of recent technological innovations and to also to project the immense benefits to be derived from its adoption.

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WHOLE LIFE COSTING PRACTICES EMPLOYED BY DESIGN TEAMS OF BUILDING CONSTRUCTION PROJECTS IN ABUJA, NIGERIA

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ABSTRACT

Although the Bureau for Public Procurement (BPP), which oversees the procurement of public projects through Value for Money (VfM) practices, has admitted that "...lowest initial price may not equate to lowest cost over an item's operating life", application of Whole Life Costing (WLC) in building projects is still limited. This study aimed to evaluate WLC practice by design team members of housing projects through determination of the extent to which WLC has been practiced, and the drivers and barriers of the use of WLC by design teams. The study adopted a quantitative research design that built up a purposive online sample of 63 professionals in construction firms through a snowballing approach. The data thus gathered was analyzed using descriptive statistical method (Mean Item Score and Standard Deviation). The study found that construction professionals tend to consider only construction cost as representative of overall project costs, often to the exclusion of other important types of costs. Availability of data and clients specifically requesting the use of WLC are two key factors that drive WLC use. Use of WLC is however hindered by absence of WLC standards, use of WLC is non-mandatory for public projects, and insufficient end-user training. This study has recommended urgent up-skilling of construction professionals for WLC use through Continuing Professional Development (CPD) seminars, redesign of tertiary education construction curricula, and amendment of existing laws that currently ignore WLC.

Keywords: buildings, construction, design team, procurement, Whole Life Costing.

INTRODUCTION

Globally, the construction industry plays a key role in the economy of both developing and developed countries. According to Abdulwahab (2015), the construction industry account for about 60% of the Nation's Capital Investment and 30 % of the Gross Domestic Product (G.D.P). The Nigerian construction industry (NCI) had been described as a 'sleeping giant' in terms of service delivery and capacity to satisfy the needs of its clients (Kolo and Ibrahim, 2010). The NCI also generates employment opportunities which place it second to the government in employment of labour (Abdulwahab, 2015). In attempting to enhance good governance in public procurement, the Nigerian government commissioned the World Bank in collaboration with some Nigerian Private Sector Specialists to undertake studies of its financial systems and general procurement related activities. The study produced the Country Procurement Assessment Report (CPAR) 2000 which led to the birth to the Public Procurement Act (PPA). The Act established the Bureau for Public Procurement (BPP) to regulate and set standards for the procurement of public projects through inter-alia the application of Value for money (VfM) standards and practices.

The BPP, in its public procurement manual, explained that "value may imply more than just price, quality issues also need to be addressed and lowest initial price may not equate to lowest

cost over the operating life of the item procured”. Although the document did not mention whole life costing (WLC) as a concept for achieving VfM, it did acknowledge that the initial price might not translate to VfM. According to Aliyu (2017), VfM is defined as “the optimum combination of whole-life cost (WLC) and quality to meet the user's requirement”. Thus, for VfM to be achieved the whole life cost of the facility must be considered. WLC theory has been well established but has not received wide practical application. This is due to the problems of data scarcity, uncertainty and the need for assessing non-monetary factors (Kishk and Al-Hajj, 2012). Research conducted in Nigeria in the area of WLC include that of Ibrahim *et al.* (2010) which identified the characteristics of WLC data in the Nigerian construction industry to include non-formal documentation of sources, availability, reliability, and consistency of WLC data as well as a standard procedure for the collection, analysis, validation and presentation of WLC data. Bala *et al.* (2008) developed a model to overcome the problem of data scarcity and uncertainty in the Nigerian construction industry. Others include those of Ityobee (2010) and that of Bimba (2008). Olawumi *et al.* (2016) investigated the application of WLC in building projects in Nigeria, while Bimba (2008) looked into the application of WLC in the design.

The BPP produced two documents to serve as a guide in the procurement of public projects which are the public procurement manual and the Standard Bidding Document (SBD). These two documents addressed issues regarding transparency and the selection of the lowest evaluated tender but no mention was made of WLC concept therein. The non-inclusion of WLC concept in the BPP guides assumed that there are established practices for WLC in Nigeria. The absence of standard procedures to set out how VfM can be achieved through WLC of the project would lead to varied understanding of the concept as well as varied methods in the practices. These two factors are barriers to a streamlined WLC practice as identified by Olawumi *et al.* (2016); Rum and Akasah (2011); and Chirigwi *et al.* (2010).

Ityobee (2010) found out that the few firms that carried out WLC in Nigeria do it based on the client request; even though the type of client was not indicated. Aliyu (2017) found out that there is a need to explore the understanding and practice of WLC among the design team; this is the gap this study was carried out to fill. In essence, the study provides research evidence on how construction professionals engaged in the design of buildings practice WLC. The aim of this study is to evaluate the practice of WLC by members of design teams of residential housing projects with a view to enhancing value for money spent on housing. The objectives of the study are to: (i) determine the extent to which WLC has been practiced by design teams of building construction projects in Abuja, Nigeria; (ii) examine the factors influencing the use of WLC by design teams of building construction projects; (iii) examine the Barriers hindering the use of WLC by design teams of building construction projects.

LITERATURE REVIEW

Whole Life Costing (WLC)

Whole life costing (WLC) as defined by the BS ISO 15686 of service life planning (BSI, 2000) is a technique which enables comparative cost assessments to be made over a specific period of time, where all relevant economic factors both in terms of initial capital costs and future operational costs are considered.

The terminology has changed over the years from “cost in use” to “life cycle costing” and further to “whole life costing” (Flanagan and Jewell, 2018). Usually, the terms LCC and WLC are more common with little variance. The ISO Standard 15686-5 (ISO, 2008) brought out the difference between WLC and LCC. Their contention is that WLC is equivalent to LCC plus external costs,

thereby defining WLC as a broader term including life cycle costing and covering a wide range of analysis. Opoku (2013) also argued that the key difference between LCC and WLC is the notion that that WLC is a management tool that is used throughout the building's life rather than the static option appraisal tool that LCC generally used for. To prevent confusion, this research had chosen to use the term whole life costing (WLC).

Essentially, whole life costing is a means of comparing options and their associated cost and income streams over a period of time. An alternative definition, from BS 3811 on maintenance management, stresses that it is 'for the purpose of making decisions.' Because the decisions involve considering events in the future as diverse as inflation rates, how long the building will be needed and what the weather will be like, there is a lot of uncertainty in the results. The Encarta dictionary (2019) defined practice as doing something in an established custom or habit, which has developed through experience. Each of the key players in the construction industry plays some roles towards improving sustainability. For instance, the client should be asking the contractor for WLC information. The design team requires the knowledge to provide environmental Information about the design and communicate with sub-contractors on the materials that are to be used. Materials suppliers need to be able to provide information on WLC, durability and maintenance data about their products.

Uses of Whole Life Costing

Whole life costing is particularly used to determine: (a) whether a higher initial cost is justified by reductions in future costs; (b) whether a proposed change is cost-effective against the 'do nothing' alternative, which typically has no initial investment cost, but higher future costs.

Whole Life Costing as a Decision-Making Tool

WLC goes beyond the traditional idea that the central element in design is the physical (mechanical) behaviour of the system (e.g., structure). This means that financial factors (e.g. cost of future investments, discount rates, etc.), inter-generational responsibility, environmental aspects and sustainability, among others, become relevant elements in the analysis and the definition of the project characteristics. There are three forces driving the evolution and use of WCC during the last decade: (1) government regulations all over the world are moving in the direction of life cycle "accountability"; (2) businesses of all sorts have recognized that WCC is the key to fostering efficiency and continuous improvement; and (3) continuous and long-term environmental protection has emerged as a criterion in both consumer markets and government procurement guidelines.

According to Kirk and Dell'Isola (1995) and Mackay (1999) as cited by Kishk *et al.* (2003), 80-90% percent of the running, maintaining and repairing cost of a building are determined at the design stage. Thus, for an effective choice to be made between alternatives it has to be carried out during early design stages. In addition, the ability to influence cost decreases continually as the project progresses, from 100% at project sanction to typically 20% or less by the time construction starts (Paulson, 1976; Fabrycky and Blanchard, 1991). Also, as soon as the building is delivered, it is not likely to be able to make changes to the total cost of ownership because the decision to own or to purchase a building normally commits users to most of the total cost of ownership (HMSO, 2016).

Whole life costing as a management tool

WLC is an investment appraisal and management tool which assesses the total cost of an asset over its whole life. It takes account of the initial capital cost, as well as operational, maintenance, repair, upgrade and eventual disposal costs. Kishk *et al.* (2003) opined that WLC can also be used as a management tool to identify the actual costs incurred in operating assets with the main objective of relating running costs and performance data.

Principles of Whole Life Costing

Buildings by their nature have long design lives, therefore sustainability issues go beyond construction only. And hence other issues such as the operation, maintenance need to be incorporated into the design. According to Evans *et al.* (1998), the ratio between the cost of ownership, maintenance and building operation cost to that of business operating cost of a commercial building over a period of 25 years is 1: 5: 200 respectively. Although these ratios have been argued not to be supported by any empirical data by Hughes *et al.* (2004), they provided a ratio backed by an empirical study to be 1: 0.4:12. This means for every one pound spent on construction cost, 0.4 are spent on maintenance and building operating costs and 12 on staffing and business operating costs. The ratio shows the significance of maintenance and operating cost in the ownership of buildings. Buildings pass through a development cycle that has four stages of varying durations. These are (i) Inception = 1 year; (ii) Design = 1 year; (iii) Construction = 3 years; (iv) In-use = 80 years (Ashworth, 2010).

The principle of WLC is based on the calculation of all costs associated with a project for its designated service life so that comparisons can be made between options (Atkinson *et al.*, 2006). In addition to that Atkinson *et al.* (2006) further states that the lowest initial cost does not give the full picture with regards to cost, because it doesn't take account of longer-term issues such as the maintenance cost associated with each option over the service life of the asset. The Chartered Institute of Purchasing & Supply (CIPS) outlined three basic principles which are fundamental to WLC to include analysis of the cost structure, cost estimating and discounting (CIPS, 2005).

Analysis of the cost structure

According to Bakis *et al.* (2003) the Cost Breakdown Structure (CBS) represents the way whole life costs elements are broken down and presented. The term building elements is traditionally used to refer to a classification scheme that is based on elements. Examples of elemental CBS are the Building Cost Information Service (BCIS) Standard Form of Cost Analysis for Building Projects (Whyte *et al.*, 1999), the cost classification scheme used by BMI in its Price Information Book (BMI, 2019) and UNIFORMAT (Charette & Marshall, 1999). An elemental CBS is usually hierarchical to enable costing at different levels of detail.

Cost estimating

Having produced a cost structure, it is necessary to work out the costs for each category; various techniques are available, one being the use of CERs (Cost Estimating Relationships). Cost estimating relationship (CER) is a mathematical expression which describes, for predicative purposes, the cost of an item or activity as a function of one or more independent variables (Fall, 1995).

Discounting

Opoku (2013) described discounting as a method in which future costs or benefits are converted into present (the point at which the purchase decision is made) value through application of a

selected discount rate making it a basis of the time value of money. Discounting methods include the Net Present Value (NPV), Equivalent Annual Cost (EAC), Discounted Payback Period (DPP), Net Savings (NS) and Savings to Investment Ratio (SIR).

The *Net Present Value* of an alternative i , NPV_i , was defined by Kishk *et al.* (2003) as the sum of money that needs to be invested today to meet all future financial requirements as they arise throughout the life of the project. Obviously, the best alternative, A^* , is the one with minimum NPV. The *Equivalent Annual Cost* takes into consideration the unequal time periods that might exist in the different investments' options at the early stages of briefing exercise (Opoku, 2013). Rather than being expressed as a one-time net present value, this method converts all costs of an alternative to a uniform equivalent annual cost (EAC). The *Discounted Payback Period* is defined as the time, usually in years, required for the expected annual savings, taking into account the time value of money, to accumulate to payback the invested amount (Kishk *et al.*, 2003). The preferred alternative, A^* , should have the shortest payback period, but the DPP should only be used as a screening device before the application of more powerful criteria. This is because the method ignores all cash flows outside the payback period (HMSO, 1997).

The *Internal Rate of Return* was defined by Kishk *et al.* (2003) as the percentage earned on the amount of capital invested in each year of the life of the project after allowing for the repayment of the sum originally invested. The ranking criterion is that the preferred alternative, A^* , has the maximum IRR, but this approach assumes that an investment will generate an income which is not always the case in the construction industry. The *Net Savings* method calculates the net amount in PV terms that an investment decision is expected to save over the specified time period (Opoku, 2013). The ranking criterion is that the preferred alternative, A^* , has the maximum NS. This method, however, suffers from the main disadvantage of the IRR method, since it implies that an investment will generate an income. The *Savings to Investment Ratio* according to Kishk *et al.* (2003) is calculated as the ratio of the present worth of the income generated by an investment to the initial investment cost. The higher the ratio, the greater the pound savings per pound spent and consequently the preferred alternative, A^* , should have the maximum SIR. Again, this method suffers from the same disadvantage of the NS method. *Inflation* is emphasised only to make a dividing line between it and discounting. Opoku (2013) opined that inflation can only be considered where there is evidence to suggest that inflation rates of elements within the model differ significantly.

Current WLC practice

Although most principles of WLC are well developed in theory, it has not received a wide practical application yet. A survey undertaken by the Building Research Establishment (BRE) indicates that life cycle costing is currently used extensively only in PFI projects and public procurement (Clift and Bourke, 1999). Opoku (2013) states however that within the UK, WLC is taken into account in any business case to justify capital investment in construction. Studies conducted in various countries have examined the application of WLC, highlighted the difficulties faced in WLC implementation and identified the drivers to WLC application. Some of these studies are those of Olubodun *et al.* (2010); Rum & Akasah (2011); and Chirigwi *et al.* (2010).

Barriers and Drivers to WLC

Kishk *et al.* (2003) summarised areas of difficulty in WLC practice as the following: (a) Industry barriers – The capital cost of construction is almost always separated from the running cost. It is normal practice to accept the cheapest initial cost and then hand over the building to others to maintain. (b) Client barriers; (c) Data problems – this is due to the difficulty in obtaining the

proper level of information upon which to base a WLC analysis. Both Chirugwui *et al.* (2010) and Olubodun *et al.* (2010) identified lack of understanding of WLC principles by the QS as a major barrier to the implementation of WLC. Other barriers include absence of a standardised methodology and complexity of the process. In addition, architects are often unwilling to provide multiple designs (Ityobee, 2000), and planned maintenance is not carried out (Iliyasu, 2004). Where maintenance (planned or unplanned) is done, relevant cost records are not kept (Bimba, 2008; Waziri, 2009). Some of the drivers of WLC that have been identified include use of WLC being required by the client, hands-on approach to WLC training, and provision of guidelines for the practice of WLC (Chirigwui *et al.*, 2010; Olubodun *et al.*, 2010).

METHODOLOGY

This study adopted a quantitative research design approach based on the use of questionnaires. Data was collected through purposive sampling of Architecture, Building, Civil/Structural/Electrical Engineering, Estate Surveying, Project Management, Quantity Surveying and Town Planning professionals in construction firms in Abuja who could be accessed electronically and were willing to participate in an online survey. The electronic survey was carried out in the first quarter of 2020. A total of 63 professionals were sampled through a snowballing approach. The selected construction professionals were those who perform project design and supervision roles on building projects. It is believed that they have adequate knowledge about the state of WLC in building construction practice in Nigeria and can answer the questions of this study. A structured questionnaire was designed in four sections, using Likert-style response options. The four sections dealt with demographics of the respondents, use of WLC, drivers of WLC and barriers impeding the use of WLC. The questionnaire data was analysed using descriptive statistical method (Mean Score and Standard Deviation), and the results were presented in charts and tables.

RESULTS AND DISCUSSION

Results of Demographic Analysis of Respondents

The total of 63 professionals was made up of, amongst others, 10 architects (representing 15.87% of the sample); 9 builders (14.29%); 18 quantity surveyors (28.57%), and 9 project managers (14.29%). this professional heterogeneity allowed reasonable expectations that the results will be a fair representation of the situation in the Nigerian construction industry with respect to WLC. Educational-wise, 34.92% of the sample possessed either higher national diplomas or bachelor degrees; 63.49% of respondents had also obtained M.Sc degrees. This level of training was bound to improve the respondent's ability to make useful contributions to the study. Respondents working in consulting firms and government agencies (MDAs) had the highest representation (26.98% and 23.81% respectively), followed by contractors' organizations and academic institutions, which had 19.05% and 17.46% respectively. Nearly half of the sample (46.03%) had worked for between 5 and 15 years. A further 22.22% had worked for more than 15 years, in some cases up to 25 years. These results were presented in Table 1.

Table 1: Selected demographics of respondents

Demographic parameter	Subgroups	Frequency	Percentage
Profession	Architect	10	15.87
	Builder	9	14.29
	Engineer	8	12.70
	Estate Surveyor	6	9.52
	Quantity Surveyor	18	28.57
	Town Planner	3	4.76
	Other (specify) (Project Managers)	9	14.29
Educational qualification	OND/NCE	1	1.59
	HND/B.Sc	22	34.92
	M.Sc	40	63.49
	Ph.D	0	0
Type of organisation	Consulting firms	17	26.98
	Contractor	12	19.05
	Client organization	6	9.52
	Ministries, Department, Agencies (MDAs)	15	23.81
	Academic institutions	11	17.46
	Others	2	3.18
Work experience	Less than 5 yrs	17	26.98
	5 yrs – 15 yrs	29	46.03
	16 yrs – 25 yrs	14	22.22
	More than 25 yrs	3	4.762

Source: Fieldwork (2020)

Extent to which Whole Life Costing (WLC) was used by design teams

Respondents were requested to indicate what components of WLC they would consider for each of the 22 elements in the Building and Engineering Standard Method of Measurement 4th Edition (BESMM4). The result was presented in Table 2. Two main discoveries were made; first, although the research questionnaire explicitly provided for respondents to be able to select more than one WLC component per each element, yet all respondents selected just one WLC component per building element. This was either a sign that respondents did not understand the questionnaire, or had a poor understanding of WLC. Secondly, construction professionals appear to have a fixation on the construction cost of projects, to the exclusion of other important costs that may not be directly related to the actual construction process such as land costs, statutory fees and levies, lawyers' fees, and accountants/auditors' fees. This is despite evidence that the cost of running and maintaining a completed construction project is many times higher than the cost of actual construction (Hughes *et al.*, 2004). Yet from the results in Table 2, most construction professionals have always employed only the construction cost in evaluating the design of projects. These findings are clear evidence of the low level of understanding and use of WLC in the study area, unlike what obtains in other climes. Opoku (2013) has stated that within the UK, WLC is always taken into account to justify capital investment in any construction business, whether financed by traditional public capital, PFI or PPP procurement routes.

Table 2: Consensus opinion results for WLC components

Building elements	No. of respondents who selected				% proportion of sample that selected				Remarks
	NCC	CC	OMDC	IFP	NCC	CC	OMDC	IFP	
Piling;	22	27	4	0	34.9	42.9	6.3	0.0	No consensus
In-situ concrete works;	8	44	9	0	12.7	69.8	14.3	0.0	Consensus
Precast concrete;	2	32	25	1	3.2	50.8	39.7	1.6	No consensus
Masonry;	12	22	18	7	19.0	34.9	28.6	11.1	No consensus
Structural metalwork;	2	33	24	0	3.2	52.4	38.1	0.0	No consensus
Carpentry;	7	31	14	8	11.1	49.2	22.2	12.7	No consensus
Sheet roof covering;	16	34	10	1	25.4	54.0	15.9	1.6	No consensus
Tile and slate roof and wall covering;	1	37	21	1	1.6	58.7	33.3	1.6	No consensus
Windows, screens and lights;	10	40	5	4	15.9	63.5	7.9	6.3	No consensus
Doors, shutters and hatches;	14	34	12	0	22.2	54.0	19.0	0.0	No consensus
Stairs, walkways and balustrades;	15	39	5	0	23.8	61.9	7.9	0.0	No consensus
Metalwork;	7	33	15	4	11.1	52.4	23.8	6.3	No consensus
Glazing,	2	39	17	0	3.2	61.9	27.0	0.0	No consensus
Floor, wall, ceiling and roof finishings;	10	35	16	0	15.9	55.6	25.4	0.0	No consensus
Decoration;	0	43	9	5	0.0	68.3	14.3	7.9	No consensus
Suspended ceilings;	0	38	22	0	0.0	60.3	34.9	0.0	No consensus
Furniture, fittings and equipment;	9	30	21	0	14.3	47.6	33.3	0.0	No consensus
Drainage above ground;	4	31	19	4	6.3	49.2	30.2	6.3	No consensus
Drainage below ground;	4	29	19	6	6.3	46.0	30.2	9.5	No consensus
Mechanical services;	8	23	27	0	12.7	36.5	42.9	0.0	No consensus
Electrical services;	2	33	21	2	3.2	52.4	33.3	3.2	No consensus
Transportation (e.g. lifts)	20	19	12	8	31.7	30.2	19.0	12.7	No consensus

Source: Fieldwork (2020)

Legend: NCC=Non-construction cost; CC=Construction cost; OMDC=Operation, maintenance and disposal cost; IFP=Income from project

The existence or otherwise of consensus opinions amongst the respondents with respect to the use of specific components of WLC was also reported in Table 2. The Consensus Agreement approach employed a cut-off value of 70% as the minimum for a consensus opinion, which describes the total number of respondents who ‘strongly agree’ or ‘agree’ with an opinion (Udoekanem, 2013). Consensus agreements could help to identify methods of use of WLC components that could be useful in the formulation of strategies for enhancing sustainable application of WLC in construction projects. However, the closest to a consensus agreement that was observed was in the case of the use of ‘construction cost’ for ‘*insitu* concrete works’; this had a value of 69.8%, which to the nearest whole number would be approximated as 70%. This is an indication of the strength of the ingrained culture of the Nigerian construction industry that views project cost as synonymous with construction cost alone. This is in direct opposition to the definition of WLC by BSI (2000) as a technique which enables comparative cost assessments to be made over a specific period of time, where all relevant economic factors both in terms of initial capital costs and future operational costs are considered. *Insitu* concrete is an almost ubiquitous structural material in the Nigerian construction industry; it is thus understandable that respondents agreed on this one element.

Factors influencing the use of Whole Life Costing

The ‘Use of WLC required in order to successfully prove the viability of a project’ was the highest ranked driver (MS = 4.34), while ‘Because data for WLC was available and accessible to design team’ (MS = 4.16) was ranked 2nd (see Table 3). Other top ranked drivers included ‘Specific request from Clients’ and ‘Use of WLC required by the job (specific job requirements)’ (MS = 3.87 and 3.87, ranked 3rd and 4th respectively). Chirigwui *et al.* (2010) has identified ‘specific requirement by the client’ as well as ‘training on and practical experience of WLC’ as key motivating factors to the practice of WLC. It was observed that respondents considered all of the six drivers to be important, hence the Mean Scores for the entire group lay between 3.50 and 4.49; this range corresponded to the ‘Agree’ portion of the semantic scale that was employed in the research questionnaire.

Table 3: Drivers of the use of Whole Life Costing by design teams

ID	Factors that influence your use of Whole Life Costing	Mean Score	SD	Rank	Level of Agreement
3.3	Use of WLC required in order to successfully prove the viability of a project	4.34	0.81	1	Agree
3.4	Because data for WLC was available and accessible to design team	4.16	0.91	2	Agree
3.1	Specific request from Clients	3.87	1.08	3	Agree
3.2	Use of WLC required by the job (specific job requirements)	3.87	1.06	4	Agree
3.6	Based on past practice of design team in the case of similar projects undertaken	3.70	0.86	5	Agree
3.5	Because design team was knowledgeable about WLC and its advantages	3.70	0.59	6	Agree

Source: Fieldwork (2020)

Legend: SD=Standard deviation

Barriers hindering the use of Whole Life Costing

The five top-ranked barriers included ‘Government policy and regulations such as absence of standards for WLC’ which was the highest ranked barrier (MS = 4.34); ‘Existing non-mandatory use of WLC for public projects especially’ (MS = 4.24) was ranked 2nd while ‘Unrecognised business benefits of WLC’ (MS = 4.03) was ranked 3rd (see Table 4). The 4th ranked barrier was ‘Insufficient end user training for construction professionals and policy makers’ (MS = 4.00). In 5th place was ‘The existing government – approved Scale of Professional Fees is based on construction costs only’ (MS = 3.87). These finding coincided with those of Olubodun *et al.* (2010) in the UK that absence of a standardised methodology is a key barrier to the implementation of WLC. On the other hand, respondents were neutral about ‘lifespan of buildings being much longer than that of political administrations’, ‘separation of capital budgets from the operating/maintenance budgets’ and ‘availability and quality of WLC data’. Bimba (2008) and Waziri (2009) have identified ‘availability of WLC data’ as a problem in Nigeria, since cost records of maintenance activities are not kept.

Table 4: Barriers of the use of Whole Life Costing by design teams

ID	Factors that negatively influence your use of Whole Life Costing	Mean Score	SD	Rank	Level of Agreement
4.05	Government policy and regulations such as absence of standards for WLC	4.34	0.81	1	Agree
4.04	Existing non-mandatory use of WLC for public projects especially	4.24	0.76	2	Agree
4.03	Unrecognised business benefits of WLC	4.03	0.99	3	Agree
4.06	Insufficient end user training for construction professionals and policy makers	4.00	0.61	4	Agree
4.14	The existing government – approved Scale of Professional Fees is based on construction costs only.	3.87	1.26	5	Agree
4.10	Decision makers may opt for minimum initial investment either to increase return on investment or meet budgetary restrictions	3.85	1.10	6	Agree
4.01	Acceptance of WLC system by the Nigerian Construction Industry	3.84	1.05	7	Agree
4.02	Inflexible company and societal culture of not planning into the distant future	3.82	0.93	8	Agree
4.13	Complexity of WLC process	3.82	0.91	9	Agree
4.12	The difficulties involved in forecasting multiple factors such as future operating and maintenance costs, and discount and inflation rates, over a long period of time.	3.76	0.95	10	Agree
4.09	The lifespan of political institutions such as governments (maximum of 8 years) is much shorter than that of buildings (usually taken as 60 years), hence non-consideration of WLC.	3.31	0.93	11	Neutral
4.08	Politically, capital budgets for construction are separated from the operating / maintenance budgets for the same facility / project	3.28	1.29	12	Neutral
4.11	Availability and quality of data upon which to base WLC calculations	3.15	0.63	13	Neutral
4.07	Lack of technical expertise and capacity	2.71	0.98	14	Neutral

Source: Fieldwork (2020)

Legend: SD=Standard deviation

CONCLUSION

The study has found that construction professionals in the Nigerian Construction Industry (NCI), specifically within Abuja, which is the study area, tend to consider only the construction cost of projects as representative of project costs. This means that other important types of costs are often excluded when alternative projects, facilities or means of construction are being considered. This study has concluded that the perception that knowledge about and use of WLC is still at a low level in the NCI is attributable to low availability of data for WLC and very few instances of clients, in particular governments, specifically requesting the use of WLC.

This study thus recommends that there is an urgent need to upskill construction professionals in use of WLC. Current cost practice in the Nigeria construction industry coupled with training curricula that have traditionally focussed on only construction costs make it imperative that existing and future professionals in the NCI should be re-oriented as to the pivotal importance of WLC. It is suggested that this can be achieved in the following ways: (a) Redesign of tertiary education construction curricula to focus on WLC rather than construction or installation costs alone. (b) Series of Continuing Professional Development (CPD) seminars and workshops that

will help to upskill existing professionals in the costing of construction works. (c) Effort to amend existing laws that currently ignore WLC. All of these suggestions must be undertaken through partnership of the Bureau of Public Procurement (BPP), trade associations such as the NIQS and statutory bodies such as the QSRBN, COREN, and CORBON.

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DEVELOPMENT OF A READINESS ASSESSMENT TOOL KIT FOR PARTNERING ADOPTION IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

The construction industry (CI) globally is faced with many problems like ‘adversarialism’, limited cooperation, lack of full commitment, distrust, unfair risk sharing, claims, delay, cost overruns, fragmentation and blemish character among others and all these are due to neglect or underutilisation of new management approaches. Partnering emerged to address some of the aforementioned problems while its patronage and propagation is increasing thus expected to bring improvements to the Nigerian Construction Industry (NCI) when implemented. As new in the NCI, readiness assessment (RA) is prerequisite to its successful implementation and using appropriate tool is prerequisite to proper assessment. Research shows that only few RA models exist within the CI and each is developed for a unique purpose. The absence of most of the partnering key elements and assessment questions rendered the existing models not suitable for partnering RA. Therefore, developing tool kit to properly assess the NCI readiness to adopt partnering is necessary. The research aimed to develop RA tool kit for adopting partnering in the NCI. This was achieved through determining the suitability of the existing RA model in the CI, establishing the essential requirements for adopting partnering (ERAP) and fuse them in the proposed partnering RA tool kit and developing the Conpartra Tool Kit (CTK). Five-point likert’s scale was used in the questionnaire survey. The essential requirement for adopting partnering under the process element of the CTK have the highest level of acceptability then followed by those under the environment and management elements with those under the people element having the least acceptability. Communication and conflict resolution strategy are the most accepted essential requirements in the CTK. The least accepted essential requirement for adopting partnering are: top management knowledge with experience and people knowledge, skills and experience. The CTK has reasonable level of acceptance as an appropriate tool for the RA for adopting partnering, thus validated. The ERAP as used in the tool kit with least acceptance level together with their assessment questions, require attention for improvement. CTK should be used to carry out RA for partnering adoption in NCI.

Keywords: Conpartra Tool Kit, Essential Requirement for Adopting Partnering, Nigerian Construction Industry, Partnering, Readiness Assessment.

INTRODUCTION

The Nigerian Construction Industry (NCI) is so large that it plays an important role in the development of the nation’s economy. Despite this the industry is faced with global problems like “adversarialism”, little cooperation, lack of full commitment, ineffective communication, lack of mutual understanding, distrust, lack of appropriate skills and competencies and unfair risk sharing. It is also full of unnecessary claims, delay, cost overruns, fragmentation, blemish character from project participants (Dlakwa and Culpin, 1990; Moore, Mosley and Slagle, 1992; Jannadia, Assaf, Bubshait, and Nuji, 2000; Cheng, Li, Drew, and Yeung, 2001; Elinwa and Uba, 2001; Aibinu and Jagboro, 2002; Chan, Chan, and Ho, 2003b; Phua and Rowlinson, 2003; Zaghoul and Hartman, 2003; Chan, Chan, Chiang, Tang, Chan and Ho, 2004; Ibrahim, Price

and Dainty, 2006; Idoro and Okun, 2011). Most of the problems are due to persistent use of the traditional contracting procedures and neglect or underutilization of new management approaches. Many new management approaches including partnering have emerged to provide solution to the above-mentioned problems. Partnering is increasingly being applied in construction projects. Many propagations and recommendations were made for adopting partnering arrangement for the management of construction projects aimed at solving some of the aforementioned problems (Chan, Chan and Ho, 2003a; Cheung, Thomas, Wong, and Suen, 2003; Ibrahim, 2005; Awodele and Ogunsemi, 2007; Bjeirmi, Begg and Scott, 2007; Dada, Oyediran and Ogunlana, 2008; Gotlieb, 2010).

Studies have shown that partnering has solutions to most of the identified problems facing the construction industry (Cowan, Gray and Larso, 1992; Black, Akintoye, and Fitzgerald, 2000; Graject, Gibson, and Tucker, 2000; Chan *et al*, 2003a; Ali, Mohd-Don, Alias, Kamaruzzaman and Pitt, 2010; CPR, 2010; Gotlieb, 2010; Ansah, 2011). Therefore, it is highly expected that adopting partnering within the NCI would yield positive results that would improve to a large extent, the general condition and well-being of the NCI. However, as a new approach in the NCI, it is essential that prior to its adoption, a readiness assessment (RA) be conducted. This will enable the NCI to know how prepared its various stakeholders are for the implementation and assist in proper planning. It would also assist the stakeholders in identifying its current state of performance as well as the areas that require attention and improvement. For proper RA, there is need for appropriate tool to conduct it. Despite the numerous readiness models developed over the years, only three were found to be specifically designed for use in the CI and all have unique assessment criteria as well as different assessment methods. These models were developed for specific purposes in finding the intended results. Compared to other industries like manufacturing, there are insufficient models or tools in CI (Stewart and Mohamed, 2003; Aziz and Salleh, 2011).

The review of the available RA model in the industry reveals that none of them can adequately be used for partnering adoption within the NCI. There is a need for specific model or tool to be developed for the RA of partnering implementation within the CI. This will ensure reliable RA via capturing all the necessary assessment requirements as well as highlighting the areas that require attentions and improvements, before the actual implementation. Undoubtedly, the implementation of partnering will bring a lot of benefits to the NCI via solving some of the problems facing the industry. However, this will only happen if proper implementation is done. In order to have successful implementation, there is need for the readiness level of the industry to be known as this will enable the industry to know the areas that require attention and improvement before full implementation takes place aimed at maximising the benefits of the partnering. The development of an appropriate RA model for partnering adoption is pre-requisite to the assessment and would be the main foundation for carrying out proper RA that would provide the desired result.

The aim of this research is to develop a RA tool kit for adopting partnering in the NCI. The aim was achieved through determining the suitability of the existing RA model in the CI, establishing the essential requirements for adopting partnering (ERAP) and fuse them in the proposed RA tool kit for adopting partnering in the NCI and developing the readiness assessment tool kit for adopting partnering in the NCI.

REVIEW OF RELATED LITERATURE

Partnering Concepts

There is no universally accepted definition for partnering as it is not neatly defined. Partnering is a relationship which occurs at a particular time to meet the needs of all parties concerned (Infante, 1995 as cited in Ibrahim, 2005). However, there are several definitions by different authors and/or institutions. The definitions indicated that even as there is no universally accepted definition of partnering, so many of the definitions were found to be converging in the core areas of the definition. The divergences were only found to be in the secondary areas. This implies that majority of the scholars were in agreement on the primary meaning of partnering.

The research reviewed about 11 definitions given by about 10 authors and/or institutions. The definitions though are neither directly converging nor directly diverging in their main views in general. However, some of the definition were found to have direct converging view in some of their key meanings and wordings. This include those given by AGC 1991, CIB 1997, NASA 1999, ADOT 2011, CPR 2010, Egan 1998 and Bennet and jays 1995. These definitions considered partnering more of a management approach but not a contract. The second set of definitions with a different converging view are NEDO 1991 and CII 1991 where they both refer partnering as a contract. Though some of their key words are similar to those given in the first category. The definition given by Crowley and Karim (1995) and Matthew *et al*, 1996 gave meaning that cut across the meaning of both the first and second category. They defined partnering in one of two ways; firstly, by its 'attributes' such as trust, shared vision, and long-term commitments; or secondly by the 'process' where partnering is seen as a verb, and as such includes developing a mission statement, agreeing goals, and organising /conducting partnering workshops. Crowley and Karim in 1995 further defined partnering from organisation perspective (AGC, 1991; CII, 1991; NEDO 1991; Bennet and jays 1995; Crowley and Karim, 1995; Matthew *et al*,1996; CIB, 1997; Egan, 1998; NASA 1999; ADOT, 2001; CPR, 2010).

For the purpose of this research, the definition adopted as working definition is the one given by Bennett and Jayes (1995) as a management approach used by two or more organisations to achieve specific business objectives by maximising the effectiveness of each participant's resources. The approach is based on mutual objectives, an agreed method of problem resolution, and an active search for continuous measurable improvements.

Critical Success Factors of Partnering

The concept of critical success factors (CSF) was developed by Rockart and the Sloan school of management with the phrase first used in the content of information system and project management. Rockart (1982) explains CSFs as: Those few key areas of activity in which favourable results are absolutely necessary for a manager to reach his/her goals. Rawlinson (1999) states that CSF are those fundamental issues inherent in the project, which must be maintained in order for team working to take place in an efficient and effective manner.

Nguyen *et al*. (2004) cited in Jefferies *et al* (2006) simply define success within the context of the construction industry as when a project is completed on or before program scheduled, at or below budget, built to the required specifications and fulfils the objectives and desires of the client/stakeholders. Chan *et al*. (2003, 2004) reviewed several empirical studies and the opinions of industry practitioners then summarised significant factors affecting success of partnering to be adequate resources; support from top management; mutual trust; long-term commitment; effective communication; efficient coordination; and productive conflict resolution. Cheng *et al*.

(2000) in introducing a framework for partnering in construction concluded that: The framework demonstrates that the use of appropriate management skills (i.e., effective communication and conflict resolution) and the development of a favourable context (e.g., mutual trust and long-term commitment) are critical to partnering success.

Cheng and Li (2002) concluded that the four critical common factors are top management support, open communication, effective coordination, and mutual trust. Also, the critical functional factors at the stage of partnering formation are team building, facilitator, and partnering agreement; those of partnering application are joint problem solving, adequate resources, and partnering goals' achievement; those of partnering reactivation (or strategic partnering) are partnering experience, continuous improvement, learning climate, and long-term commitment. Chan *et al.* (2005) concluded that success factors were identified as critical in explaining the personal perception of partnering success from the multiple regression results. Establishment and communication of conflict resolution strategy, willingness to share resources among project participants, clear definition of responsibilities, commitment to win-win attitude and regular monitoring of partnering process proved to be essential in bringing successful outcomes to partnering projects. CIDB (2009) concluded that the major critical success factors for adopting partnering identified from case studies are: Support from senior management, Commitment from all participants, Accredited Project Directors or Project Sponsors and Openness and Trust.

Readiness Concept

There are many definitions of readiness from the literature and most of the definitions were based on the subject matter in view. One of the first efforts to define readiness was the one given by the Computer Systems Policy Project (CSPP) in 1998, in which readiness was defined with respect to a community that had high-speed access in a competitive market; with constant access and application of ITs in schools, government offices, businesses, healthcare facilities and homes; user privacy and online security; and government policies which are favourable to promote connectedness and use of the network (Aziz and Salleh, 2011). On the other hand, Dada (2006) defined readiness as the measure of the degree to which a country, nation or economy may be ready, willing or prepared to obtain benefits that arise from Information and Communication Technologies (ICT). Harvard University Centre for International Development's (CID, 2000) defined the term readiness as the degree to which a community is prepared to participate in the networked world - a world in which everyone, everywhere, has the potential to reap the benefits of connectivity to the network. McConnell International came out with their own definition on readiness, which is the capacity of nations to participate in the digital economy (Budhiraja and Sachdeva, 2002). The review of readiness definitions shows that it is obvious, there is no specific definition for the concept of readiness because it depends on various contexts, different situations and different users. Generally, the term readiness is to measure the capability to adopt new changes, programme, concept into an organization, community or a nation prior to its implementation (Budhiraja and Sachdeva, 2002; Dada, 2006; Aziz and Salleh, 2011).

Readiness Assessment Models

Review of the readiness models that can be found in literature, reveals certain common parameters that always appeared in most of the models (Schreurs *et al*, 2011). There are so many readiness assessment models in existence but only few were found to be developed for use in construction. Aziz and Salleh (2011) concluded that several readiness models have been

developed. However, only three models were found to be developed for the construction industry and each of the models was developed for different purposes.

SPICE (Structured Process Improvement for Construction Environment): This is a model developed by University of Salford UK in 1998. The main purpose of this model is to evaluate the key construction processes within the construction organization. The aspects covered by this model are: Brief management, project planning, project tracking and monitoring, contract management, quality assurance, project change management, risk management, organization process focus, organization process definitions, training programme, inter-disciplinary co-ordination, peer review and technology management. The model has five levels of assessment namely: initial, planned and tracked, well defined, quantitatively controlled and continuously improving. The model framework identifies process strength and weakness. It creates a strong platform to discuss improvement and give clear guideline in identifying ways of improvements. The model can be applied for design process, construction and maintenance procedures; but finance or marketing are not included. Some respondents that participates in the readiness assessment using SPICE are confused with the terminology used in the questionnaire. Modification is needed to apply in construction industry to differentiate Facility Management (FM) and construction (Finnemore and Sarshar, 2000; Ruikar *et al.*, 2006; Aziz and Salleh, 2011)

BEACON (Benchmarking and readiness assessment for concurrent engineering in construction) model: This model was developed by Khalfan in 2001. The main purpose of this model is to assess the readiness of construction companies to improve project delivery processes through implementation of concurrent engineering. The aspects covered by this model are: process, people, project and technology elements. Five criteria of process elements were assessed in the first quadrant, which include management system, process focus, organizational arrangements, strategy deployment and agility. In the second quadrant, four critical factors relating to the people element were used to evaluate the readiness level in organisation. The third element which is project comprises three critical project factors: facility design, quality assurance and client focus. The final quadrant focuses on the technology highlighting five critical technology criteria which comprises of task support, integration support, information sharing, co-ordination support and communication support. Five levels of maturity were adopted for all the four elements. The levels are Ad-hoc, repeatable, characterised, managed and optimizing. The model specifically focused on construction supply chain and identify aspect of its project delivery processes that require improvements. It provides guideline for effective implementation of concurrent engineering. The model needs to be updated to meet some industry need as well as some recent technology in the industry (Khalfan, 2001; Ruikar *et al.*, 2006; Aminali *et al.*, 2010; Aziz and Salleh, 2011).

VERDICT (Verify end-user readiness using diagnostic tool) model: This model was developed by Ruikar in 2004. The main purpose of this model is to assess the e-readiness of construction sector end-user. The aspects covered by this model are management, process, people and technology elements. These four elements were chosen because the developer believed they were important in order for the organization to be e-ready. Management was identified as the critical elements that will affect the success of IT implementation in the organisation. Full commitment from management is essential to acquire full benefits of adopting the technology. Process was defined as a series of actions, changes, or functions bringing about result, making it one of the important elements for successful IT implementation. Analysing companies' existing process is

crucial in order to identify weaknesses and find ways of solutions. The third element which is people factor, is an important issue that can affect an organisation's overall readiness as the introduction of any new technology (or change) will affect the workforce within that organisation. The final element, technology, is necessary to support the business functions and it includes the usage of both hardware and software. The model is applicable to assess the e-readiness of construction companies, department(s) within a company, or even individual work groups within a department. It shows a clear result on the organization strengths and weaknesses including identifying the areas that need improvement. However, it does not provide guidelines for improvement (Khalfan, 2001; Ruikar *et al.*, 2006; Aminali *et al.*, 2010; Aziz and Salleh, 2011).

The review of the above three models reveals that none of the three models can appropriately carry out the readiness assessment for partnering adoption in construction. This is as a result of the absence of most of the Essential Requirement for Adopting Partnering (ERAP) in the models and the absence of some of the key elements required for partnering readiness assessment. An attempt has been made to carry out readiness assessment for collaborative procurement strategy using the VERDICT assessment factors and elements. Collaborative procurement strategy is a broad term comprising of so many strategies that can lead to collaboration which partnering is part of (Faruk, 2014). It is important to emphasize that the tool kit developed (Conpartra Tool Kit) as would be discussed later, is to be used solely for the RA of partnering adoption and not for all the collaborative procurement strategies in general. The VERDIT model used in the assessment was found to be not suitable for the readiness assessment of partnering adoption in construction industry. This is due to absence of some important assessment requirement and factors such as trust, culture, legal, integration, knowledge and experience which were all found to be necessary for the assessment of the readiness to adopt partnering. Legal, culture and integration are environment issues but no environment element was found in the model.

Review of the readiness models that can be found in literature, reveals certain common parameters that always appeared. Three large categories: resources, education and environment are suggested. Each category contains certain criteria. In the category resources, the technological readiness, the economic readiness and the human resources readiness are investigated. Education means the readiness of content and the training needs and preferences. Environment includes entrepreneurial readiness, leadership readiness and readiness of culture (Schreurs *et al.*, 2011).

Kolo and Ibrahim (2010) while researching on the adoptability of value management in Nigerian construction industry, considered four main aspects of environment, people, issues/information and process. Environment aspect cover five issues as follows: working relationship, team-spirit, governance, decision-making, comfort and politics. People category cover five issues as follows: public sector client, ownership and commitment, communication, experience and knowledge and personalities and reputation. Issues/information category cover six issues as follows: construction programmes, value for money, return on investment, cost and time, business opportunity and contribution margin and profit. Process category cover six issues as follows: procurement and contract strategy, quality and function, skills and techniques, logistics appropriate, performance assessment and change and process management. Some aspect in the above research were found suitable for partnering readiness while some were found not suitable to be used in the RA for partnering adoption as they are value management specific thus may

not be very suitable for partnering. Koraltan and Dikbas (2002) when researching on the applicability of partnering in the Turkish construction sector concluded that implementation may likely face some complication in terms of cultural changes required and the bureaucratism associated in the public construction process. It was also emphasised that legal issues, technical knowhow, education and training and management approach to the new strategy needs to be considered in terms of adopting partnering in the CI. This was found useful in an attempt to developed CTK but the parameters not enough to carry out RA for partnering adoption. Additional parameters need to be added so as to have comprehensive RA for partnering.

3.0 RESEARCH METHODS

3.1 Data Collection and Analysis Tools

The secondary data used for the study were obtained from the literature reviewed with the aim of articulating the concept of partnering, its essential requirement in the CI as used in the tool kit. The concept of RA was also articulated from the literature aimed at understanding the existing RA models and highlight their limits of application together with their general capabilities. The primary data which are the responses from the respondents were obtained through a field survey via a structured questionnaire. It also forms the basis of validating the developed tool kit through obtaining the level of acceptance of the tool kit's four elements, nine essential requirements referred to as the sub-elements of the tool kit and the assessment factors used under each sub-element. Five-point Likert's scale was used to assess the extent of agreement with the elements and sub-elements (essential requirement) for partnering adoption as contained in the tool kit where 1= strongly disagree, 2=disagree, 3= somewhat agree, 4=agree and 5= strongly agree. Descriptive analysis was used in the analysis and were mostly expressed in mean scores with ranges and interpretation as describe below. The range of $4.51 \leq x \leq 5.00$ which is an acceptable range interpreted as strongly accepted. The range of $3.51 \leq x \leq 4.50$ is an acceptable range interpreted as accepted. A range of $2.51 \leq x \leq 3.50$ is interpreted as somewhat accepted. Results that fall between range of $1.51 \leq x \leq 2.50$ is interpreted as not accepted while $0.00 \leq x \leq 1.50$ range is interpreted as strongly not accepted.

3.2 Population and Sampling

The targeted respondents are the direct stakeholders of the NCI as indicated in the survey questionnaire. The total number of contractors, consultants and public clients was established to be 65,072. List of registered contractors and consultants obtained from CAC stands at 62,955 (CAC, 2014). Public federal ministries, parastatals and others established to be about 418 in Nigeria. An average of 25 public organizations that frequently execute construction projects per state and FCT was assumed based on public clients identified in Kaduna State as at June 2014 therefore making a total of 925 states public clients in the 36 states and FCT. The 774 local governments authorities were also considered. Therefore, the total contractors, consultants and public clients established is 65,072 and this constitute the research's sample frame. The cluster sampling which is a simple random sample of groups of cluster elements, was used in the distribution of the questionnaire based on the explanation given in Keller and Warrack, (2003), Ogunbameru and Ogunbameru (2010), Teddie and Yu (2007), Davis (2011). The sample was arrived at using the approach proposed by IWSD (2003) as cited in UNDP (2004) which is for populations greater than 10,000. The sample size arrived at is 227 and was used in the administration of the questionnaires.

DATA PRESENTATION, ANALYSIS, AND DISCUSSION

Response to Administered Questionnaire

Table 1: Breakdown of Administered Questionnaires and the responses obtained

No. distributed	227
No. returned	129
No of invalid response	14
No of valid response	115
Percentage of valid response	50.66%

Source: Field survey, 2015

From Table 1, a total of 227 questionnaires were distributed out of which 129 were returned. The analysis of the data was based on the 115 which is the valid response. The percentage of the valid response is 50.66% thus adequate for the analysis to be conducted based on the assertion of Moser and Kalton (1971) which states that the result of a survey could be considered significant if the response rate is not lower than 30-40%.

Survey Data

The response of the survey shows that the contractor's organization form the largest groups of the respondents with 42 number (36.52%). Consulting organization closely followed with 42 number (36.52%) and client's organisations group having 31 number (26.96%) of the total responses. The analysis carried out was based on the above grouping of the stakeholders.

Acceptance of the respondents with the Conpartra Tool Kit for adopting Partnering.

Table 2: Summary of results on the acceptance of the respondents with the Conpartra Tool Kit

Element	Essential Requirements for adopting partnering (ERAP)	Mean Elements (Aggregates)	Mean Essential Requirement (Aggregate)	Mean (Over all)	Rank (Elements)	Rank (Essential Requirement)	Remark
Environment		3.53			2		Accepted
	Legal issues		3.40			7	Somewhat accepted
	Cultural issues		3.53			5	Accepted
	Integration		3.65			4	Accepted
People		3.35			4		Somewhat accepted
	Knowledge, skills, & experience		3.25			8	Somewhat accepted
	Mutual Trust		3.45			6	Somewhat accepted
Process		3.95			1		Accepted
	Conflict resolution		3.91			2	Accepted
	Strategy		3.99			1	Accepted
Management		3.44			3		Somewhat accepted
	Top management support and commitment		3.72			3	Accepted

	Knowledge & Experience	3.16	9	Somewhat accepted
Overall	Overall		3.57	Accepted

(Source: Field Survey, 2015)

From Table 2, the results indicated that process element has the highest level of acceptance as an ERAP from the response with an average mean score of 3.95 then followed by environment element with 3.53. The process and environment elements have both fallen within the range of $3.50 \leq x \leq 4.50$ which is an acceptable range termed as “accepted”. Therefore, in terms of process and environment elements the respondents have accepted the assessment requirements considered in the Conpartra Tool Kit (CTK) under process and environment elements as ERAP within NCI. The result also reveals that management and people elements have mean scores of 3.44 and 3.35 respectively. This indicated that the assessment factors considered in CTK under management and people elements have fallen within the range $2.50 \leq x \leq 3.50$. This range is interpreted as being somewhat accepted and is the extent of acceptance at the moderate level. This implies that the respondents have somewhat or moderately accepted the assessment factors under management and people elements in the CTK as ERAP. This implies that the assessment factors in the CTK under management and people elements have been accepted by the respondents even though they require additional attention and improvement in order to increase the effectiveness of the CTK.

Table 2 results indicated that the integration requirement of the environment element in the tool kit has the highest level of acceptance with a mean score of 3.65 then followed by cultural and legal issues requirements with mean scores of 3.53 and 3.40 respectively. The extent of acceptance of the integration and cultural issues requirements have fallen within the range of $3.50 \leq x \leq 4.50$ thus, having an acceptable level termed as “accepted”. This implies that the respondents have accepted the integration and cultural issues requirements in the CTK as an ERAP in NCI at a reasonable level of acceptance. The legal issue requirement of the environment element of the tool kit has an acceptance level falling within range $2.50 \leq x \leq 3.50$ thus, it was moderately accepted as an essential environment requirement for adopting partnering as proposed in the tool kit. This implies that the assessment factors under the legal requirement of the environment element, require improvement in order to increase the effectiveness of the legal readiness assessment of the tool kit.

Table 2 results also shows that mutual trust requirement of the people element has the highest mean score of 3.45 being higher than the other requirements of knowledge skills and experience which has a means score of 3.25. However, both the two requirements have fallen within range $2.50 \leq x \leq 3.50$ thus, they were all moderately accepted as ERAP in the tool kit. This implies that the assessment factors under the mutual trust and knowledge, skills and experience, require improvement in order to improve on the effectiveness of the people readiness assessment of the tool kit. The result also indicated that communication requirement of the process element has the highest mean score of 3.99 being higher than the other process requirement of conflict resolution strategy which has a means score of 3.91. However, both the two requirements have fallen within range $3.50 \leq x \leq 4.50$ thus, they were all accepted as ERAP in the tool kit. This implies that the assessment factors under the conflict resolution strategy and communication, have reasonable degree of acceptance by the respondents as an ERAP in the CTK. Table 2 results also indicated that top management support and commitment requirement of the management element has the highest mean score of 3.72 being higher than other management requirement of knowledge and

experience which has a means score of 3.16. The extent of acceptance with the top management support and commitment falls within range $3.50 \leq x \leq 4.50$ thus, having an acceptable range termed as “accepted”. This implies that the respondents have accepted the top management support and commitment requirement in the CTK as an essential management requirement for adopting partnering in NCI at a reasonable degree of acceptance. The knowledge and experience requirement of the management element of the tool kit has acceptance level falling within range $2.50 \leq x \leq 3.50$ thus, it was moderately accepted as an essential management requirement for adopting partnering as proposed in the tool kit. This implies that the assessment factors under the knowledge and experience requirement of the management element require improvement in order to increase the effectiveness of the management readiness assessment of the tool kit. The overall acceptance has average mean of 3.57 thus falls within the range $3.50 \leq x \leq 4.50$ which is an acceptable range termed as “accepted”. This implies that the respondents have accepted the tool kit as an appropriate readiness assessment tool kit for partnering adoption within the NCI. The acceptance of the tool kit by the respondents is at reasonable level as the overall means falls within a reasonable range of accepted as stated earlier. However, some areas as highlighted before require improvement in order to increase the effectiveness of some element’s readiness assessment in the tool kit and this will in-turn assist in the improvement of the effectiveness of the CTK generally.

Conpartra Tool Kit (CTK)

The CONPARTRA (Construction Partnering Readiness Assessment) Tool Kit as its name implies has been developed by this research to carry an assessment of the readiness of organizations to adopt partnering approach in the management of construction projects. The study seeks to assess the organizations and know their current level in terms of preparation for introducing the partnering approach. It is questionnaire-based tool kit with graphical representation as indicated in Figure 1.

Composition of Conpartra Tool Kit

It has four key elements of assessment namely: Environment, people, process and management. The details of the essential requirements under each element together were presented in Table 2 and figure 1. For a graphical representation, the four key elements were each fixed into a quadrant as indicated in figure 1. The graphical presentation has some similarities to that of BEACON Model developed for the readiness assessment of organization to implement concurrent engineering. Three essential requirements were assessed under the environment element of the CTK and these are: Legal issues, cultural issues and integration. Two essential requirements of knowledge, skills and experience and trust were assessed under the people element of the tool kit. Two essential requirements of conflict resolution and communication were assessed under the process element of the tool kit. The management element of the tool kit has two essential elements of assessment namely: Knowledge and experience and support and commitment. CTK questionnaire has four assessment factors under the legal essential requirement of the environmental element of the tool kit. The cultural essential requirement has seven assessment factors while integration has five of the assessment factors. While knowledge, skills and experience essential requirement of the people element has nine assessment factors, the trust essential requirement has five of the assessment factors. There are four assessment factors under the conflict resolution strategy of the process element while the communication essential requirement has seven of the assessment factors. Top management support and commitment of the management element has six assessment factors while knowledge and

experience of the management element has four assessment factors. In summary, the CTK developed contains four elements, nine essential requirements spreading over the four elements and fifty-one assessment factors/questions under the nine-essential requirement of the tool kit.

Assessment Procedure of Conpartra Tool Kit

There are five levels of assessment given by the research in the CTK all of which are based on a mean score of a range of 0.00 -5.00. The assessment levels are: Reluctant, aspire, partial, acquire and excel levels. These assessment levels were given to the tool kit by the research for ease of interpretation of the result and categorisation of the assessment into various levels. The detail description of each levels is given below while the graphical representation of these levels was given in figure 1.

Reluctant level: This level is the lowest assessment level with a range of score $0 \leq x \leq 1.49$. The organization is either not familiar with partnering and its essential requirement or the organization is aware of partnering and its requirement but is persistently resisting its acceptance as part of its operation internally within the organization or externally with other stakeholders. There is almost total absence of the essential requirement for adopting partnering within the organization or its project environment at this level and not ready to adopt partnering at all.

Aspire level: This level has an average range of score $1.50 \leq x \leq 2.49$. At this level, the organization is said to have some mild familiarity with partnering and its essential requirement and is having some mild passion for partnering and its requirement. There is low level of admiration and existence of partnering essential requirement within the organization's operation internally or externally with other stakeholders. There is low level of knowledge but with aspiration to know and acquire the essential requirement for adopting partnering within the organization or its project environment. Therefore, organizations at this level are generally not ready for the implementation of partnering.

Partial level: This level has an average range of score of $2.50 \leq x \leq 3.49$. At this level, the organization is considered to be averagely familiar with partnering and its essential requirement and is having average liking for partnering and its requirement. There is average admiration and existence of partnering essential requirement within the organization's operation internally or externally with other stakeholders and it has average knowledge of partnering. There is also average level of prevalence of the essential requirement for adopting partnering within the organization or its project environment. This implies that the extent of existence of the essential requirements are generally at a level that is not below the minimum requirement but yet some areas require improvement in order to be reasonably prepared for the adoption. Organisations at this level are said to be partially ready for the introduction and implementation of partnering for its operation.

Acquire level: This level has an average range of score of $3.50 \leq x \leq 4.49$. At this level, the organization is considered to be highly familiar with the partnering and its essential requirement and is having high passion for partnering and its requirement. Organisation at this level tend to have high level of prevalence of the essential requirement for partnering within the organization's operation internally, externally with other stakeholders or within its project environment and there is very good understanding of the concept of partnering by the organization's members. This implies that the extent of existence of the essential requirements

are generally at a reasonable level or at an adequate level with only few areas that may require improvement in order to further increase the level of its preparation. Organisations at this level are said to be highly ready for the introduction and implementation of partnering for the management of projects.

Excel level: This is the highest level with an average range of score of $4.50 \leq x \leq 5.00$. At this level, the organization is considered to be fully familiar with partnering and its essential requirement and is having full interest in partnering. Organisations at this level tend to have very high level of prevalence of the essential requirement for partnering within the organization's operation internally, externally with other stakeholders or within its project environment and there is excellent understanding of the concept of partnering. This implies that the extent of existence of the essential requirements are generally at the highest possible levels that need no further improvement. Organisations at this level are said to be fully prepared for the introduction and implementation of partnering for the management of projects.

Graphical Representation of Conpartra Tool Kit

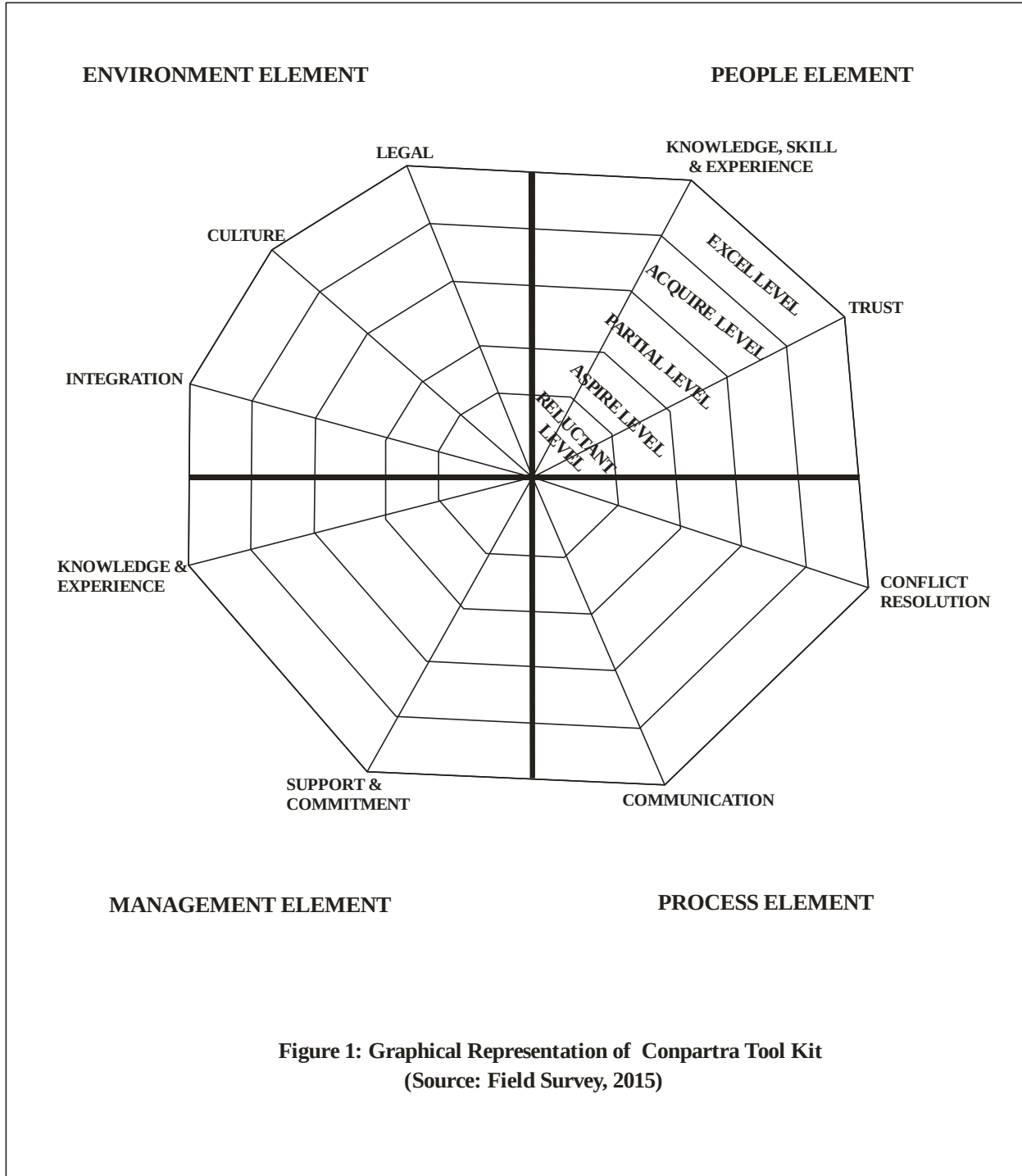


Figure 1 shows the graphical representation of CTK as previously explained while the figure 2 below shows the graphical presentation of a pilot readiness assessment of some organisation as presented in Table 3 below where each of the essential's requirement falls on a certain level of the assessment. For instance, conflict resolution and communication requirement under process element have both fallen at acquire level. The trust and knowledge, skills and experience requirement under people element have both fallen at acquire level. The pilot readiness assessment result in Figure 2 also indicated that knowledge and experience and support and

commitment under the management requirement have both fallen under acquire level. The legal, culture and integration requirements under environment element have fallen at partial, acquire and acquire levels respectively.

Graphical Presentation of Pilot Readiness Assessment Result using Conpartra Tool Kit

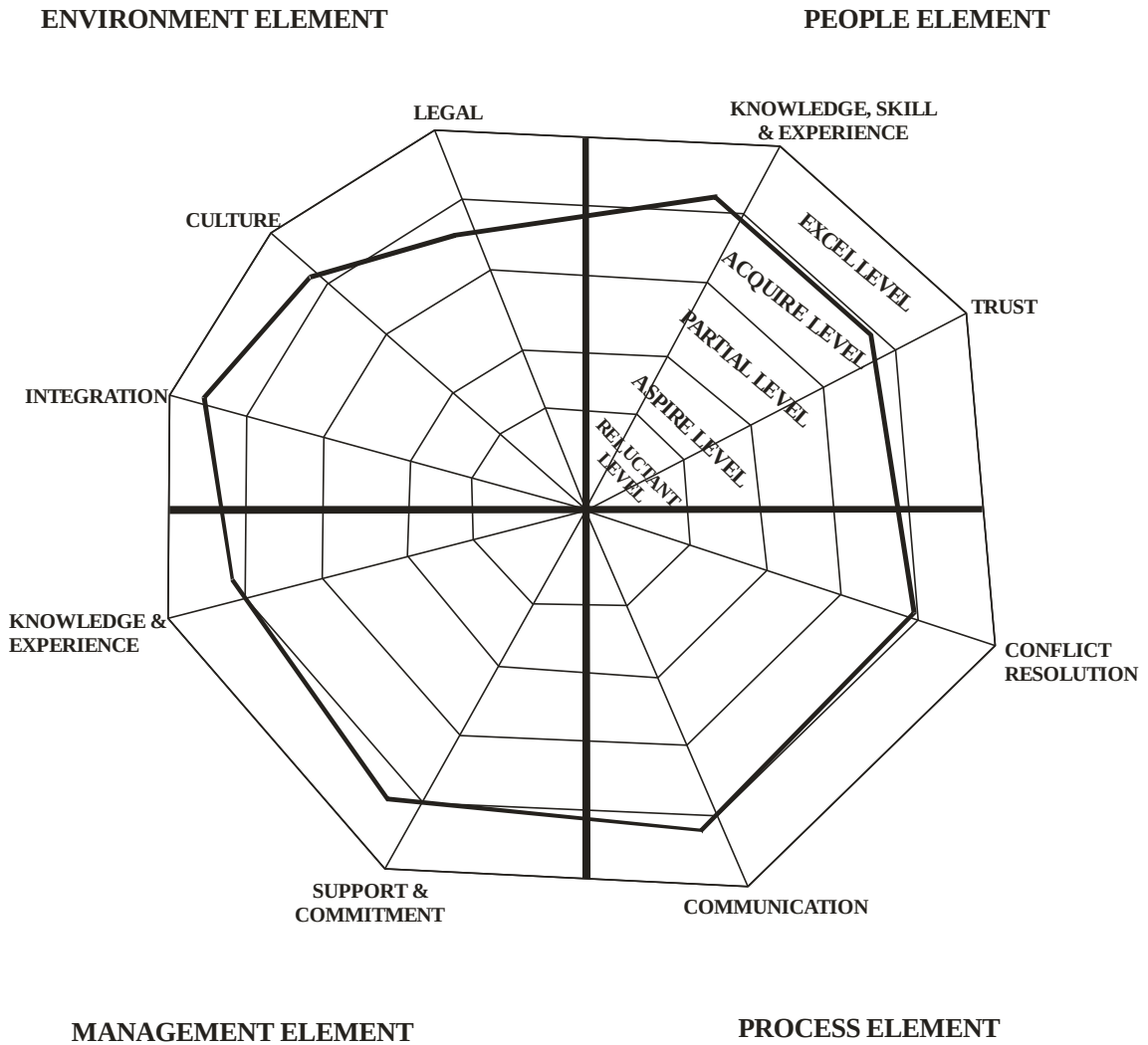


Figure 2: Graphical Presentation of Pilot Readiness Assessment result using Conpartra Tool Kit
(Source: Field Survey, 2015)

Pilot Readiness Assessment of some organisation using Compartra Tool Kit

Table 3: Pilot Readiness Assessment Result of some organisation using Compartra Tool Kit

Element	Essential Requirement	Mean (Aggregate)	Rank	Remark
Environment	Legal issues	3.28	8	Partial level
	Cultural issues	3.88	6	Acquire level
	Integration	4.20	3	Acquire level
People	Knowledge, skills & experience	4.05	5	Acquire level
	Mutual Trust	4.1	4	Acquire level
Process	Conflict resolution Strategy	4.36	2	Acquire level
	Communication	4.46	1	Acquire level
Management	Top Management Support and Commitment	4.20	3	Acquire level
	Knowledge and Experience	3.80	7	Acquire level

(Source: Field Survey, 2015)

The above readiness assessment results and analysis has further explored how to carry out readiness assessment using CTK including presentation, analysis and interpretation of results obtained using the CTK. This will give a better understanding of the CTK and the results obtained.

CONCLUSIONS AND RECOMMENDATIONS

The respondents have accepted the essential requirements and assessment factors of the environment, process and management elements of the CTK as their overall average means have fallen within the range interpreted as “accepted”. All the environment, process and management elements, their essential requirements and the assessment factors have reasonable level of acceptance by the respondents. However, People element have acceptance level termed “Somewhat accepted”. Therefore, the inclusion of all the four elements in the CTK is necessary for the proper readiness assessment of adopting partnering.

Overall, the respondents have accepted the CTK as an appropriate tool kit for conducting the readiness assessment for partnering adoption within the NCI. This is because the overall means of all the elements within the tool kit falls within the range termed as “accepted”. However, some of the elements have higher level of acceptance than others even as they have all fallen within the acceptable range. Process elements has the highest level of acceptance then followed by the environment. The management element took the third position while the people element has the least.

Recommendations

Since the respondents have agreed with the CTK as an appropriate tool to be used in conducting readiness assessment for partnering adoption, it is recommended that the tool kit should be used to conduct the readiness assessment of the NCI to adopt partnering approach. This will enable the industry to know it current state of readiness to adopt partnering.

The areas in the tool kit with moderate level of acceptance should be improved further in order to increase the effectiveness of the tool kit.

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ASSESSMENT OF RISK MANAGEMENT CAPABILITY LEVEL OF BUILDING CLIENTS IN ABUJA, NIGERIA

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Abstract

Construction organisations in developing countries face uncertain events that occur in different environment and with different characteristics and impacts. These uncertain events called risk can generate more or less severe consequences for the organisation. The purpose of this study is to evaluate the risks management capability by the client. The study appraises the basis for assessing the risk management capacity of building client with a view to improving the level of competencies of the client. In order to attain the objective of the study Mean item score (MIS) and Relative importance index (RII) were used. It was evident that risk response development and risk identification are the highly ranked risk management processes that relate to client's knowledge about risk. This study also concludes that risk management is a critical success factor which significantly improve project performance. Organisations and construction stakeholders should encourage, ensure and promote the implementation of the risk management maturity model as it is intended to support organisation and stakeholders.

Keywords: Capability, Client, Management, Nigeria, Risk

INTRODUCTION

Today every organization faces uncertain events that occur in different environments and with different characteristics and impacts. These uncertain events can generate severe consequences for the organization (Aven, 2011). Uncertain events with negative impacts are called risks. The construction industry is no exception in being exposed to these uncertainties, which are complex and diverse risks (Zhao *et al.*, 2013).

Risk is a term that has long been studied in different areas. Hillson (2013) defines risk as the uncertainty that can be measured, while uncertainty is a risk that cannot be measured. In an effort to mitigate or eliminate the risk, researchers count on risk management, which is an integral part of project management. Risk management is a positive and proactive process intended to reduce the likelihood of unsatisfactory consequences to the project in its different stages, such as design, construction and operation (Mills, 2001; Rohaninejad and Bagherpour, 2013).

One of the challenges being faced at this time then is how to measure the capability of a construction organization to perform risk management effectively and how to help this organization to improve along time. Although risk is a somewhat multi-layered concept, in a construction context, it typically refers to the likelihood of a detrimental event/factor occurring during the lifespan of a construction project (Wang *et al.*, 2004).

Accordingly, risk management is concerned with the identification of risks and the execution of plans aimed at minimizing, sharing, transferring, or accepting those risks (Jergeas and Put, 2001). In order to reach the targets, set up for the construction projects, the risks associated with the project need to be managed on a proactive basis (Goh *et al.*, 2012). This in turn necessitates that project related risks have been identified and classified prior to the commencement of the construction project (Adam and

Göran, 2015). There are numerous ways in which risks can be classified. A typical convention in risk management is to consider risks as belonging to either an internal group wherein one possesses some amount of control or an external group where one is subjected to circumstances beyond control.

The aim of this research is to assess the risk management capability level of building clients in Nigeria, with a view to improving the level of competence of the client. (i.) Identify and assess risk management process in relation to client knowledge of risk. (ii) Identify and examine the basis for assessing the risk management capacity of building client (iii.) To evaluate current capacity in order to improve areas of strength and weakness in the risk management practice.

LITERATURE REVIEW

The need for infrastructural development brings about the rapid growth in construction industries around the world. Development of infrastructure is one of the key drivers in business over the globe; it increases the GDP of a nation (Odeyinka *et al.*, 2007). This made countries to prioritize infrastructural development and make provisions in their budgets for financing it. This leads to new challenges and considering the risks involved in the design and production. Construction projects by its nature allows a lot of scope for many environmental and socio-political problems from pre-contract, contract up to post-contract stage leading to completion time problem, cost overruns and poor-quality work (Okuwoga, 1998). Cost overruns will definitely affect project especially when involving a large amount of money (Odeyinka *et al.*, 2007). In order to avoid or reduce the losses, management of the risk involved in the construction project is required.

Construction process or activity deals with materials and components which need to be assembled, designed and produced by different suppliers from diverse disciplines and with different technologies, so as to develop ‘the built environment’. These activities include project planning, work regulation, design, construction, maintenance and final commissioning of the structure. The complexity and size of activities differs from one activity to the other based on the work undertaking by local builders or international construction firms engaging in complex or even high-risk projects e.g. civil construction or a simple building. A new construction is regarded as a means of providing a structure or building (e.g., a warehouse or bungalow), or infrastructure which will develop the economy (e.g. a railway), a societal improvement or service (e.g., a hospital) or provision for direct need. This means that construction can be a means of economic development for a nation and accounts for a certain percentage of a nation’s annual fixed capital formation. It helps in the delivery of goods and services from other parts of the economy.

The construction industry on its part, provide many employment opportunities within the field of building, engineering, architectural and private industries. It requires the effort of different firms, experience contractors, architects and engineers, professionals like structural engineers and quantity surveyors, suppliers and manufacturers of equipment.

The Concept of Management

According to Bhandari and Gayakwad (2014), throughout the world the construction industry has changed rapidly over the past decade; companies are now faced with more risk and uncertainty than before. As the project starts taking up speed and progresses further many points, misunderstanding, conflicts start to rise up which leads to probable risk in the projects.

Risk which have not been identified and managed are undoubtedly unchecked threats to a project’s objectives, which in turn may lead to considerable overruns in cost scheduling/time. Risk management presently is a critical factor for successful project management, as projects are tending to be more complex and day by day competition is increasingly tougher. It can be said that exist direct relationship between effective risk management and project success since risks are assessed by

their potential effect on the objectives of the project. Therefore, a systematic approach must be taken to manage risks through the development of a project (Mills, 2001). Risk management is a proactive decision-making process, which involves accepting known risks, and/or taking steps to mitigate the impact and likelihood of the occurrence of risks, to minimize the threats and maximize the opportunities (Loosemore *et al.*, 2006). Despite numerous risk management processes proposed in the literature (He, 1995; Chapman, 1997; Tah and Carr, 2001; PMI, 2004; Loosemore *et al.*, 2006), the five main steps in the risk management processes are generally, risk planning, risk identification, risk analysis, risk response and risk monitoring and control.

Risk Management Process

The identification, assessment and management of risk across an organization help to reveal the importance of the whole project. The overall risk management process is summarized into the following four processes

Risk Identification

According to Bhandari and Gayakwad (2014), risk identification is the first step of risk management process, in which potential risk associated with a construction projects are identified. Determination of most likely affecting the project and documentation of characteristics of each risk is the main task in risk identification. Risk identification involves accepting the risk which would occur at any phase of the project. It helps to understand the risk, its consequences and probability of occurrence. The project or the risk manager will react to the risk in case of occurrence. Identification of risk can be carried out according to Mahendra *et al.* (2013) through the following five (5) methods as stated below:

- i. **Brainstorming:** This is one of the most popular techniques. Generally, it is used for ideas generation, it is also very useful for risk identification. All relevant persons associated with the project gather at one place. There is one facilitator who is briefing about various aspects with the participants and then after, note down the factors. Before closing, the facilitator reviews the factors and eliminates the unnecessary ones.
- ii. **Delphi Techniques:** This Technique is similar to brainstorming but the participants in this do not know each other and they are not at the same place. They will identify the factors without consulting other participants. The facilitators like in brainstorming sum up the identified factors.
- iii. **Interview/expert Opinion:** Experts or personnel with sufficient experience in a project can be a great help in avoiding/solving similar problems over and over again. All the participants or relevant persons in the can be interviewed for the identification of factors affecting risk.
- iv. **Past Experience:** Past Experience from the same kind of project, the analogy can be formed for identification of the factors. When comparing the characteristics of projects, this will provide insight about the common factors.

Risk Assessment/Quantification

Assessment of risk and the possible interaction of risks with project activities to evaluate the possible outcomes of the project. Actually, risk can be avoided by not doing part of the project which contains risk or otherwise changing strategy so as to minimize the risk which would likely to come into the

project phase (Bhandari and Gayawad, 2014). According to Mahendra *et al.* (2013), risk qualification/assessment can be carried out through any of the under listed four methods

Risk Response

According to Buhandari and Gayawad (2014), risk response can be defined as response steps for opportunities and threats associated with risks. Risk can be monitored by employing a predictive indicator to watch the project as it approaches a risky point. The risk strategy is to monitor the risk by being part of the test term. Mahendra *et al.* (2013) identified eight (8) methods listed below for risk response.

- i. Risk Avoidance: Risk can be awarded by removing the cause of the risk executing the project in a different direction while still aiming to accomplish project objectives. Change project management plan to eliminate a threat, to isolate project objective from the risk's impact, or to relax the project objective that is in jeopardy, such as extending schedule or reducing the scope.
- ii. Risk Transfer: Transfer risk involves finding some other party who is willing to accept responsibility for its management, and who will bear the liability of the risk should it occur. Transferring a threat does eliminate it; the threat still exists however it is owned and managed by other party. Transferring risk can be an effective way to deal with financial risk exposure. The aim is to ensure that the risk is owned and managed by the party best able to deal with it effectively.
- iii. Risk Mitigation/Reduction: Risk mitigation reduces the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or of risk is often more effective than attempting to repair the damage after the risk has passed.
- iv. Risk Exploit: This risk by creating the opportunity definitely happen Eliminate the uncertainty association with a particular upside risk. An opportunity is defined as a risk event that if it occurs will have a positive effect on achievement of project objectives.
- v. Risk Share: Allocate risk ownership of an opportunity to another party who is best able to maximize its probability of occurrence and increase the potential benefit if it does happen. Transferring threats are sharing opportunity are similar in that a third party is used, those to whom the threat is transferred take on the liability and those to whom opportunity are allocated should also be allowed to share in the potential benefits.
- vi. Risk Enhance: This response aims to alter the "size" of the positives risk. The opportunity is enhanced by increasing its probability and/or impact thereby maximize, the benefit grained from the project. Seeking to facilitate or strengthen the cause the case of the opportunity, and proactively targeting and reinforcing its trigger conditions.
- vii. Risk Acceptance: Ultimate it is not possible to eliminate threat or take advantage of all opportunity through documenting them and at least provide awareness that these exist and have been identified, some term this passive acceptance. This strategy is adopted when it is not possible or practice to grandness of the risk by the other strategies or a

response is not justified by the accepted a risk, they agreeing to address the risk if and when it happens.

- viii. Contingency Plan: This involves the use of a fall-back plan if a risk occurs. Contingencies can also be in the form of sometime kept in reserve to idea with unknown risks.

Risk Control

Mahendra *et al.* (2013) stated that risk control is the final step of the process. After implementation of response action. Tracking and recording must be carried out for their effectiveness and take care of any change to the project risk profile. Did the response action have a positive or negative effect on achieving project objective? Response to the change implemented to remove risk throughout the project duration by transferring the risk by mean of insurance. Response taken in risk should also document for future reference and project plan.

Classification of Risk

Risk classification is a significant step in the risk management process, as it attempts to structure the diverse risk affecting a contracture project. In the effective management of risk, several many methods have been suggested for the classification of risk.

Furthermore, Bhandari *et al.* (2014) classified risk according to their source into the following:

- i. Technical risks: improper and inadequate site Survey & investigation, incomplete and faulty design, Appropriateness of specification and uncertainty over the source and availability of materials.
- ii. Logistical risk: Non availability of sufficient transportation facilities and Non availability of construction equipment spare parts, fuel and labour.
- iii. Management related risk: Uncertain productivity of resource and industrial relation problems.
- iv. Environmental risk: Weather and seasonal change and Natural disaster
- v. Financial risk: availability and fluctuation in foreign exchange. Delay in payment, inflation and local taxes.

RESEARCH METHOD

Having reviewed the related literature on various research methods, the study adopts the quantitative methods of approach, first handed source of data collection follow through the establishment of well-structured questionnaires to 200 respondents and completed questionnaires returned were analysed that is from the contractor and professionals' groups respectively. The data collected was analysed using the computer software packages, Statistical Products for Services Solutions (SPSS), in order to attain the objectives of the study as discussed, mean items score (MIS) was used in analysing the objective. Data was analysed using descriptive statistics to show the frequencies and mean of reaction to questions with fixed reactions to establish the background information of the respondents and other various project parameters to respondent's organization, risk management capability level.

Data Analysis

Analysis of the Respondent's Profile: Two hundred (200) numbers of questionnaires were administered during the course of the study a total of 133 questionnaire which represent 66.5% were correctly completed and good for analysis. The analysis below represents the professional

designation of the various professionals involved in the survey. Quantity Surveyors made the largest population representing 25% of the total responses, followed by Architects representing 25% of the response, 16% of the response represents Builders, Engineers represents 14% of the survey while 11% represents other professionals in the built environment which were not categorized here.

Table 1: Respondent's Professional Designation

S/NO	Professional Designation of Respondents	Frequency	Percentage (%)
1.	Architects	33	25
2.	Builders	21	16
3.	Engineers	19	14
4.	Quantity Surveyors	45	34
5.	Others	15	11
Total		133	100

RESULTS

The respondents agree that “having risk discussion on the project scope and milestone information at regular interval”, “a documented, repeatable for identifying project risk and an improvement process to completely identify the risk as early as possible” and “identifying risk has effect on the long term objective of project” were ranked fifth, sixth and seventh with the MIS of 2.947, 2.939 and 2.782 respectively.

Table 2: Risk Identification in Relation to Client's Knowledge of Risk

S/NO	Risk Identification	Mean Score	Ranking	Decision
1.	At the beginning of project risk is identify as a standard activity.	3.308	1 st	Strongly Agree
2.	Risk identification has impact on quality, health and safety, environment.	3.203	2 nd	Strongly Agree
3.	Identifying risks has impact on time and cost.	3.045	3 rd	Strongly Agree
4.	Applying formalized risk identification process to most of the projects.	3.015	4 th	Strongly Agree
5.	Having risk discussion on the project scope and milestone information at regular interval.	2.947	5 th	Agree
6.	A documented, repeatable for identifying project risk and an improvement process to completely identify the risk as early as possible.	2.939	6 th	Agree
7.	Identifying risk has effect on long term objective of project.			
	<i>Group Mean</i>	2.782	7 th	Agree
		3.034		Strongly Agree

Source: Researcher's Field Survey, (2020).

The analysis of the second process which is risk analysis, shows that the respondents strongly agree with “risk assessment using qualitative methods such as risk rating technique, probability impact matrices” which ranked first with the MIS of 3.000.

However, the respondents agreed with “Systematic approach impact project assessed intuitively” which was ranked second with the MIS of 2.993, “risk analysis using advanced methods such as simulation, sensitivity testing and decision support tools” which was ranked third with the MIS of 2.917 and “risk analysis using statistical tools as well as qualitative methods” which was ranked fourth with the MIS of 2.316.

Table 3: Risk Analysis in Relation to Client’s Knowledge of Risk

S/No.	Risk Analysis	MIS	Ranking	Decision
1.	Risk assessment using qualitative methods such as risk rating technique, probability impact matrices.	3.000	1 st	Strongly Agree
2.	Systematic approach impact project assessed intuitively.	2.993	2 nd	Agree
3.	Risk analysis using advanced methods such as simulation, sensitivity testing and decision support tools.	2.917	3 rd	Agree
4.	Risk analysis using statistical tools as well as qualitative methods.	2.316	4 th	Agree
Mean Score		2.807		Agree

From the analysis in Table 4, it can be seen that the stakeholders strongly agree that “historical information such as common risk items and risk triggers are collected and organized in the historical data base” which was ranked first with the MIS of 3.090 followed by “besides collecting the information such as common risk items and risk triggers, historical database is subject to a continuous improvement process” which was ranked second with the MIS of 3.000.

However, the respondents agree that “team members take decisions based on their own past experiences and discussion with the project team” with the MIS of 2.993, “have specific method to collect historical information, although some historical information about general trends in risk on similar projects may have been collected” with the MIS of 2.993 and “organization having a data base on typical risk encounter and related experiences impact on project” with the MIS of 2.91.

Table 4: Risk Information Database in Relation to Client’s Knowledge of Risk

S/No.	Risk Information Database	MIS	Ranking	Decision
1.	Historical information such as common risk items and risk triggers are collected and organized in the historical data base.	3.090	1 st	Strongly Agree
2.	Besides collecting the information such as common risk items and risk triggers, historical database is subject to a continuous improvement process.	3.000	2 nd	Strongly Agree
3.	Team members take decisions based on their own past experiences and discussion with the project team.	2.993	3 rd	Agree

4.	Have specific method to collect historical information, although some historical information about general trends in risk on similar projects may have been collected.	2.993	4 th	Agree
5.	Organization having a data base on typical risk encounter and related experiences impact on project.	2.910	5 th	Agree
Mean Score		2.997		Agree

The analysis in Table 5 shows that the respondents strongly agree with “contingency plans and mitigation strategies are developed for each risk item, so that project reserves can be allocated to cover such items when needed”, “risk management plans, contingency plans and risk allocation plans are prepared and risk control strategies are formulated as well as risk finance strategies” and “organization determines mitigation strategies or contingency plans for the future risk events” which were ranked first, second and third with the MIS of 3.233, 3.226 and 3.008 respectively. “Risk consideration in large emerge” was the least ranked factor under risk response development with the MIS of 2.707.

Table 5: Risk Response Development in Relation to Client’s Knowledge of Risk

S/No.	Risk Response Development	MIS	Ranking	Decision
1.	Contingency plans and mitigation strategies are developed for each risk item, so that project reserves can be allocated to cover such items when needed.	3.233	1 st	Strongly Agree
2.				
3.	Risk management plans, contingency plans and risk allocation plans are prepared and risk control strategies are formulated as well as risk finance strategies.	3.226	2 nd	Strongly Agree
4.	Organization determines mitigation strategies or contingency plans for the future risk events.	3.008	3 rd	Strongly Agree
	Risk consideration in large emerge.	2.707	4 th	Agree
Group Mean		3.044		Strongly Agree

The analysis in Table 6 indicates that the respondents strongly agree that “a formalized process for risk monitoring is used for project and risk management plan updated periodically” which was ranked first with the MIS of 3.083.

The respondents agreed with “project teams apply their own approach to management and controlling risks as a former process”, “responsibility is assigned for each risk item as it occurs” and “formalized generic process for actively and routinely tracking risks for projects” which were ranked second, third and fourth with the MIS of 2.932, 2.865 and 2.865 respectively.

Table 6: Risk Monitoring and Control in Relation to Client's Knowledge of Risk

S/No.	Risk Monitoring and Control	MIS	Ranking	Decision
1.	A formalized process for risk monitoring is used for project and risk management plan updated periodically.	3.083	1 st	Strongly Agree
2.	Project teams apply their own approach to management and controlling risks as a former process.	2.932	2 nd	Agree
3.	Responsibility is assigned for each risk item as it occurs. Formalized generic process for actively and routinely tracking risks for projects	2.865	3 rd	Agree
4.		2.865	4 th	Agree
Group Mean		2.936		Agree

From the analysis below, it was identified that the respondents strongly agree with “prepare report stored on the computer, shared and used forthcoming projects” as the notable factor of risk evaluation with the MIS of 3.083.

“Prepared report stored as hardcopy and shared” and “prepared report on an ad-hoc basis and failed” were ranked second and third with the MIS of 2.925 and 2.850 respectively.

Table 6: Risk Evaluation in Relation to Client's Knowledge of Risk

S/No.	Risk Evaluation	MIS	Ranking	Decision
1.	Prepare report stored on the computer, shared and used forthcoming projects.	3.083	1 st	Strongly Agree
2.	Prepared report stored as hardcopy and shared.	2.925	2 nd	Agree
3.	Prepared report on an ad-hoc basis and failed.	2.850	3 rd	Agree
Group Mean		2.953		Agree

From the analysis of the level of agreement of the six processes of risk management as it relates to client knowledge of risk, a group mean of each of the processes was derived and it shows that stakeholders in the various ministries and parastatals strongly agreed that “risk response development” and “risk identification” which were ranked first and second with the group mean of 3.044 and 3.034 respectively.

On the other hand, “risk information database”, “risk evaluation”, “risk monitoring and control” and “risk analysis” were agreed upon by the respondents having ranked third, fourth, fifth and sixth with a group mean of 2.997, 2.953, 2.963 and 2.807 respectively.

Generally, for exceeding the threshold of two (2) point, it can be deduced that the risk management processes are all in relation to the client knowledge of risk.

Table 8: Summary of Risk Management Processes

S/No.	Risk Management Processes	Group Mean	Ranking	Decision
	Risk Response Development	3.044	1 st	Strongly Agree
	Risk Identification	3.034	2 nd	Strongly Agree
	Risk Information Database	2.997	3 rd	Agree
	Risk Evaluation	2.953	4 th	Agree
	Risk Monitoring and Control	2.936	5 th	Agree
	Risk Analysis	2.807	6 th	Agree
	Average Mean	2.962		Agree

DISCUSSION OF RESULTS

Findings from the research revealed that the respondents strongly agree with risk response development and risk identification as it relates to client's knowledge about risk. They also agreed with risk information database, risk evaluation, risk monitoring and control and risk analysis as they also relate to client's knowledge about risk. This finding is in line with that of Jergeas and Put (2001) who found that risk management is concerned with the risk identification and the execution of plans aimed at minimizing, sharing, transferring, or accepting those risks. It also corroborates with the study of Ehsan *et al.* (2010) which concluded that risk information database is crucial because new projects are always prone to risk because the process has not been experienced over time. Hence, there is always uncertainty when something is been done for the first time. But if a similar project of that nature has been done before and documented, then the prospect of a successful operation is enhanced. From the analysis of the basis of assessing the risk management capacity of building client, it was discovered that some of the important basis for assessing risk management capability of building client are; risk management is a critical success factor which significantly improve project performance, risk management is essential to achieve successful projects, risk management provides benefits and adds value to organization performance, risk management minimizes cost increase/profitability, risk management increase safety and reliability, risk management increase quality of projects, risk management increase organization learning, and risk management increase client satisfaction. This is in consonance with the findings of Odeyinka *et al.* (2007) that cost overruns will definitely affect project especially when involving a large amount of money, hence the need for a reliable basis for assessing risk management. Findings from the analysis of the current capability in order to improve areas of strength and weakness in the risk management practice shows that: Risk management is necessary for every organization to improve its competitive advantage. Risk management is a critical success factor and it can significantly improve business performance, benefits of risk management demonstrated by various applications. This is in line with the study of Awodele *et al.* (2009). Top management gives full commitment to risk management, gives promotion, support and requires risk reporting. Risk management is practiced on all projects, it is systematic, routine and standardized. Total project risks are covered, but no risk management planning across projects. This is in line with the proposition of Mills (2001) that a systematic approach must be taken to manage risks through the development of a project and this is also consistent with the findings of Adam and Goran (2015). Risk management has a high integration with some project management tasks such as value management, quality assurance and management, contract management and environmental impact management. Risk management has a high

integration with some corporate management tasks such as business development, strategic planning, financial/portfolio management, and procurement management. This finding is supported by the findings reported by Ehsan *et al.* (2010).

CONCLUSION

From the six (6) processes of risk management identified, it was evident that risk response development and risk identification are the highly ranked risk management processes that relate to client's knowledge about risk. This study also concludes that, risk management is a critical success factor which significantly improve project performance, risk management is essential to achieve successful projects, risk management provides benefits and adds value to organization performance, risk management minimizes cost increase/profitability, risk management increase safety and reliability, risk management

Recommendation

This paper assessed the risk management capability level of building clients in Abuja Nigeria, with a view to improving the level of competence of the client. It is in this regard that the following recommendations are made:

- i. Organizations and construction stakeholders should encourage and foster participation in risk response development and risk identification, so as ascertain the possibility of risk occurrence and how to respond to it when it occurs.
- ii. Since it has been identified that; risk management is a critical success factor which significantly improve project performance, to achieve successful projects, provides benefits and adds value to organization performance, and minimizes cost increase. This study recommends that the aforementioned basis of assessment should be adopted and improved so as to improve organization's competitive advantage

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ASSESSING THE READINESS OF CLIENTS TO IMPLEMENT WHOLE LIFE COSTING IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

The total amount to be spent on a building requires a more precise and adaptable method to achieve the desired quality of service. Therefore, by adopting whole life costing (WLC) technique together with risk management, practitioners (consultants & clients) will have at their disposal a valuable tool for assessing economic performance of a building throughout its life cycle. Studies have reported low implementation despite its importance. Although, recent efforts have revealed that consultants are ready to implement WLC, to a large extent the readiness level of clients to implement WLC has not been reported and until all stakeholders are ready, WLC implementation will not be successful. Hence, this study assessed the readiness level of clients to implement WLC in the Nigerian construction industry. The study administered questionnaires to the tertiary institutions benefiting from the Tertiary Education Trust fund (TETFund) in Nigeria. Descriptive statistics and VERDICT (Verify End-user e-Readiness using a Diagnostic Tool) model were the analytical tools used in this study. The study found that, unstable economic situation was the most important barrier to the adoption of WLC, while the most important driver was training & education on WLC. Lastly, results showed that construction clients are not ready to adopt WLC in the Nigerian construction industry, having had very low values in all dimensions of the model. Therefore, the study recommends further studies to develop strategies for improving the readiness level of clients to implement WLC.

Key words: Whole life costing, VERDICT, Risk management

INTRODUCTION

Towards the late 1990s, the concept of ‘whole life costing’ (WLC) and ‘whole life-cycle costing’ (WLCC) emerged. The terms whole life costing and whole life-cycle costing are interchangeable. WLCC is a new term that appears to have been adopted by many building economists involved in the preparation of forecasts for the long-term cost assessments of capital projects (source). There has been debate amongst academics and practitioners as to whether a difference really does exist between WLCC and LCC. The key emphasis in most of the

definitions lies in the implication that Life Cycle Costing (LCC) is only concerned with the economic life of the building, in other words the period of commercial interest. It could be argued that WLCC forms the attempt by academia and practitioners to overcome some of the problems of LCC. Moreover, it takes into account the costs of running and operating a building over its entire life span, as opposed to over a specified period of time, which is a feature of LCC models. LCC in construction industry according to Anao (2001) in Akinrata (2016) is the sum of acquisition cost and ownership cost for an asset over its life-cycle from design stage, manufacturing, usage, maintenance and disposal. LCC is an economic estimation method that evaluates the entire cost of a building over its operating life, including initial capital costs, maintenance costs, operating costs and the ultimate disposal of the asset at the end of its life (Oduyemi, 2015). For the purpose of this study whole life costing (WLC) will be used.

Several studies have been carried out on establishing WLC in construction projects. Aye, Bamford, Charters, & Robinson (2000) carried out a research on 'Environmentally sustainable development; a life-cycle costing approach for a commercial building in Australia', where they used WLC to evaluate a range of property and a construction options for a building. Abraham & Dickinson (1998) studied the disposal of a building in which WLC calculation was used to quantified disposal costs. Bogenstatter (2000) in his prediction and optimization of life-cycle costs in early design, promoted the usability of active WLC calculation in the early design phase. Buildings as the outcome of construction projects are long lasting goods and decisions connected with construction projects have long-term consequences (Ryghaug & Sorensen, 2009). Yet often, building owners or investors focus only on the purchase cost when they make decisions about such matters as building design, equipment and energy systems, and they then tend to ignore future operation and maintenance costs (Heralova, 2017). For every £1 spend on capital cost, £50 is spent on maintenance costs and £200 is spent on operational costs (Langdon, 2007). The effects of maintenance and running costs on construction are so evident that any attempt to overlook them would be at the detriment of the clients.

Previous research conducted in Nigeria in the area of WLC like that of Ityobee (2000) investigated the application of WLC in building projects in Nigeria. Bello (2012) investigated the application of WLC in the procurement of public buildings, while Ibrahim *et al.* (2010) identified the characteristics of WLC data in the Nigerian construction industry to include non-formal documentation of sources, availability, reliability and consistency of WLC data as well

as a standard procedure for the collection, analysis, validation and presentation of WLC data. Folorunsho (2016) concluded that the professional Quantity Surveyors are ready to practice WLC in the Nigerian construction industry. Existing literature has generally demonstrated the readiness of consultants to implement WLC, however, not much research has been conducted to determine the readiness of client sector in implementing WLC in Nigerian construction industry. Thus, it will be incomplete and unsuccessful if the consultants are ready to practice WLC without the readiness of the client sector in implementing it. Hence, this research aims to assess the readiness of client sector in implementing WLC in Nigerian construction industry. The paper first presents a review of literature on barriers and drivers to WLC, and subsequently the research methods; results and discussion; and conclusion were presented.

Barriers and Drivers to Whole Life Costing

Over the years, the construction industry operates in an increasingly uncertain business environment, characterized by increasing competitiveness, resource scarcity, sustainability requirements, and demand for current and future value for money by its stakeholders in Nigeria. Despite the fact that there is need for life cycle costing in the industry, these are the barriers facing its implementation in Nigeria:

(1) Fragmented nature of the construction industry

The fragmented nature of the construction industry has been a key inhibitor to an increase in the uptake of WLC. The argument put forward implies that a lack of joined up thinking regarding the overall construction process would restrict its application. Each component of the construction process, whether planning, building or maintaining, is considered separately and this approach offers a complete contrast to the philosophy of WLC. In addition, Cole and Sterner (2000) explain that bureaucratic structures affecting public sector client organizations have also severely restricted the use WLC analysis on their projects.

(2) Lack of common and standard method

Oduyemi *et al.* (2014) identified lack of a common method as the major limitation of WLC and one of the key problems that exist in WLC is the lack of an acknowledged methodology for carrying out an WLC procedure. The journey towards a standardised method has been muted by practitioners since 1970. However, the construction industry is yet to develop a framework for WLC that is not only universally acceptable, but more importantly dynamic

in use as most clients now want buildings that demonstrate value for money over a long term. Subsequently, several researchers have sought to use different methods to deliver effective solutions to the problems of uncertainty quantification (Kelly & Hunter, 2009; Kirkham, 2002; Choong, *et al.*, 2002; Kirkham, Boussabaine & Kirkham, 2002). However, there is still no real credible user-friendly method in place as the existing frameworks do not enable researchers to forecast future operational and maintenance costs before integrating quantitative risk assessment measures (Creedy, 2006).

(3) Risk and uncertainty

It has been widely noted that concerns about using a WLC approach are based mainly on the risky nature of the assumptions on which the forecasts are modelled (Boussabaine & Kirkham, 2008). Whilst forecasting of future costs is to some extent not an inexact science, this should not dissuade analysts and managers from attempting to apply WLC principles (Kishk, Al-Hajj & Pollock, 2001).

(4) Client unwillingness

Clients do not request for WLC during execution of project, this is because most Clients in Nigeria are ill informed about the benefits of a life cycle approach which can lead to subjective decision-making (Boussabaine & Kirkham, 2008).

(5) Unstable economic situation

Unstable economic situation is one of the major barriers facing WLC implementation in Nigerian construction industry. The construction industry in the Nigeria is facing unprecedented and demanding uncertainty, rising inflation with poor economic trends, reduction in purchasing power, budget limitation. These really affect WLC implementation in Nigeria (Oduyemi *et al.*, 2014).

(6) Separation of capital and running cost of project

Separation of capital/acquisition and running cost of most projects, the divorce between capital cost and running cost really affect application of WLC in Nigerian construction industry. The practice of accepting the cheapest tender and then the subsequent handover without any interest in its future beyond the defect liability period serve as a major barrier. The lack of clear definition of the responsibilities of the buyer and seller are thought to be the reason for this assert that the way public funds are divided between capital spend and

ongoing revenue budgets ensure that decisions are made in isolation from each other and not in accordance with the suggested WLC framework. These sentiments are further alluded to, by Perera, *et al.* (2009) who assert widespread reforms of public expenditure are required to allow WLC to be better incorporated within public procurement budgeting.

(7) Type of investor/user

Most developers are concerned with the initial costs as they do not manage the buildings when completed. This result in a lack of long-term interest in the building operating and maintenance costs and similarly, the lack of capital and the high financial costs and prevailing interest rates can limit investors on advanced investment to cut the operating costs (Oduyemi *et al.*, 2014).

(8) Lack of quality data

Kishk (2004); Kishk *et al.* (2006) identifies the quality of the data available to execute the analysis of a potential building project's initial costs, future operating and maintenance costs, life cycles and discount and inflation rates as a critical issue affecting the use of WLC in practice. This is one of the problems of implementing WLC in Nigerian construction industry. Oduyemi *et al.* (2014) reported the lack of quality data to execute the analysis due to unstable economy, bring a big blow on WLC implementation in the Nigeria industry.

(9) Unreliable data

The trouble of getting the correct level of information to calculate WLC is one of the main problems in Nigeria. This is as a result of the absence of suitable, applicable and consistent historical figures and statistics. It is true that life cycle costing (WLC) plays an increasingly significant aspect in assessing the procurement of constructions in Nigeria, but the absence of consistent and reliable data for precise WLC examination remains the problem as stated by Bouachera *et al.* (2007).

RESEARCH METHODS

A survey research method was adopted to assess the readiness of the construction clients in implementing WLC in the Nigerian construction industry. Questionnaires were designed and distributed to Tertiary institutions benefiting from TETFUND in Nigeria, of which there are 200 Tertiary institutions benefiting from TETFUND as obtained from their website www.tetfund.gov.ng in March 2018. A sample size of 67 was computed and data collected were assessed using descriptive statistics and VERDICT (Verify End-User e-Readiness using Diagnostic Tool). VERDICT assesses the e-readiness of construction companies in terms of their

management, people, process and technology and presents the e-readiness results in both textual and graphical formats (Ruikar *et al.*, 2006).

The assessment is performed by finding the average score for each of the four categories from the judgements of the respondents on the statements in the questionnaire. Furthermore, colour indicator in form of lights from traffic used in this model shows the strength and weakness of the organization, which visibly pointing parts that require improvement. The textual and graphical forms are broken down into three sections as follows:

- i. Table showing summary of average scores in each category,
- ii. Radar diagram showing overall scores and
- iii. Summary containing all responses.

The table showing summary of average scores for each aspect presents responses to various aspects that is, Management, People, Process, and Technology and presents the mean score in each aspect. As outlined by Ruikar *et al.* (2006), an average score is taken, and on that basis, respondents are shown with traffic light indicators which are red, amber and green, to visually represent their readiness in each category. A mean score between 0 and 2.5 is represented with a red light which signifies that several aspects needs urgent attention. Also, a mean score between 2.6 to 3.5 is represented with Amber colour which signifies that few aspects needs attention and lastly, mean score above 3.5 is presented with a green, signifying that the organization is fully matured and prepared.

RESULTS AND DISCUSSIONS

The barriers and drivers for the implementation of WLC have assessed and presented in Tables 1 and 2. Also table 3 and 4 shows the readiness assessment of client sector to implement WLC. Finally figure 1 presents the radar diagram showing overall scores.

Table 1: Barriers to the implementation of WLC

Barriers	Number	$\sum Fx$	Mean	STD	Rank
Unstable economic situation	45	185	4.11	1.11	1
Risk and uncertainty	45	171	3.8	1.1	2
Separation of capital and running cost of project	45	167	3.71	1.08	3
Unreliable data	45	156	3.47	1.2	4
Lack of quality data	45	154	3.42	1.08	5
Government policy	45	134	2.98	1.29	6
Fragmented nature of the construction industry	45	120	2.67	1.15	7
Lack of common and standard method	45	115	2.56	1.1	8

Table 1 shows the extent to which the clients agree with the following as barriers to the implementation of WLC. Unstable economic situation, risk and uncertainty and separation of capital and running cost of projects are the top three (3) barriers while government policy,

fragmentation of the industry and lack of common standard are the least three (3) barriers to the implementation of WLC. These findings contradict that of Chiurugwi, Udejaja & Hogg (2010) which reported lack of fiscal measures that encourages clients' use of WLC, clients' unwillingness to pay for it and clients do not request it as barriers to the implementation of WLC costing. Similarly, Oduyemi, Okoro & Dean (2014) reported lack of reliable data, lack of common and standard method and type of investor/user as the most significant barriers to the implementation of WLC. A number of reasons such as the perception of the respondents used, differences in economies and also project types, could be the justification for varied findings. In addition, Oduyemi, et al. (2014) reported that most of the barriers are directly caused by lack of knowledge and information on WLC.

Table 2: Drivers for the implementation of WLC

Drivers	Number	$\sum Fx$	Mean	STD	Rank
Training and education of whole life-cycle costing	45	176	3.91	0.79	1
Client commitment and involvement	45	168	3.73	1.05	2
Incorporation of whole life-cycle costing in procurement and contract award	45	168	3.73	0.99	3
Societal awareness	45	157	3.49	1.2	4
Government intervention	45	142	3.16	3.46	5

Table 2 shows the extent to which the clients agree with the following as drivers for the implementation of WLC costing. Training and education of WLC, client commitment and involvement and incorporation of WLC in procurement and contract award are the top three (3) drivers while societal awareness and government intervention, are the least two (2) drivers for the implementation of WLC. Chiurugwi, *et al.* (2010) reported incorporating WLC into procurement and contract awards and clarify when and how to carry out WLC as the top drivers for the implementation of WLC. This to some extent is in line with the findings of this study.

Table 3: Summary of Average Scores in Each Category

Category Name	Average Score	Traffic Light Indicator
Management Readiness	2.86	●
Process/Project Readiness	3.25	●
People Readiness	3.07	●
Technology Readiness	3.29	●

Table 3 summarizes the average scores in each category (management, process, people and technology) with corresponding traffic light indicators. An average score ranging between 2.86 to 3.29 across all categories signifies Amber indicators. This means certain aspects within all the categories need attention to achieve e-readiness.

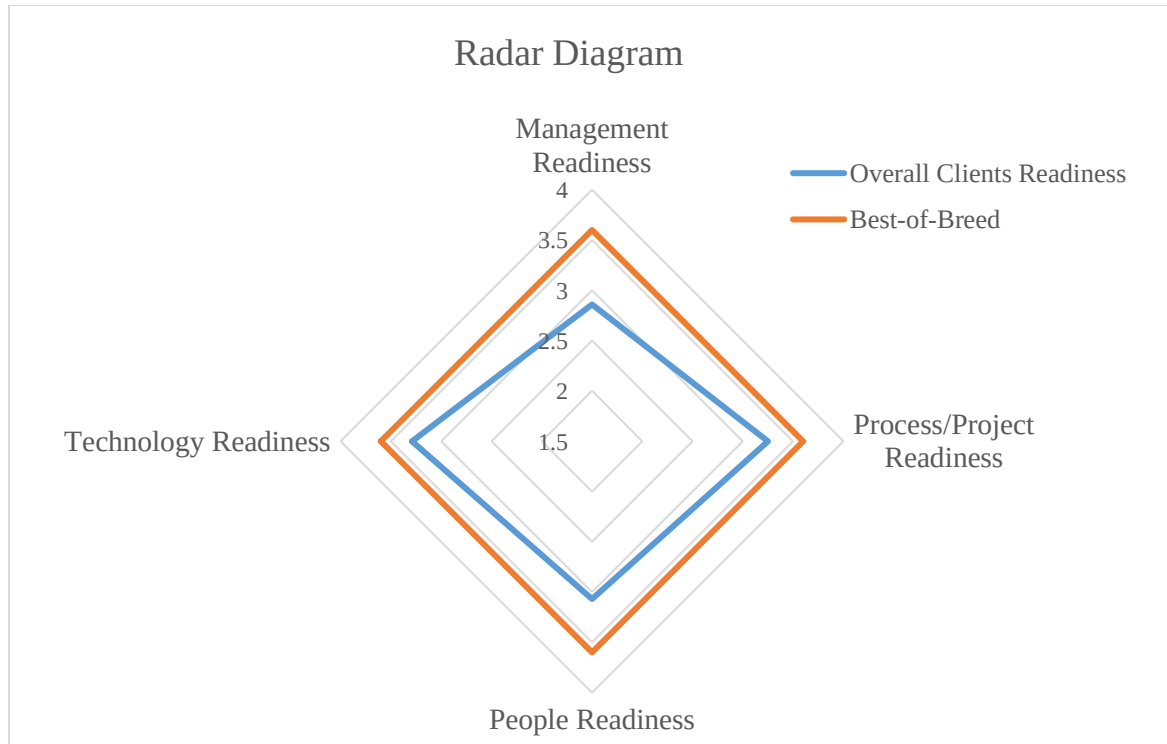


Figure1: Radar Diagram showing average e-readiness of clients compared to best-of-breed

Figure 1 shows a radar diagram which seeks to provide the readers a visual representation of the overall e-readiness of clients (shown in blue line) as compared to the best-of-breed (shown in red lines). In this study the best-of-breed is the point at which clients becomes fully matured and prepared to implement WLC. From the radar diagram above, clients are edging closely towards

technology and process/project readiness, while for management and people readiness, clients have very low values as discussed in Table 3.

Table 3: Readiness assessment

Organisational Readiness Assessment	Number	$\sum Fx$	Mean	S.D
Management Readiness				
Our management is aware of WLC and recognized the benefits of WLC	45	134	2.98	0.99
All levels of management in our institution have a WLC mind approach	45	124	2.76	0.74
WLC strategy is well communicated to all levels within the organization	45	133	2.96	0.95
We have provided adequate financial resources to facilitate WLC in our practices	45	119	2.64	0.86
We have a policy for training and capacity. building to keep our staff up to date with WLCC tools	45	134	2.98	0.99
Average Score			2.86	
Process/Project Readiness				
Our organisation is flexible enough to accommodate WLC	45	136	3.02	0.89
Our business process support and encourage interdisciplinary/inter-organisational Collaboration	45	146	3.24	1
We have adequate competent design team and construction process	45	136	3.02	0.87
Our current ICT infrastructure is adequate for supporting WLC	45	136	3.02	0.72
Our use of WLC will improve Health and safety during project delivery	45	147	3.27	0.81
Our organisation focusses on client expectations	45	150	3.33	1.07
We display high level of quality assurance	45	151	3.36	0.91
Our use of WLC will reduce risks on overall project management	45	167	3.71	0.73
Average Score			3.25	
People Readiness				
We have people with ability to implement change and move quickly to adopt the use of WLC	45	148	3.29	0.89
Our staff have the necessary levels of IT literacy, functional expertise and skills to use WLC	45	139	3.09	0.85
Our current organisational structure provides an environment that is well suited to use WLC	45	127	2.82	1.11
Table 3 Continues				
Our staff fully understand the importance of training required for using WLC	45	140	3.11	1.01

We have devised training procedures that will enable our staff to effectively use WLC	45	137	3.04	0.9
Average Score			3.07	
Technology Readiness				
Our current ICT systems are flexible to accommodate rapid change and scalability	45	154	3.42	0.87
We have effective intranet and extranet facilities to facilitate information sharing and interoperability.	45	155	3.44	0.81
Our organization have well defined IT policy	45	153	3.4	0.86
We are familiar with the use specialist software applications related to our expertise.	45	131	2.91	0.82
Average Score			3.29	

Table 3 shows the readiness of the client in adopting WLC in the Nigerian construction industry. To successfully implement any technology, there is a need to have people with adequate skills, understanding and belief in the technology, then process that support and enable the adoption of the technology, then the technology tools and infrastructure necessary to support the business functions and, lastly, consideration of management buy-in and belief.

The assessment showed an average score ranging between 2.86 to 3.29 for the components of the readiness assessment model. This shows that the average score in all categories are greater than 2.5 but less than 3.5 (amber). This clearly indicates that the clients in the Nigerian construction industry are not ready to implement WLC and they need to pay attention to all aspects to achieve management, process/project, people and technology readiness for implementing WLC. Furthermore, in Table 3, all of the constructs have been highlighted amber except one (Our use of WLC will reduce risks on overall project management) that is from the process/project readiness. This means only one construct exceeds the threshold of 3.5 (Green), signifying that the clients are fully matured and prepared regarding the construct (Our use of WLC will reduce risks on overall project management).

In summary, this study has brought to the fore, the major barriers to the implementation of WLC in Nigeria to be; unstable economic situation, risk and uncertainty, separation of capital and running cost of projects. While the drivers of WLC are; training and education on WLC, client commitment and involvement and incorporation of WLC in procurement and contract award. Finally, the readiness assessment showed that the clients are not ready to implement WLC.

CONCLUSIONS AND RECOMMENDATIONS

Cost has been traditionally known as a key factor that needs to be considered in the decision-making process (Ayangade, 2009). However, the construction clients often focused on the initial capital cost which does not necessarily improve the lifetime performance of buildings. A higher initial capital cost might decrease total life cycle cost. It is therefore, important to show the construction client in the early design stage the relationship between design choices and the resulting lifetime cost (Kotaji *et al.*, 2003). Prior to that, both clients and consultants need to be ready to implement WLC, otherwise the ultimate goal of the client to achieve value for money becomes unsuccessful. This study has used the VERDICT readiness assessment model developed by Ruikar *et al.* (2006) to assess the clients' readiness level to implement WLC and found that they are not completely ready, there are aspects that needs urgent attention. This could largely be as a result of some barriers (time constraints, lack of information among others) hindering its implementation.

Hence, construction clients should be educated on the benefits and requirements of WLC by the professionals responsible for cost planning and management in the Nigerian construction industry. The study also recommends further studies to develop ways and strategies on how clients will adopt and implement WLC in order to achieve value for money.

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ASSESSING THE PATTERN OF QUANTITY SURVEYING PRACTICE IN THE NIGERIAN INFORMAL SECTOR

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ABSTRACT

The purpose of this paper is to assess the pattern of quantity surveying practice in the informal sector of the Nigerian economy. The specific objectives are to assess the awareness and utilisation of quantity surveying services, means of securing commission, type of services rendered and remuneration structure. Survey research method, using questionnaire, was adopted for the study. Primary data were elicited from the practicing quantity surveyors and the prospective clients utilising the services of quantity surveyors in the informal sector of Ogun State, Nigeria. Out of the 648 building owners in the study area, 50% (348) were systematically selected for sampling. In addition, a census of the total 27 quantity surveyors in Ogun State was surveyed. The data obtained were analysed using both descriptive and inferential statistics. While the patronage of quantity surveyors was revealed to be low, preparation of schedule of materials was the most utilised quantity surveying services and the most frequent means of securing commission was through friends. The payment structure was mostly by negotiation. It was concluded that awareness of quantity surveying services, means of securing commission and ability to pay for services rendered were significant in the pattern of quantity surveying practice in the sector.

Keywords: informal sector, Nigeria economy, pattern of practice, quantity surveying, service delivery.

INTRODUCTION

The concept of the informal sector originated from a study in a Third World context (Conroy, 2012). The sector denotes economic activities that obtain outside the formal standard of economic transaction established by the state and formal business practices. The informal sector is more or less an open market, where there is free entry and exit. World over, the concept of the informal sector has been applied to analyse the employment situation and policy options for economic survival (Fasanya *et al.*, 2012). The growth of the informal sector during the economic reform has led to the renewal of the interest in studies of the informal sector with a view to assessing dynamics of the sector. The informal sector of the Nigerian economy, accounts for about 21 percent of total employment in Sub-Saharan African countries, and about 38 percent of the gross domestic product (GDP) in Nigeria (Onyemaechi, 2013). In the world over; Attah *et al.* (2013) had submitted that about two-thirds of all employees work in the informal sector. These submissions highlight the significance of the sector to the economy of any nation. However, the informal sector, as an avenue for construction professionals to display their prowess and engendering professional practice, seems to suffer dearth of research to exploring its potentiality, especially in Nigeria. The survival of a profession with rules and regulations and standards for practice is rather slim in this type of an environment. Especially, when quackery and unemployment are at their highest ebb in the country and the sector seems rather attractive for professionals to consider venturing into. Babalola (2006) happened on reduced patronage of quantity surveyors by government agencies and opined that it would be astute if the informal

sector of the economy, with its prospect for sustainability, is explored. The aim of this study, therefore, is to examine the pattern of quantity surveying practice in the informal sector of Nigeria with a view to standardising and enhancing service delivery. The specific objectives are to assess the awareness and utilisation of quantity surveying services, means of securing commission, type of services being rendered and remuneration structure. The paper starts with a review of relevant literature followed by a description of the research method and presentation of the research findings. The main findings are discussed and conclusions drawn with appropriate recommendations.

LITERATURE REVIEW

The Concept - “Informal Sector”

It was in the third world countries that the informal sector was initially observed and studied, followed by the increased interest in developed countries. Eventually, significant studies about less developed countries, a few on former socialist countries, mainly about the former Soviet Union, and more recently about transition countries started to appear, defining it as an unregistered and unlicensed sector (Klaritha, 2006). Informal sector applies to micro or small business that starts as individual or family self-employment business. It ranges from production and processing as well as cross country trading. Some of these activities involve lack of appropriate business permit tax evasion, non-compliance with labour regulations, governing contracts and work conditions and the non-existence of legal guarantees between suppliers and clients (Bromley, 1978). This sector covers a wide range of labor market activities that combines two groups of different nature. On one hand, the informal sector is formed by the coping behaviour of individuals and families in economic environment where earning opportunities are scarce. On the other hand, the informal sector is a product of rational behavior of entrepreneurs that desire to escape state regulations (Concept of the Informal Sector, 2015). ILO (2002) regarded this sector as economic activities in all sectors of the economy that are operated outside the purview of government regulation. The sector is often invisible, irregular, non-structured and uncoordinated with the attendant challenges poor quality service delivery (Losby *et al.*, 2002; Ekpo *et al.*, 2013; Pratap *et al.*, 2013).

As a result of the World War II, global economy underwent significant structural changes (Kniivilä, 2004; Adelma, 1999) particularly the developing economies. The developing countries were characterised by dualistic economic structures with the existence of both a developed urban market economy and a backward agriculture-oriented subsistence economy (Chaudhuri *et al.*, 2009). Moreover, the expansion of industries and the resulting economic opportunities in urban areas triggered rural-urban migration and massive urbanization. However, industrial development failed to generate adequate employment and income opportunities in the urban sector. Consequently, the surplus urban labour force was compelled to generate its own means of employment and survival in the informal sector (Onwe, 2013). Stemming from the precarious economic situation of both developing and developed countries as a result of COVID-19 pandemic, informal sector is gradually becoming the new normal for human survival (Elizabeth, Emma and Abigail, 2018; James, Martin, Andrew and Rebecca; 2020). The dominance of the informal sector is one of the most important structural features of developing countries (Kumar, 2013; Onwe, 2013). Moreover, the average size of the informal economy, as a percent of official GNI in the year 2000, in developing countries, is 41%. In transition countries, it is 38% and in

OECD countries, it is 18%. Similarly, about 400 million African workers earn their livelihood in the informal sector and income generated supports additional 200 million people (Ijaiya, 2011). This sector represents an important part of the economy, and particularly of the labour market, in many countries, especially developing countries, and plays a major role in employment creation, production and income generation (OECD, 2002). An evaluation of the informal sector shows that it contributes immensely to global development (Cassidy *et al.*, 2013). In countries with high rates of population growth or urbanisation, the informal sector tends to absorb most of the growing labour force in the urban areas.

The Nature and Significance of the Nigeria Informal Sector

It has been discovered that the informal sector is a thriving market in developed and transition economies (Cassidy *et al.*, 2013; Klaritha, 2006; Oladapo, 2006). Similarly, the informal sector phenomena have also assumed significant proportions in many developed countries pinpointed to the restructuring and rationalisation of the public sector and the deregulation of the labour market in the private sector, (ILO, 2003). From one place to another, about 85% of all investments worldwide stem from the informal sector including companies but also small and medium enterprises, individual investors and much of this investment goes into construction projects. Moreover, speaking in terms of resource mobilization, employment generation, production and distribution of goods and services, the informal sector continue to play a significant role in the economy of developing countries. Omisakin (1999) and Fapohunda (1991) opined that the informal sectors are heterogeneous mix, encompassing a wide variety of economic activities that tend to be ignored in normal financial statistical analysis. These economic activities among others include manufacturing activities, construction trade and commerce and other services such as preparing all types of vehicles, radio and television sets, refrigeration, hair dressing and carpentry. It is assumed that all these activities are often carried out in small unit establishment, owned and operated by one or a few individuals with minimal capital. The evidence seems to indicate that these activities are generally growing fast as they have an increasing capacity to absorb large number of workers who may not be able to secure or hold a wage-earning job in the formal sector.

The progressive influence of the informal sector on the economy of developing nations, Nigeria inclusive, is giving it a strategic significance. Generally speaking, the contributions of the informal sector to the development of the Nigerian economy cannot be over emphasized. Sub-Saharan Africa is reported to have the largest concentration of informality globally while Nigeria has the largest and the most dynamic informal sector in sub-Saharan Africa (Meagher and Yunusa, 1996; ILO, 2002). The informal sector constitutes a significant segment of the Nigerian economy which contributes significantly to the Gross Domestic Product (GDP) (Omisakin, 1999). Its contributions has great impact in areas of employment generation, capital savings and mobilization, efficiency, strong linkages with other sectors, utilization of local technology training ground for entrepreneurs and self-reliance.

Nigeria, being one of the developing countries, is experiencing rapid growth in its economy with much contribution from the informal sector. Onwe (2013) submitted that the Nigeria informal sector accounts for about 38% of the gross domestic product (GDP) in terms of employment. The development of the informal sector follows closely the general pattern of urban development in Nigeria. Each phase in the development of Nigeria's cities and economy has its own dynamics

in informal sector development (Uwaka, 2005). Informal economic activities in Nigeria encompass a wide range of small-scale, largely self-employment activities. Most of them are traditional occupations and methods of production. Others include such financial and economic endeavours of subsistence nature, such as retail trade, transport, restaurant, repair services, financial inter-mediation and household or other personal services.

Quantity Surveying Practice in the Informal Sector

The traditional pattern of quantity surveying practice includes preparation of bills of quantities (with measurement competence), and arrangement of contract between the client and contractor while the receipt of most work (commission) is via the patronage of an architect (Duncan, 2006). Due to the ever-dynamic nature of the construction industry, the traditional roles of the quantity surveyor started to diminish, giving way to new ones requiring skill and competence. Quantity surveying profession has come to stay in Nigeria. The Regulated and Other Professions (Miscellaneous Provisions) Act 1978 of Nigeria gave its recognition as one of the scheduled Professions, while Decree No. 31 of 1986 gave legal the backing and also set up the Quantity Surveying Registration Board of Nigeria (QSRBN) to regulate it (Dada and Jagboro, 2012).

The Quantity Surveying profession guarantees the judicious allocation of the construction resources of materials, manpower, machinery, money, methods and management with the overriding aim of ensuring value for money spent on construction projects. Consequently, quantity surveying was concisely defined as the profession concerned with ensuring that the resources of the construction industry are utilized to the best advantage of society by the Royal Institution of Chartered Surveyors (RICS). The profession offers unique services to construction clients, in the area of financial probity in the execution of construction works (Babalola, 2006).

It has been argued that people at the grassroots are difficult to persuade to engage the services of quantity surveyors before commencing construction works because they focus attention on getting the job started than on getting the professional advice needed to aid the early completion of the project and thereby obtain value for the money invested (Babalola, 2006). Similarly, the little knowledge about the services quantity surveyors provide is another challenge militating against their involvement. Furthermore, it has been acknowledged that project procurement process in the informal sector is often characterized by the use of inferior materials and minimal use of qualified professionals. This is due, largely, to the mentality of saving cost (Njoku, 2006). Moreover, the majority of the Nigerian populace are at the grassroots and within the lower-middle, upper-lower and lower-lower classes, however, their level of information of the benefits to be derived from the services offered by quantity surveyors is low (Babalola, 2006). This makes it imperative to reach out to them (the potential clients) in order to increase their level of awareness of the benefits to be derived in engaging the services of quantity surveyors. In the past, the government was the major client of the construction industry, but with the past incidences of sinusoidal recession and boom, the economic growth of the Nation declined, and the patronage from the government reduced drastically, thereby leaving so many quantity surveyors jobless (Babalola, 2006) and creating the room to vigorously explore the informal sector.

Notwithstanding, prospective clients in the informal sector still find a way of benefitting from quantity surveying services, either directly or indirectly. The implication of this is that quantity surveying is still being practice in the informal sector. For the purpose of this study, the clients

engaging the services of quantity surveyor in the informal sector comprise of owners and caretakers of commercial and residential buildings. However, the major questions in this regard are: what are the means of getting in touch with the prospective clients in the informal sector, what are the ranges of services being rendered and what about the issue of remuneration. While these concerns largely depict the pattern of quantity surveying practice in the sector, yet they remain a research issue, hence this study.

RESEARCH METHOD

Survey research method was adopted for this study. Primary data were obtained through structured questionnaire administered on registered quantity surveyors and the prospective clients, utilizing the service of quantity surveyors, in informal sector of Ogun State, Nigeria. Two sub urban area of the state (Mowe and Ibafo in Obafemi Owode Local Government Area) were purposively selected for the study. The choice of these two locations is due to the massive influx of people as a result of congestion of the nearby Lagos Metropolis. The population for the informal clients comprises of owners and caretakers of residential buildings in the study area. Pilot survey shows that Mowe is stratified into sixty-one (61) Community Development Associations (CDAs) while Ibafo is stratified into 59 streets. In Mowe, six (6) CDAs comprising of an average of 6 streets were randomly selected giving a total of 36 streets. Each street consists of average of (18) buildings to give a total of six hundred and forty-eight (648) buildings. Fifty percent (50%) of the selected buildings were systematically selected to give three hundred and twenty-four (324) buildings to be sampled. Similarly, in Ibafo, 10% (6) of the 59 streets were randomly selected. Each street consists of an average of twenty (20) buildings to give a total of one hundred and twenty (120) buildings. Fifty (50%) were systematically selected to give a total of sixty (60) buildings. The second set of the respondents were the registered Quantity Surveyors in Ogun State. All the twenty-seven (27) registered Quantity Surveyors in Ogun State, as published in the directory of the Nigerian Institute of Quantity Surveyors (NIQS, 2012) were selected for the survey. The information elicited from the respondents include their socio-economic and demographic characteristics and information on the means of contacting quantity surveyors, type service rendered and structure of remuneration/payment schedule. The elicited data were analyzed using Percentage and Mean Item Score (MIS) statistics. For the purpose of this study, a rating scale of 1 to 5, with 1 representing the lowest level and 5 the highest level, was adopted. The variables, synthesized from literature, for different items of the study were set out for the respondents to rate their significant level. Statistical Packages for Social Science (SPSS) was used to rank the variables, based on the mean value responses. The mean scores were presented in Tables. Subsequently, the variables were ranked according to their perceived level based on the mean scores and discussed as appropriate.

RESULTS AND DISCUSSION

A total of three hundred and twenty-four (324) properly completed questionnaire by the prospective clients and (15) by the registered quantity surveyors were used for the analysis. This represents a respective response rate of 84.38% and 55.56% out of a total of three hundred and eighty-four (384) and twenty-seven (27) questionnaire distributed among the prospective clients and the registered quantity surveyors in the study area.

Respondents' Information

The socio-economic characteristics of the prospective clients engaging the service of quantity surveyors in the informal sector indicates that majority of them are male and married. About 90% have formal education ranging from primary to tertiary education levels. The employment status indicates that majority (17.35%) are teachers while 16.76% are businessmen/women. The average monthly income is about one hundred thousand naira only (N100,000.00). The revealed income level can be regarded as small and going with the fact that after satisfying the basic needs and with the present depreciation in the value of the naira; the patronage of quantity surveyors and remuneration cannot be sexpected to match the standard scale. The socio-economic characteristics of the client have been properly defined to determine their appropriateness for the study. The classification is in line with Andrew *et al.*'s (2006) submission, where it was opined that informal sector players could be defined based on the employment and other activities status. The academic and professional qualifications as well as the experience of the surveyed quantity surveyors are considered appropriate. Majority (93.33%) have academic qualifications ranging from HND to PhD levels. Also, majority (60.17%) are registered, with MNIQS and FNIQS professional status. From the general background information, the participants were adjudged qualified and competent to provide the needed information for the study and the information so provided can be relied upon.

Awareness and Utilization of Quantity Surveying Services in the Nigeria Informal Sector

Prior to evaluating the pattern of quantity surveying practice in the informal sector, the prospective clients were asked about their level of awareness and actual utilization of quantity surveying services. The results are as shown in Table 1. While most (67.9%) of the respondents are aware of quantity surveying services; very few (25.93%) actually engage quantity surveyors in the execution of their projects. This shows an inverse relationship which is, however, unexpected. Whereas, it is expected that the more aware one is of the pros and cons of a subject the wiser one becomes in making choices. In this case a higher patronage is anticipated but alas the converse is the case. However, the report of the patronage aligned with the submission of submission of Babalola (2006) which opined that the patronage of quantity surveyors was low at the grassroots and informal settings. It is therefore pertinent to further probe into the underline causes of the low patronage.

Table 1: Level of Awareness and Utilisation of Quantity Surveying Services in the Informal Sector

Level of Awareness/Utilisation	Frequency	Percentage (%)
Awareness		
Aware	220	67.90
Not Aware	68	20.99
Undeclared	36	11.11
Total	324	100.0
Utilisation		
Utilised	84	25.93
Not Utilised	220	67.90
Undeclared	20	6.17

Total **324** **100.0**

Pattern of Quantity Surveying Practice in the Informal Sector

The main objective of this study is to examine the pattern of quantity surveying practice in the informal sector. The concept of the pattern touches on means of securing commission, types of services rendered and remuneration/payment structure.

Means of Securing Commission

The results on means contacting quantity surveyors for service commission are as shown in Table 2. “Contact through friends” was revealed as the most important means with the highest rating of 3.40. The architect and engineers followed with the respective rating values of 3.08 and 3.04. However, contact through architect has the highest rating contact means from the perspective of the quantity surveyors with a mean of 3.93. These results are very much in tandem with view of Duncan (2006) who submitted that the route to receiving commission for the quantity surveyor are fast changing. This implies that the traditional route of the quantity surveyor’s engagement is changing from architect and could likely be through friends.

Table 2: Means of Securing Quantity Surveying Commission in the Informal Sector

	Mowe		Ibafo		QS		Overall	
Contact Means	MIS Rate		MIS Rate		MIS Rate		MIS Rate	
Friends	3.20	1	3.42	1	3.57	3	3.40	1
Architect	3.10	3	3.00	2	3.93	1	3.34	2
Engineers	3.11	2	2.58	4	3.60	2	3.10	3
Personal Contact	2.94	4	2.67	3	2.93	5	2.85	4
Relatives/Family								
Members	2.67	5	2.67	3	2.93	5	2.76	5
Previous Employer	2.29	6	2.50	5	3.21	4	2.67	6

Furthermore, it can be inferred that a good relationship with friends, architects, engineers and relatives/family members of the clients is directly proportional to the engagement of quantity surveyors in the informal sector. This has been denoted as:

$$GWR(frd., arc., engr., rel/fam) \propto SE (Qs)$$

where, GWR = Good Working Relationship; frd. = friends; arc. = architects; engr. = engineers; rel/fam = relatives/family members; SE= Service Engagement; Qs= Quantity Surveyor

Range of Services Rendered

The results shown in Table 3, reveals “preparation of materials schedule” (with a mean value of 3.36) as the most important quantity surveying service being rendered in the informal sector. Assistance in the engagement of contractors, procurement of materials (only) and procurement of materials including supervision were also rated important services frequently used. Conversely, the preparation of BoQ (only) and preparation of

BoQ including supervision were not considered frequently rendered. It can be inferred that the preparation of bill of quantities, which is perceived to be a major request from every client, was not considered important in the informal sector.

Table 4: Utilization of Quantity Surveyors' Services Rendered in the Informal Sector

Services	Mowe		Ibafo		Qs		Overall	
	MIS Rate		MIS Rate		MIS Rate		MIS Rate	
Preparation of material schedule	2.99	7	3.30	4	3.80	2	3.36	1
Provision of assistance in engaging contractors only	3.43	2	3.83	1	2.53	8	3.26	2
Procurement of Materials only	3.47	1	3.81	2	2.47	9	3.25	3
Procurement of Materials and Supervision	3.22	3	3.33	3	2.67	5	3.07	4
	3.04	4	3.25	4	3.67	6	2.99	5
Engagement of Artisans and Supervision								
Material Schedule Preparation and Supervision	3.00	6	3.00	5	2.93	4	2.98	6
	2.28	10	2.08	9	4.47	1	2.94	7
Preparation of BoQ	2.96	8	2.75	6	3.00	3	2.90	8
Preparation of BoQ and Supervision								
Engagement and Supervision of Contractors	3.01	5	2.30	8	2.57	7	2.63	9
	2.95	9	2.25	7	2.40	10	2.53	10
Engagement of Artisans only	2.96	8	2.75	6	3.00	3	2.90	8
Supervision								
Engagement and Supervision of Contractors	3.01	5	2.30	8	2.57	7	2.63	9
	2.95	9	2.25	7	2.40	10	2.53	10
Engagement of Artisans only								

Remuneration and Payment Structure

Table 4a revealed the means of remunerating quantity surveyors for services rendered in order of importance. Negotiated amount is seen as the most payment structure in use with MIS value of 3.67. Negotiation here reveals a characteristic found in the informal sector whereby haggling is allowed. This finding tallies with previous submission that, overtime, the pattern of work or practice in the profession changed from a standard scale of fees to fee competition (Duncan, 2006). It can be deduced that, due to the unstandardised nature of the informal sector and coupled with the continuous dwindling economic situation, negotiation will be most preferred rather than the use of any standardised scale of fees in remuneration for any service rendered in the sector. So, it is not surprising that the scale of fees is the least frequently used payment structure with a mean value of 2.55. Inference could therefore be made from this that the structure for payment in the informal sector for service engagement is unregulated at the moment. In furtherance to this fact, the changing nature of Nigeria economy has great influence on payment structure of service rendered in the informal sector. This practice is seen as more or less like haggling in the open market.

Table 4a: Remunerating structure for Quantity Surveying Services in the Informal Sector

Payment Structure	Mowe		Ibafo		Qs		Overall	
	MIS	Rate	MIS	Rate	MIS	Rate	MIS	Rate
Negotiated Amount	3.19	1	3.42	1	4.40	1	3.67	1
Any amount offered by the client	3.05	2	2.83	3	2.80	2	2.89	2
Scale of Fees	2.57	3	3.00	2	2.07	3	2.55	3

The different payment schedules for remunerating service rendered by quantity surveyor in the informal sector includes the long unspecified time, deposit of payment by the client before service delivery after service delivery, payment shortly after delivery of service, full payment before the delivery of service. However, deposit of payment before service delivery (3.26) was seen to be the payment schedule mode mostly in use (Table 4b). It was opined that this choice could be due to the lack of contractual agreement between the parties transacting in this sector.

Table 4b: Payment Schedules for Services Rendered by Quantity Surveyors in the Informal Sector

Payment Schedule	Mowe		Ibafo		Qs		Overall	
	MIS	Rate	MIS	Rate	MIS	Rate	MIS	Rate
Deposit payment before the delivery of service	3.17	1	3.08	2	3.53	2	3.26	1
Before the delivery of expected service	2.84	2	3.25	1	3.13	3	3.07	2
Shortly after delivery of expected service	2.60	4	2.17	4	3.73	1	2.83	3
Long unspecified time after the delivery of service	2.72	3	2.92	3	2.47	4	2.70	4

CONCLUSION AND RECOMMENDATIONS

This paper d the patterns of quantity surveying practice in the informal sector of Nigeria. This is with a view to standardising and enhancing service delivery. Findings indicate the awareness of quantity surveying service is high, in the informal sector is high, which is however at inverse relationship with the level of actual utilization. The most frequently used means of securing service was found to be through friends as against the general notion of getting commission from architects. While preparation of materials schedule was found to be the common types of service often rendered, negotiation was the most used remuneration structure. The findings have great implications on quantity surveying practice and could influence policy formulation towards informal sector practice for an enhanced service delivery. In this regard the following recommendations are germane:

1. Continuous advocacy on the services being rendered by quantity surveyors as well its benefits.
2. Social interaction with friends and associates should be leveraged on, by quantity surveyors, for service commission.
3. Entrenching the understanding and use of the Standard Method of Resource Scheduling (SMRS) for material schedule preparation service.
4. The quantity surveying regulatory bodies should formulate a specific policy towards the issue of remuneration for service rendered in the informal sector and this should be strictly monitored.

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EVALUATING THE GAP BETWEEN EDUCATIONAL TRAINING AND INDUSTRY EXPECTATIONS OF QUANTITY SURVEYING GRADUATES IN NIGERIA

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ABSTRACT

The effectiveness of the educational training received by graduates, to adapt to the changing realities and practices of the industry needs, cannot be overemphasized. Unfortunately, employers have continuously expressed concerns about the graduates being produced by the educational institutions. This paper aims at evaluating the gap between the education training and the industry expectations of the Nigerian quantity surveying graduates with a view to improving their performance. The study was carried out in Southwestern Nigeria, through a quantitative survey research design. Structured questionnaire was administered on relevant stakeholders: quantity surveying firms (randomly selected in Lagos State), lecturers and students (randomly selected from 4 selected institutions offering quantity surveying in Lagos, Osun, Oyo and Ondo States). A total of 279 questionnaires were distributed among the sampled respondents out of which a total of 230 (82.4%) valid responses were received. Specifically, 24 quantity surveying firms, 26 lecturers and 180 students provided valid responses. The data generated were analyzed using descriptive and inferential statistics. The results revealed that gaps exist between the educational training and the industry expectations for most of the required competencies and with grave consequences. The study provides invaluable information on the area of improvement in quantity surveying education.

Keyword: educational training, competencies, gap, industry expectations, quantity surveying graduates, skills.

INTRODUCTION

The Royal Institution of Chartered Surveyors (RICS) (1998) described quantity surveyors as professionals, within the construction industry, with expertise in administering cost related aspects of any construction project. Thus, they are the cost managers of the construction industry responsible for ensuring proper utilization of the construction resources to the advantage of the client by providing the required financial management services (Ashworth and Hogg, 2007). Whereas, the construction industry is changing and the advent of ICT possess a lot of challenge to construction professionals; the answer to the challenges will be through a pragmatic periodic review of the quantity surveying training programme. As such, the primary motive behind Educational Training (ET) is to align graduates' qualifications to meeting the Industry Expectations (IE) (Krogt and Warmerdam, 1997; Tener, 1996; NWDA, 2004). Griesel and Parker (2009) opined that knowledge, conceptual foundation and intellectual approach by higher institutions are of essence to employers. It is then inferable that employers of quantity surveying graduates are always on the lookout for employees who are rich in practical applicability of theoretical knowledge gained during their educational period. Aside this, employers equally expect graduates to possess some soft skills which also aid work delivery. These skills are, but not limited to interactive skills, such as decision-making skills, analytical skills, team working skills, and planning and organizational skills (Will, Milica, Niccolo, Vassilis and Tanguy, 2016).

However, the industry has overtime been criticizing academic institutions for not providing well equipped graduates for the work place (Banik, 2007). Mole (1997) recognized this separation between educational training and industry expectation as a potential problem. Employers are looking for rounded people with a depth of understanding, and ability to take responsibility and develop their own role in the organization to be educated rather than trained (Banik, 2008). The aim of this paper, therefore, is to evaluate the gap between the ET and the IE of the Nigerian quantity surveying graduates. This is with a view to improving quantity surveying education and the attendant improvement in the performance of graduates being produced. The paper starts with a review of relevant literature followed by a description of the research method and presentation of the research findings. The main findings are discussed and conclusions drawn with appropriate recommendations.

LITERATURE REVIEW

The Concept and Significance of Educational Training

Various individuals and corporate bodies have defined education to mean different things. Dada and Jagboro (2012a) defined ET as a comprehensive package prepared simply to instill specialize skills in an individual in other to function in a particular field of study. This definition summarised ET as an integral part of organisation learning and change. Sleezer (1993) considered ET as a channel for linking organizational strategies and goals while Good (1993) defined education to mean the sum total of all processes through which a person develops values, abilities and other forms of values through conscious, coordinated and controlled learning environment so as to be socially competent. From the foregoing, it could be inferred that educational training covers all forms of cogent and coordinated learning instructions received by an individual towards becoming competent and certified in a particular field of study. Education plays vital role in the developmental of any individual, community and the nation at large. Every nation depends largely on education for empowerment, innovations and values. It is the core requirement of modernization, civilization, urbanization and industrialization. It empowers the nation and helps it to meet its ever-growing needs (Mehta and Rakhi, 1997). This is because the transfiguration of an individual from being uninformed to being well equipped is made possible by education. Hence, the growth of a nation cannot be achieved outside the confines of education.

In the context of this paper, ET is regarded as a comprehensive package prepared to equip an individual with specialise skills to function in a particular context. This is different from professional training, a form of adult education albeit for highly-educated individuals, often regarded as continuing professional development (Ariffin and Torrance, 2008) which involves learning new skills, and/or updating existing knowledge and skill. In this regard, ET programmes need to be tailored to meeting the needs of the end users. This will require close collaboration between the academic community, industry and professional institutions (NWDA, 2004). By this, ET is expected to give students exposure to more than the academic aspects of the construction process. A proactive approach should therefore, be initiated to make ET more adaptable to the ever “changing-needs” of the built environment and thereby embracing the capabilities needed by graduates being produced from time to time.

Quantity Surveying Educational Training in Nigeria

The philosophy of the quantity surveying education program, in Nigeria, are to: produce graduates with theoretical knowledge and practical skills while providing efficient balance between education and industry expectations; produce graduates that will excel in special quantity surveying areas; produce graduates with sound theoretical expertise of quantity surveying concepts with a view to applying them to solve construction problems; produce graduates with leadership qualities and produce graduates who are equipped with technical, managerial and analytical skills (Department of Quantity Surveying, 2017). In Nigeria, both private and public higher educational institutions (i.e. universities and polytechnics) offer quantity surveying as diploma, undergraduate and postgraduate degrees. In Nigeria, the National University Commission (NUC) specify the minimum academic standards for undergraduates programme in the Universities while the National Board for Technical Education (NBTE) stipulates the minimum standards for all diploma programmes in Polytechnics. Dada and Jagboro (2012a) highlighted the entry requirements to undertake the course in both universities and polytechnics. It is stated that aspirants through Joint Admission and Matriculation Board (JAMB) must have at least five credit passes in Senior Secondary School Certificate Examination (SSCE) or its equivalent in English, Mathematics, Physics and any two of Chemistry, Biology, Further Mathematics, Geography, Technical Drawing and other science related subjects, in not more than two sittings. The requirements for Ordinary National Diploma direct entry to universities from polytechnics are a General Certificate of Education or its equivalent with three passes at the Advanced Level in not more than two sittings plus satisfying the general requirements; while a least grade of an upper credit plus satisfying the general requirements are required of Higher National Diploma direct entry. At the polytechnic, the course runs for two years for the award of Ordinary National Diploma (OND) and an additional two years for the award of Higher National Diploma. At the university level, the course runs through a period of five years for the award of bachelor's degree, two years for master's degree and a year for doctoral degree. A graduate of the course is regarded as a person who has fully satisfied the requirements for graduation and has been awarded a degree (Glover, Law and Youngman, 2002).

Industry Expectations of Quantity Surveying Graduates

Quantity surveying competencies are often acquired through formal ET and subsequent Continuous Professional Development (CPD) through workplace training. The industry expects quantity surveying graduates to be versatile in all quantity surveying functions and contribute to the growth of the respective organisations where they work (Wickramasinghe and Perera, 2010). Though the industry may recognize the potential that graduates have in developing their professional skills, once they get employed, they are expected to perform the basic required competencies. RICS (1998) listed the core, basic and optional skills and competencies required of quantity surveyors. These include measurement rules, construction economics, construction technology, construction management, construction law, contract documentation and administration, budget and cash flow analysis. As such, graduates are expected to have in-depth knowledge of quantity surveying measuring tools, ability to efficiently use quantity surveying software, sound knowledge of interpreting drawings, good interpersonal skills, good communication skills, good team work spirit, ability to work with little or no supervision, high computer literacy, knowledge of valuation, sound data management skills and good understanding of construction technology.

However, with changes in the industry and the advancement in frontier of knowledge, the roles and duties of quantity surveyors have shifted from being traditional to contemporary. Going by these changes, the contemporary areas can be listed as insurance, financial, manufacturing, taxation, valuation, petro chemical, mining, aeronautical, shipping and transport. The evolving and emerging duties of quantity surveyors can also be categorized as risk management, quality management, feasibility study, taxation advice, expert witness/appraisal, value management, audit and post occupancy evaluation. As such, the ET of quantity surveyors needs to be in tandem with these future role projections if they are to meet the industry needs. In this regard, Nkado and Meyer (2001) have advocated for distinctive competencies, aside the basic core, if quantity surveyors are to excel in new future opportunities.

The dichotomy between Educational Training and Industry Expectation in relation to Quantity Surveying Graduates

It is worthy to note that the construction industry is constantly experiencing varieties of changes. As such, the roles of its professionals are also changing and the quantity surveyors are not spared of these changes. Design, execution and management of construction projects are constantly getting more complex. The higher institutions are constantly working to incorporate these changes into students' curricular to better prepare the students for life after school. Unfortunately, employers have continuously expressed concerns about the capacity of the trained graduates. Banik (2008) was of the opinion that educational institutions are not producing graduates with requisite skills that match the industry needs. Wickramasinghe *et al.* (2010) were of the view that higher institutions have failed to produce graduates with required skills, hence; graduates are found wanton of knowledge of labour market realities. As such, Harvey and Green (1994) and Davies *et al.* (1999) were of the view that it is not uncommon for employers to express their dissatisfaction about the diversity between higher education training and industrial expectations. Archer and Davison's (2008) perspectives of employers on graduates' employability provided a contrast between what is obtainable in some universities and what is expected by the industry. They were of the opinion that employers were in concession with what were considered the most significance skills, which they envisaged in graduate employees. Jamali (2005) criticized the effectiveness of the educational programs received by graduates to adapt to the changing realities and practices of the industry. Allison *et al.* (2002) opined that quite a number of graduate employers seek proactive employees who can use high level skills including critique, multi-layered communication, analysis and synthesis to facilitate innovative teamwork in catalyzing the transformation of their organizations. These are however, more of a graduate's personal qualities or rather, qualities, which are outside the confines of the educational curriculum. As such, the institutions are not to be burdened with these since personal qualities differ from person to persons.

In relation to quantity surveying, the education systems focus on bringing forth versatile graduates who have the foundation knowledge in all aspects of the profession along with the capability for their further development in future. The educational institutions consider only the competencies of graduates outlined by the regulatory bodies. As they do not consider the opposing needs of the construction industry, the quantity surveying graduates lack some competencies expected by the industry (Wickramasinghe and Perera, 2010).

RESEARCH METHOD

This research evaluated the gap between ET and IE of the Nigerian quantity surveying graduates. Survey research method was adopted for the study. Primary data were obtained through structured questionnaire administered on targeted relevant stakeholders in Southwestern Nigeria. Relevant information was initially obtained through an extant literature search and review upon which the criteria and variables used in the compilation of the questionnaire were based. The population within the context of the study is a database of quantity surveying practicing firms, quantity surveying lecturers and students of higher institutions offering quantity surveying in the study area.

For the practicing firms, Lagos State, being the epicenter and conglomeration of quantity surveying firms in Southwestern Nigeria, was selected. Based on the NIQS Lagos State Chapter (website) Directory, there are one hundred and thirty-one (131) registered quantity surveying firms in Lagos State. Using a cluster sampling method, thirty (30) firms were selected for survey. According to the Quantity Surveying Registration Board of Nigeria (QSRBN) website, a total of twelve (12) Accredited Universities and nine (9) Accredited Polytechnics running quantity surveying programme in Southwestern Nigeria were listed. Four of these institutions were purposively selected. These are: Obafemi Awolowo University (OAU), Ile-Ife; Federal University of Technology (FUTA), Akure; Yaba College of Technology (YABATECH), Lagos and The Polytechnic, Ibadan. OAU (being one of the foremost universities to start quantity surveying programme) and FUTA (being rated among the leading universities of technology in Nigeria) were selected to represent the universities. YABATECH and The Polytechnic, Ibadan (being the foremost polytechnics to start quantity surveying programme) were selected to represent polytechnics and colleges of technology. For the purpose of credibility, only students in 400 and 500 levels and HND 1 and 2 were considered for the universities and polytechnic respectively. This was because it is believed that these categories of students would have been more exposed and conversant with the profession and as such information provided by them could be relied on. From the population of the target respondents, in the selected institution, 34 lecturers and 215 students were randomly selected.

Three sets of structured questionnaires were prepared; the first was used for the practicing firms, the second for the lecturers and the third for the students. Generally, the first part of the questionnaire elicited general information about the respondents. Other parts dealt with issues relating to quantity surveyors ET and IE. The respondents' choices of answers ranged on a 5-point Likert scale 1 to 5, where 5 indicates 'highly important'; 4 'very important'; 3 'important'; 2 'slightly important' and 1 'not important'. In all, a total of 279 questionnaires were distributed among the sampled respondents out of which a total of 230 (82.4%) valid responses were received. Specifically, 24 quantity surveying firms, 26 lecturers and 180 students provided valid responses. The data obtained were analysed using frequency, mean score rating, ANOVA statistics and independent sample t-test upon which inferences and conclusions were drawn.

RESULTS AND DISCUSSION

Respondents' Information

The results indicate that a good number (16.7%) of the surveyed firms had been established for between 15 and 20 years and the bulk of the responding officer (66.7%) had professional qualification with about 10years working experience. The bulk of the surveyed lecturers (23.8%) are senior lecturers, most (42.9%) are PhD holders and majority of them (61.9%) are professionally qualified. The profile of the students indicates that 9.2% were in HND 1, 20.5% in HND 2, 23.2% in 400 level and the majority (47%) in 500 level. From the general background information, the participants were adjudged qualified and competent to provide the needed information for the study and the information so provided can be relied upon.

Industry Expectations of Quantity Surveying Educational Training

This section presents the results of the IE of quantity surveying graduates. The respondents (quantity surveying firms and lecturers) were asked to indicate the importance placed on the identified basic minimum core skills and other required skills expected of any quantity surveying graduates. The results are as presented in Table 1.

skills/competencies such as measurement skills, ability to interpret drawings, knowledge of estimating, ability to prepare valuations, knowledge of construction technology, effective communication skill, ability to use ICT effectively, ability to prepare variation accounts, knowledge of economics and good use of quantity surveying software, among others, were rated very high. The Mean Scores (MSs) range from 4.00 to 4.93. These skills are not so different from the basic/core skills required for quantity surveying practice. For example, knowledge of measurement is very key and forms the basis of the profession. As important as measurement is, measured works won't be justifiable if there is no in-depth understanding of the drawings to be measured. Furthermore, knowledge of estimating, understanding of construction technology, ability to prepare valuation, knowledge of the application of ICT, ability to use quantity surveying software, cost planning techniques, preparation of tender report, effective communication skill, knowledge of contract documentation, among others, all constitute basic and core requirements. It must therefore be evident that these highly rated skills/competencies are well taught and acquired by quantity surveying graduates. In this regard, Massyn *et al.* (2009) had submitted that "academics at tertiary institutions are required to provide an education programme that both meets the expectation of industry and balances sound academic principles". Alshawi *et al.* (2007) had also supported this call, in that the students will be made to acquire the necessary skills for a successful and rewarding career. The employer would also have a wide range of skilled graduate ready to work and as such effective curriculum will be seen as an investment which prepares organisations not only to adapt to the changing environment, but also to remain competitive.

Other skills/competencies such as ability to prepare cash flow analysis, construction management skills, value management skills, ability to prepare program of work, interpersonal skills and data management skills, among others, were rated as important. The MS ranges from 3.24 to 3.98. While few of these skills/competencies can be likened to the basic and not core, they are all considered important. Dada and Jagboro (2012b) had listed skills/competencies such as marketing/business skill, leadership skill, managerial skill and interpersonal skill. These are

all regarded as essential requirements needed by quantity surveyors to be able to perform their duties. They can also be regarded as essential supporting skills.

It could be seen from Table 1 that at the significant error level of <0.05, none of the skills/competencies showed any statistical difference in the respondents' responses.

Table 1: Industry Expectations of Quantity Surveying Graduates

Skills/Competencies	Q.S Firm		Lecturers		Total		t	Sig.
	Mean	Rk	Mean	Rk	Mean	Rk		
Measurement skills	4.88	1	5.00	1	4.93	1	-1.813	0.083
Ability to interpret drawings	4.67	3	4.86	2	4.76	2	-1.367	0.179
Knowledge of estimating	4.71	2	4.81	3	4.76	2	-0.695	0.491
Ability to prepare valuations	4.54	6	4.62	4	4.58	4	-0.473	0.639
Knowledge of construction technology	4.58	4	4.48	6	4.53	5	0.569	0.572
Effective communication skills	4.46	7	4.43	8	4.44	6	0.149	0.882
Ability to use ICT effectively	4.63	4	4.24	12	4.44	6	1.769	0.087
Ability to prepare variation accounts	4.33	6	4.52	3	4.42	8	-0.970	0.337
Knowledge of economics	4.25	12	4.57	5	4.40	9	-1.367	0.179
Good use of quantity surveying software	4.42	6	4.33	8	4.38	8	0.450	0.655
Ability to prepare tender reports	4.33	4	4.29	6	4.31	11	0.236	0.815
Knowledge of market forces	4.13	13	4.38	6	4.24	12	-1.423	0.162
Knowledge of contract documentations	4.29	11	4.19	14	4.24	12	0.521	0.605
Good market surveying capabilities	4.21	10	4.24	8	4.22	14	-0.134	0.894
Decision-making skills	4.25	12	4.00	17	4.13	15	1.276	0.209
Knowledge of procurement methods	4.00	19	4.14	16	4.07	16	-0.632	0.530
Knowledge of cost planning techniques	4.21	14	3.90	22	4.07	16	1.580	0.121
Preparation of life cycle costing data	4.04	10	4.00	10	4.02	18	0.191	0.850
Ability to prepare cash flow analysis	4.04	17	3.95	20	4.00	19	0.401	0.691
Construction management skills	3.79	24	4.19	14	3.98	20	-1.817	0.076
Value management skills	3.96	11	3.86	15	3.91	21	0.440	0.662
Ability to prepare program of work	3.88	21	3.90	22	3.89	22	-0.127	0.900
Interpersonal skills	3.79	23	3.95	20	3.87	23	-0.680	0.500
Data management skills	3.75	25	4.00	17	3.87	23	-1.108	0.274
Construction feasibility skills	3.83	11	3.86	12	3.84	25	-0.112	0.912
Knowledge of arbitration	3.88	21	3.71	26	3.80	26	0.771	0.445
Good supervisory skills	3.63	26	3.52	26	3.58	27	0.356	0.723
Ability to carry out simple research	3.29	25	3.19	25	3.24	28	0.342	0.734
Participation in extracurricular activities	2.83	21	2.62	21	2.73	29	0.587	0.561
Ability to operate construction equipment	2.63	27	2.33	27	2.49	30	1.034	0.307

*: significant at <5% level

Assessing the level of Quantity Surveying Educational Training

This section presents the results of the ET of quantity surveying graduates. In this regard, the respondents were requested to indicate their level of satisfaction with the skills and competencies possessed by quantity surveying graduates. It is expected that the firms, who often engaged the graduate, are in good stead to give an informed judgment in this regard. In addition, it is expected that the students, themselves, should be able to give appropriate assessment of the level of training received in respect of the identified skills and competencies. So also, the lecturers should be able to give a very fair assessment of what they have instilled in their students regarding the expected quantity surveying skills and competencies. One-way ANOVA was conducted to analyze the responses of respondents on this section. The test also relays if there is differences in the responses received from the three groups of respondents. The results are as presented in Table 2.

Table 2: Level of satisfaction with the skills and competencies of Quantity Surveying Graduates

Skills/Competencies	Q.S Firm		Lecturers		Students		Total		F	Sig.
	Mea n	R k	Mea n	R k	Mea n	R k	Mea n	R k		
Ability to interpret drawings	3.96	1	3.76	2	3.77	1	3.79	1	0.382	0.683
Knowledge of estimating	3.96	3	3.67	4	3.68	3	3.70	2	0.926	0.398
Knowledge of construction technology	3.75	6	3.62	6	3.71	2	3.70	3	0.105	0.900
Measurement skills	3.88	4	3.81	1	3.62	4	3.67	4	1.030	0.359
Ability to prepare valuations	3.71	10	3.57	7	3.50	5	3.53	5	0.458	0.633
Ability to carry out simple research	2.79	28	3.71	3	3.48	6	3.43	6	4.870	0.008
Good market surveying capabilities	3.88	4	3.43	11	3.36	8	3.42	7	2.800	*
Knowledge of procurement methods	3.38	18	3.33	13	3.40	7	3.39	8	0.045	0.063
Ability to prepare variation accounts	3.63	12	3.67	4	3.32	11	3.38	9	0.045	0.956
Effective communication skills	3.96	1	3.10	20	3.34	9	3.38	10	1.630	0.198
Knowledge of economics	3.75	7	3.24	16	3.33	10	3.37	11	0.008	*
Knowledge of contract documentations	3.42	15	3.29	15	3.32	11	3.33	12	4.894	0.139
Construction management skills	3.33	19	3.33	13	3.28	13	3.29	13	0.123	0.884
Knowledge of cost planning techniques	3.42	14	3.52	9	3.23	15	3.28	14	0.064	0.938
Ability to prepare program of work	3.13	25	3.24	17	3.26	14	3.24	15	1.100	0.334
Decision-making skills	3.42	15	2.95	24	3.22	16	3.21	16	0.155	0.857
Knowledge of market forces	3.67	11	3.33	12	3.14	20	3.21	17	1.109	0.332
Ability to prepare cash flow analysis	3.17	22	3.57	7	3.15	18	3.19	18	2.963	0.054
Ability to prepare tender reports	3.50	13	2.86	26	3.17	17	3.17	19	1.129	0.325
Interpersonal skills	3.29	20	2.76	27	3.14	19	3.12	20	1.799	0.168
Knowledge of arbitration	2.88	27	3.14	19	3.12	21	3.10	21	1.572	0.210
Construction feasibility skills	3.13	25	2.90	25	3.10	22	3.08	22	0.689	0.503
Value management skills	3.21	21	3.00	23	3.03	24	3.05	23	0.320	0.726
									0.323	0.725

Good supervisory skills	3.17	23	2.52	28	3.06	23	3.03	24	2.437	0.090
Data management skills	3.17	23	3.10	20	2.90	25	2.94	25	0.898	0.409
										0.001
Ability to use ICT effectively	3.71	9	3.19	18	2.79	26	2.92	26	6.851	*
										0.027
Preparation of life cycle costing data	3.38	17	3.10	20	2.78	27	2.87	27	3.668	*
Good use of quantity surveying software	3.71	8	3.48	10	2.66	29	2.85	28	12.06	0.000
									6	*
Participation in extracurricular activities	2.63	29	1.90	29	2.75	28	2.66	29	4.257	0.015
										*
Ability to operate construction equipment	2.46	30	1.57	30	2.39	30	2.32	30	1.335	0.265

*: significant at <5% level

The level of satisfaction with the identified skills and competencies are considered to be above average. The MS ranges from 2.32 to 3.79. This is an indication that a good effort has been made in the ET of quantity surveying graduates. Skills and competencies such as: ability to interpret drawings, knowledge of estimating, knowledge of measurement, understanding of construction technology, ability to prepare valuations, knowledge of contract management, preparation of tender report, effective communication skill, knowledge of contract documentation, among others were rated high. The ANOVA (*F* statistic test) result shows that there are differences in respondents' responses to ability to carry out simple research, effective communication skills, ability to use ICT effectively, preparation of life cycle costing data, good use of quantity surveying software and participation in extracurricular activities.

Evaluating the Gap between ET and IE

In an attempt to find out if there is any difference in quantity surveying ET and IE, the results of the ET were set against those of IE by comparing the degree of importance of the skills and competencies against the level of satisfaction. Independent t- test was used for this. The test compares the statistical difference between two variables using their means. The results are as shown in Table 3. It is inferable from the Table that, at a significant level of <5%, there is statistical difference between the IE and ET of quantity surveying graduates. There were statistical differences in majority of the highly expected skills and competencies such as: measurement skill, knowledge of estimating, ability to interpret drawings, effective communication skills, knowledge of construction technology, amongst others. The graduates, however, met up with the IE in skills such as: market surveying capabilities, knowledge of economics, knowledge of market forces, construction management skills, interpersonal skills and good supervisory skills. Although the table shows that there are no differences between IE and the performance of graduate quantity surveyors in skills like ability to carry out simple research, participation in extracurricular activities and ability to operate construction equipment. However, the importance of these skills has been rated low (see Table 1) and as such, the case of no differences here may not be farfetched.

Having inferred from Table 3 that gaps exist, the independent sample t-test, coupled with effect size formula, was used in evaluating the magnitude of the gaps. This is with a view to evaluating the effect of the gaps on quantity surveying graduates' performance. The results are as presented

in Table 4. The formula with which the sizes and magnitude of the effects were computed is given as:

$$Eta^2 = (t^2)/((t^2) + df)$$

Where:

Eta^2 = effect size; t = test statistic value; df (degree of freedom) = $(N1 + N2 - 2)$; $N1$ and $N2$ = the number of respondents for category 1 and 2 respectively

To determine the effect of the differences, according to Cohen (1988):

• $Eta^2 = .01$ (small effect); • $Eta^2 = .06$ (medium effect) ; • $Eta^2 = .14$ (large).

Table 3: Independent t-test analysis of Industry Expectation and Educational Training

Skills and Competencies	t-test for Equality of Means		
	t	df	Sig.
Measurement skills	17.402	252	0.000*
Knowledge of arbitration	4.617	273	0.000*
Effective communication skills	8.894	92	0.000*
Ability to use ICT effectively	11.282	101	0.000*
Knowledge of economics	6.406	273	0.000*
Ability to prepare valuations	9.915	118	0.000*
Ability to interpret drawings	9.854	133	0.000*
Interpersonal skills	4.498	273	0.000*
Data management skills	6.930	83	0.000*
Knowledge of estimating	10.919	125	0.000*
Good use of quantity surveying software	12.599	123	0.000*
Knowledge of cost planning techniques	6.742	88	0.000*
Knowledge of contract documentations	7.912	90	0.000*
Knowledge of construction technology	7.299	93	0.000*
Knowledge of procurement methods	5.194	78	0.000*
Construction management skills	5.352	75	0.000*
Ability to prepare cash flow analysis	5.935	98	0.000*
Ability to prepare program of work	4.718	84	0.000*
Good supervisory skills	3.093	273	0.002*
Knowledge of market forces	9.090	103	0.000*
Ability to operate construction equipment	0.496	273	0.620
Ability to carry out simple research	-1.109	69	0.271
Decision-making skills	7.655	93	0.000*
Participation in extracurricular activities	0.373	273	0.709
Good market surveying capabilities	6.248	80	0.000*
Preparation of life cycle costing data	8.861	89	0.000*
Value management skills	6.488	80	0.000*

Construction feasibility skills	6.003	90	0.000*
Ability to prepare variation accounts	8.559	99	0.000*
Ability to prepare tender reports	9.105	102	0.000*

*: significant at <5% level

In the results presented in Table 4, it can be seen that there was large effect of the exiting gaps in majority of the skills and competencies on quantity surveying graduates' performance in the industry. Knowing the magnitude of the gap in ET and IT will inform the decision makers of how wide the gap is. This will prove to be a tool for prioritizing the efforts to fill up the gap. It will help in the preparation of a good scale of preference. Hence, it could be seen that skills/competencies with small effect need least attention, those with medium effect require moderate attention while those with large effect demand very high and immediate attention.

Table 4: Evaluating the size and effect of gap between ET and IE

Skills and Competencies	t-value	Size	Magnitude of Effect
Measurement skills	17.402	0.55	Large Effect
Knowledge of arbitration	4.617	0.07	Large Effect
Effective communication skills	8.894	0.46	Large Effect
Ability to use ICT effectively	11.282	0.56	Large Effect
Knowledge of economics	6.406	0.13	Large Effect
Ability to prepare valuations	9.915	0.45	Large Effect
Ability to interpret drawings	9.854	0.42	Large Effect
Interpersonal skills	4.498	0.07	Large Effect
Data management skills	6.930	0.37	Large Effect
Knowledge of estimating	10.919	0.49	Large Effect
Good use of quantity surveying software	12.599	0.56	Large Effect
Knowledge of cost planning techniques	6.742	0.34	Large Effect
Knowledge of contract documentations	7.912	0.41	Large Effect
Knowledge of construction technology	7.299	0.36	Large Effect
Knowledge of procurement methods	5.194	0.26	Large Effect
Construction management skills	5.352	0.28	Large Effect
Ability to prepare cash flow analysis	5.935	0.26	Large Effect
Ability to prepare program of work	4.718	0.21	Large Effect
Good supervisory skills	3.093	0.03	Medium Effect
Knowledge of market forces	9.090	0.45	Large Effect
Ability to operate construction equipment	0.496	0.00	Small Effect
Ability to carry out simple research	-1.109	0.02	Medium Effect
Decision-making skills	7.655	0.39	Large Effect
Participation in extracurricular activities	0.373	0.00	Small Effect
Good market surveying capabilities	6.248	0.33	Large Effect
Preparation of life cycle costing data	8.861	0.47	Large Effect
Value management skills	6.488	0.34	Large Effect

Construction feasibility skills	6.003	0.29	Large Effect
Ability to prepare variation accounts	8.559	0.43	Large Effect
Ability to prepare tender reports	9.105	0.45	Large Effect

CONCLUSION AND RECOMMENDATION

Quantity surveying ET is supposedly designed to meeting the IE. As such the ET programmes are expected to focus on producing versatile graduates that will meet the basic need of the industry. However, there are series of complaint by the employers on the quality of the graduates being produced. Hence, this study analysed the requirements of the industry and the competencies actually possessed by the graduates with a view to evaluating and closing the gap.

The comparative analysis carried out on the level of skills and competencies expected from and possessed by the graduates shoed that there exist gaps in most of the skills and competencies with large effect on their performance. Generally speaking, the IE was higher than the actual ET possessed by quantity surveying graduates.

The findings call for a concerted effort in improving the ET of quantity surveying graduates. The implications have direct effect on the major players: the academic institutions (the lecturers and students inclusive), the academic and professional regulatory bodies such as NUC, NBTE, NIQS and QSRBN. Ultimately, the study will be useful for academic institutions in improving their ET programmes which, in turn, will help in closing the apparent gaps and perhaps help in resolving many of the compliant about the performance of quantity surveying graduates.

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ASSESSMENT OF RISK MANAGEMENT ON CONSTRUCTION PROJECT IN ABUJA, NIGERIA

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ABSTRACT

The requirements of every construction project is meeting client's need of cost, and quality which are achieved through consciousness of uncertainty and taking pro-active measures. The construction industry is overwhelmed with risks which must be mitigated as it leads to cost overruns that have negative impact on the efficiency of project that would also lead to displeasure of client. The research assessed risk management on construction project in Abuja, Nigeria. The study adopted a quantitative research approach using questionnaires to source relevant information from respondents. Data collection was done through a questionnaire survey self-administered on 60 randomly selected construction industry participants. Out of the 60 questionnaires administered, 52 responses fit for analysis were received representing 87%. Data were analysed with the use of descriptive statistics such as mean item score and correlation analysis. The study revealed nine factor of effective risk management among which organization structuring and design has highest impact with MIS 4.60. Also, from the ten poor risk management factor, lack of team work had the highest impact with MIS 4.58. Likewise, from sixteen barriers of risk management, ineffective monitoring had the highest impact with MIS 4.43. The study concluded that lack of team work and ineffective monitoring were the major hindrances of risk management, while organization structuring and design were the most effective risk management factors in construction projects. It was recommended that in achieving effective project delivery, it required the best knowledge that will effectively manage project risks include material, cost, quality management and consciousness of project period which attract harmonious development in Abuja, Nigeria.

Keywords: Risk management; Construction projects management; Project delivery.

INTRODUCTION

The construction industry is one of the sectors that meaningfully contributes to every society economy and successful delivery of construction projects. Consequently, every stage of a project is face with innumerable risks due to the complex and dynamic nature of the industry (Zhao, Hwang, & Low, 2013). The rate of change in the construction industry has imposed further demands on construction project management. Risk management is a vital project administrative planning and governing tool for reducing ambiguity and improving decision-making. Risk cannot be avoided but must be recognized, assessed and managed. Construction project efficacy and effectiveness largely depends on how managers image the exterior project environment, recognize the life-threatening factors and adapt their establishments accordingly (Baloi and Price, 2003).

According to (McNamara George, Rejda and Michael, 2014), defined risk management as an attempt to identify potential threats to projects and their potential to take appropriate measure to address these threats and to verify their likelihood as consideration of these possibilities leads to action to reduce these risks. (Cagliano, Grimaldi and Rafele, 2015), maintained that there are many techniques used to control risks at the lowest probable cost, including risk avoidance methods through loss prevention, control, and/or job rejection, before the organization is exposed to further loss arising from a particular activity. Proper and systematic techniques, knowledge

and experience are required approaches to enable effective and efficient risk management. For instance, knowledge of the unanticipated events that might prevail while execution of the project is required (Serpella; Ferrada; Howard and Rubio, 2014). The performance of diagnosing and risk assessment as well as the ability to apply methods and approaches in order to reduce these risks to a tolerable extent can be referred to as risk management (Tohidi, 2011). However, the main focus of risk management is to identify, evaluate, and control the risks of project success (Lee *et al.*, 2009). Risk management is used in various fields and varies depending on the situation.

In most cases, risk is managed through the influence of contingencies or floats (respectively money or time) which are not defined depending on a comprehensive analysis of the risks that can trigger a certain project, which in many cases is insufficient to cover the outcomes of the risks that take place during the project execution (Serpella *et al.*, 2014). It has also been stressed that construction industry is risk-prone, with a poor track record of coping with risks, which clients have been enduring the unbearable outcomes of failure in the form of unnecessary delays in project completion, cost overrun and sometimes failure to meet quality standards and operational requirements (Wakjira, 2011).

Effective risk analysis and a determinable cost will ensure certainty of achieving project cost, quality timely delivery of project, and ensure client has value for the money spent (Awodele, 2012). Thus, it may be suggested that, in an attempt to better the risk management and project success in the construction industry, the main focus would be on the management of the influences related to organizational structure that are unlikely to the general cultural matters (Hasani *et al.*, 2017). The major causes of risk in construction include design error, estimating error, competitive tendering risk, financial risk and changes in political and economic weather among others. Schedule interval risk has many effects such as increased cost, late completion, disruption, third-party claims, loss of efficiency and quality, disagreements, and termination of contracts (Mahamid, 2012).

The increase pressure on effective project delivery suggest that it is prudent for anyone involved in a project to be concerned about the associated risks and how they can be effectively managed. Construction activities in Nigeria which are mostly carried out by Government, consultants and contractors normally face diverse kinds of risks like (Management, Strategy, Finance, Construction, Political and Peripheral) throughout construction. The need to assess risk management in the construction project delivery by the following objectives, to assess the factors of effective risk management, to examine the factors of poor risk management in the construction project delivery, investigate barrier to risk management implementation in order to improve the output and safety of work force on the task carried out by industry in Abuja-Nigeria.

The construction industry is under more risks than others since projects support their own risks, due to the fact that they involve different people or uncontrollable external factors (Khodeir and Mohamed, 2015; Peckiene, *et al.*, 2013). Notwithstanding, these risk factors are known to the Nigerian construction practitioners. The relative likelihood of occurrence and impacts in case of occurrence at pre and post contract stages is yet to be evaluated. This study inclines to assess factors that support risk management as to helps in meeting the objectives of a construction project delivery, examine the factors of poor risk management in the construction project, investigate barrier to risk management implementation in order to improve the production and safety of work force in the construction project and benefit of proper risk management to construction project and construction industry as a whole.

CONCEPT OF RISK MANAGEMENT

The pace of variation in the construction industry has enacted additional demands on construction project management. Risk management is an energetic project management planning and control tool for reducing uncertainty and improving decision-making. The risk management of a certain project is considered as one of the major roles that is undertaken by the project manager. Proper and systematic techniques, knowledge and experience are required approaches to enable effective and efficient risk management. In a simple illustration, knowledge of the unanticipated events that might prevail while execution of the project is required (Serpella *et al.*, 2014).

Projects from the construction industry are diverse in size (small, medium and, large) which involves risk of varying degrees of impact (Hwang, Bon-Gang, Zhao, and Toh, 2014). Frequently, the risk is not dealt with satisfactorily, and, as a result, the industry is facing poor performance (Iqbal, Shahid, Rafiq, Klaus, Ahsan and Jolanta, 2015). Many infrastructure projects, being massive in shape, involve huge budgets leading to huge monetary losses, and these injuries are caused by the various risks linked with such megaprojects (Deviparasath, 2007).

Some important issues to be considered in terms of risk management in the construction project are highlighted below.

- i. Identification of the risk occurrence by using risk identification techniques (Tang *et al.*, 2007; Hwang *et al.*, 2014; PMI, 2017).
- ii. Analyzing the risk source and risk impact (Westland, 2006; Zou *et al.*, 2007; Paek, 2009).
- iii. Risk evaluation and risk response by using risk response techniques (Choudhry and Iqbal, 2012; Loosemore *et al.*, 2012; PMI, 2017).
- iv. In respond to threats and opportunities of the risk event by using the risk management techniques (Faber, 1979; Choudhry & Iqbal, 2013; PMI, 2017).

Therefore, it is notable that the essential aspiration of risk management is the identification, evaluation, and controlling of the risks in order to achieve project success (Lee *et al.*, 2009). It has also been stressed that construction is a risk-prone industry, with a poor track record of coping with risks, as a result of which clients have been enduring the agonizing outcomes of failure in the form of unnecessary delays in project completion, cost overrun and sometimes failing to meet quality standards and operational requirements (Wakjira, 2011). Proper risk analysis and cost control will ensure certainty of project price cost and will be within budgets, timely delivery, predetermine quality and the added value to the client (Awodele, 2012). The phases included in construction projects during the later decades have become much more complicated in nature, which is the outcome of technological upgrading and stakeholder pressure, and are classified by an extent of riskiness that have a dissenting impact on the projects (Mohammad & Husameddin, 2018).

All risks are connected to cultural differences either by corporation or by matters of imperative direct or indirect impacts. Thus, it may be recommended that, in an attempt to better the risk management and project success in the construction industry, the main focus would be on the management of the factors related to the cultural diversity in contrast to the general cultural matters (Hasani *et al.*, 2017). Construction risk is generally perceived as events that influence project objectives, that is, cost, time, and quality. Some of the risks associated with the

construction process are fairly predictable or really identifiable; others may be totally unpredictable (Luka & Ibrahim, 2016). In project management terms, the most serious effects of risk can be concise as, Failure to keep within the estimated cost, time, quality and operational requirements (Mehdi *et al.*, 2012). According to (Mubarak, 2010), “lack of time” could be seen as a common factor that lead poor risk management as (Akintoye and MacLeod, 1997; Lyons and Skitmore, 2004) found that this factor was a critical reason for poor Risk Management in the construction project.

Factors of Effective Risk Management Implementation in the Construction Project Delivery.

Risk is an event that is having an impact on the organization’s objectives and may affect the performance of the organization in relations with low productivity, poor quality, and an increase in the budget (Akintoye and MacLeod, 1997; Loosemore *et al.*, 2012). Effective risk management necessitates doing the accurate job with respect to risk management process. Top management needs to embark on critical success factors of effective risk management as means of minimizing or eliminating risks in their organizations. Studies worldwide have documented critical success factors of effective risk management which serve as a basis for dealing with risks as shown in Table 1.

Table 1: factors of effective risk management in the construction project delivery

Factors	Source
1 Organization structuring and design	(Robert <i>etal</i> , 1990; Geraldine, 2018)
2 Communication	(Roberts et al, 1990; (Geraldine, 2018; Ranong and Phuenngam 2017; Agyakwa-Baah & Chileshe 2010; Lundqvist, 2014; Kamau & Mohamed 2015)
3 Organizational culture	(Roberts <i>etal</i> 1990; Geraldine 2018; Ranong and Phuenngam 2017; Yaraghi et al. 2011, and Mikes <i>etal.</i> 2014)
4 Responsibility	
5 Information technology infrastructure	
6 Measurement	(Oztas & Okmen 2004) (Hasanali 2016)
7 Trust	(Ranong and Phuenngam 2017; Zhao <i>etal.</i> 2017)
8 Training	
9 Commitment and support from top management	

Source: Researcher (2019)

Factors of Poor Risk Management in the Construction Project

Management of risk is considered to be the most important part of the execution in construction management (Tang *et al.*, 2007). It is mostly concerned with the triple constraints (time, cost, and quality) of the project, the integration of the project, communication, Human Resources (HR), and the procurement process (Sathishkumar *et al.*, 2015). In achieving the goal and objectives of a project, the following factors of poor risk management in the construction project from inception to completion stage are shown in Table 2.

Table 2: Factors of poor risk management in the construction project

Factors	Source
1 Lack of team work	(Firaskhairy Jaber 2015; Sathishkumar <i>etal.</i> 2015)
2 Poor relation and dispute with partners	
3 No past experience in similar project	(Tang <i>etal.</i> 2007; Sathishkumar <i>etal.</i> 2015)
4 Improper project planning and budgeting	
5 Change of top management	
6 Sub-contractor related problem	
7 Poor relation with government department	
8 Internal management problem	
9 Project delay	(Tang <i>etal.</i> 2007)
10 Time constraint	(Tang <i>etal.</i> 2007; (Sathishkumar <i>etal.</i> 2015; Mubarak, 2010),

Source: Researcher's (2019)

Barriers Affecting Risk Management Implementation in the Construction Industry

There are a number of barriers affecting the adoption and implementation of risk management in the construction project. However, the majority of these barriers in the implementation of risk management have been within the context of developing countries inclusive of Nigeria. From the literature review the barriers affecting risk management implementation may have direct/indirect effect on the productivity of the project are shown in Table 3.

Table 3: Barriers to risk management implementation in the construction project.

Barriers	Source
1 Complexity of analytical tools	(Hwang <i>etal.</i> 2013)
2 Lack of potential benefits	
3 Lack of budget	
4 Low profit margin	
5 Lack of government legislation	
6 Lack of knowledge	(Aliyu, 2013; Hwang <i>etal.</i> 2013)
7 Lack of time	

8	Lack of holistic approach to risk management	(Kikwashi 2011)
9	Reluctance of consultant to pear head	
10	The risk management process not being a priority in the client requirement.	
11	Lack of information	(Chileshe <i>etal.</i> 2012)
12	Lack of coordination between the parties involved	
13	Availability of specialist risk management consultants	
14	Lack of joint management mechanisms by parties involved	(Aliyu, 2013), (Tang <i>etal.</i> 2007)
15	Ineffective implementation of risk control strategies	
16	No incentive for better risk management	
-

Source: Researcher's (2019)

The ultimate goal of project risk management is to improve project performance and this study assessed the significant of risks management on the construction projects delivery in Abuja Nigeria.

METHODOLOGY

The research methodology selected for this study comprised of a comprehensive review of relevant literature, as well as the use of historical project data which will assist in providing an insight into current problem of risk in the construction projects through the examination of what has happened in the past. Data collection was done through a questionnaire survey self-administered on 60 randomly selected construction practitioners involved in Abuja. The location was selected as a result of frequent construction activities carried out within the metropolis. The research covers stakeholders in construction industries, and primarily Project manager, Contractor, Consultants and other workers such as skilled labour but not professionals in the location. The research specifically assess data from the above-mentioned stakeholders relating to their academic qualification, years in service, the likely number of projects they have handled with the value of the project. Other data that was collected includes information about their awareness of risk factors, likelihood of occurrence of risk factors and its bearing on the performance of the projects. The simple random sampling method was chosen so as to give equal chances to all the listed professionals and contractors in the study areas.

A well-structured close- ended questionnaire was designed for the research and directed to the selected targets. The questionnaire was divided into five sections. Where section A, deals with the general information and issues relating to the characteristics of respondents, while questions in Section B-D focused on the assessment of risk management on construction projects delivery. Data collected were analyzed through descriptive method of analysis. Mean Item Score was used for all the objectives. Data analysis was carried out using statistical software package SPSS 16.

Data Analysis and Result

Mean Item Score was employed as a tool for descriptive statistics in the study to rank the significance level of Risk Management on the Construction Project Delivery.

Respondents' Demography

This section shows the demographic characteristics of respondents that contributed to the research. Highlight of the respondents' demographics are given below:

The Respondents Profession were Quantity Surveyors 19, followed by Builders 17 and the Architects 16.

Respondents Designation includes: Project Manager (PM) 16, Consultant 12, Contractor 11 and Workers (none professionals) 13.

The respondents' years of experience ranged from 4-5 years 38%, 6-10 years 29%, 11 years and above 14%, less than 1 year 11% and 1-3 years 8%.

The number of projects executed in the respondent industry for the last five years. Less than 5 project response to the study with 54%, 5-10 project response to the study with 31%, 11-20 project response to the study with 9%, and 21 project and above response to the study with 6%.

Table 4: Factors that support risk management in the construction project delivery.

Factors	MIS	Rank
Organization structuring and design	4.60	1 st
Commitment and support from top management	4.48	2 nd
Information technology infrastructure	4.44	3 rd
Training	4.40	4 th
Organization culture	4.37	5 th
Communication	4.33	6 th
Measurement	4.27	7 th
Responsibility	4.21	8 th
Trust	4.17	9 th

Source: Researcher's Analysis (2019)

Table 5: Factors of poor risk management in the construction project delivery.

Factors	MIS	Rank
Lack of Team Work	4.58	1st
No Past Experience in the similar project	4.35	2nd
Improper project planning and budgeting	4.33	3rd
Internal management problem	4.33	3th
Poor relation and dispute with partner	3.98	5th
Time constraint	3.96	6th
Poor relationship with government department	3.94	7th
Project delay	3.87	8th
Change of top management	3.83	9th
Sub-contractor related problem	3.81	10th

Source: Researcher's Analysis (2019)

Table 6: Common barriers to risk management in the construction project.

Barriers	MIS	Rank
Ineffective monitoring	4.43	1 st
Complexity of analytical tools	4.40	2 nd
Lack of budget	4.37	3 rd
Ineffective implementation of risk control strategies	4.33	4 th
Lack of information	4.33	4 th
Lack of knowledge	4.27	6 th
No incentive for better risk management.	4.20	7 th
Lack of potential benefits	4.17	8 th
Lack of joint management mechanisms by parties	4.13	9 th
Lack of coordination between the parties involved	4.07	10 th
Lack of government legislation	4.03	11 th
Reluctance of consultant to pear head the risk management process	4.03	11 th
Lack of holistic approach to risk management	4.03	11 th
Availability of specialist risk management consultants	4.03	11 th
Not being a priority in the client requirement	3.87	15 th
Lack of time	3.83	16 th

Source: Researcher's Analysis (2019)

DISCUSSION OF RESULT

The factors that support risk management are revealed: “Organization structuring and design” was ranked 1st highest as to the agreement by the audience in regards to the effectiveness of Risk Management in the construction project delivery, ‘Commitment and support from top management’ was ranked 2nd highest on the effectiveness of Risk Management, “Information technology infrastructure” was ranked 3rd highest in regards to the agreement to effectiveness of Risk Management in the construction project delivery, “Training” was ranked 4th highest in the effectiveness of Risk Management, “Organization culture” is being ranked 5th amongst the factors revealed in regards to the agreement with the effectiveness of Risk Management, and “Communication” “Measurement” “Responsibility” and “Trust” was also ranked 6th, 7th, 8th, and 9th ranked respectively aid the effectiveness of risk management in four steps Risk Identification, Risk Assessment, Risk Management, Risk Monitoring. Therefore, Risk management can be seen as a systematic application of management policies, procedures and practices to assess and manage risk in construction project execution.

The factor that lead to poor risk management in the construction project among which are: “Lack of team work” was ranked 1st in the course study with the agreement by the audience as a most factor that lead to poor risk management, “No past experience in the similar project’ was ranked 2nd as the second most factor that lead to poor risk management, “Improper project planning and budgeting” and “Internal management problem” was ranked 3rd as third most factors that lead to poor risk management. “Poor relation and dispute with partner” “Time constraint” “Poor relation with government department” “Project delay” “Change of top management” “Sub-contractor related problem” was ranked between 5th and 10th respectively as is the remaining factors that

lead to poor risk management in the construction project delivery. According to (Mubarak, 2010), “lack of time” could be seen as a common factor that lead to poor risk management as (Akintoye and MacLeod, 1997; Lyons and Skitmore, 2004) found that this factor was a critical reason for poor Risk Management in the construction development. “Lack of budget”, “low profit margin”, and “not economical”, which were all related to the expense of poor Risk Management, were the remaining three impactful factors of poor risk management.

The common barriers to implement risk management in the construction project amongst which are: “Ineffective monitoring” was ranked 1st as the most common barrier in the implementation of risk management in construction project, “Complexity of analytical tools” was ranked 2nd as the most common barrier, “Lack of budget” was ranked 3rd as the most common barrier of risk management implementation in the construction development, while the following are the other impactful barriers and challenges of risk management implementation in the construction project “Ineffective implementation of risk control strategies” “Lack of information” “Lack of knowledge” “No incentive for better risk management” “Lack of potential benefits” “Lack of joints management mechanisms by parties” “Lack of coordination between the parties involved” “Lack of government legislation” “Reluctance of consultant to pear head the risk management process” “Lack of holistic approach to risk management” “Availability of specialist risk management consultants” “Not being a priority in the client requirement” “Lack of time” respectively.

According to (Milad, 2014), “lack of time” could be seen as a common barrier to Risk Management implementation form the previous research it obtained highest mean score and rank 1st as overall common barrier. In addition, “lack of potential benefits” and “lack of manpower” were ranked fifth and sixth. Previous studies indicated that lack of sufficient knowledge would hinder Risk Management implementation in small projects (Ho and Pike, 1992; Smith and Bohn, 1999), “lack of knowledge” obtained a low mean score and least ranked.

CONCLUSION

Success in a construction project is repeatable, and there is a great value in developing a protocol to improve risk management in construction activities. The identification of construction project delivery factors can furnish project participants with an indicator to attain project success. This has brought us the following areas:

- i. The knowledge in achieving effective project delivery by adopting effective risk management factors, organization structuring and design, commitment and support from top management and information are highly ranked factors.
- ii. The knowledge on poor risk management factors menace on construction project delivery which include, lack of team work, no past experience in the similar project, and improper planning and budgeting. It was also revealed that poor relation and dispute with partner, time constraint, poor relation with government department, and sub-contractor related problem which must to be confronted in project
- iii. The knowledge on the barriers to risk management such as ineffective monitoring, complexity of analytical tools, and lack of budget attract knowledgeable personnel in order to be mitigated
- iv. The knowledge on factor to be adopted in achieving an effective project delivery which include, scope and work definition and planning efforts, Adequate risk analysis and

specification and Effective project briefing, Adequacy of plans and specification and Effective project briefing.

- v. Moreover, impact of risk management can provide participants with a focus of what they should be aware of in order to ensure the success of construction project. More also it aids the understanding to be exploited by project managers or construction professional to select efficient strategies to alleviate the root causes of poor performance.

RECOMMENDATIONS

Based on the findings in this research, the following recommendations were made;

- i. Organization structuring and design has been the major effective factor of risk management in the construction industry which required maximum attention and improvement in organization structuring and design as the driver of effective risk management.
- ii. Lack of team work is the major factor of poor risk, So the best way to improve risk management in the construction industry is by adopting team work, Ineffective monitoring as the major barrier to risk management implementation in the construction project therefore effective monitoring has to be adopted in order to enhance proper risk management in the construction industry.
- iii. Management course will help upcoming building professionals to adopt organization structuring and design, team work, effective monitoring and scope of work definition of risk management. Which will aid in adopting and participating in the background knowledge of risk management is properly transferred than to be introduced during the projects which may not be fully understood.

CONTRIBUTION TO THE BODY OF KNOWLEDGE

The research premised on the basis of bringing about effective measures to mitigating Risk in the construction industry therefore findings from the study will assist construction professionals and other stakeholders in the following aspect;

- i. To understand the bearing of risk management in the construction project execution.
- ii. To develop better risk management strategy on how to mitigate risk during and after project execution
- iii. To provide necessary information required on project to be embarked upon.

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WHERE EXACTLY ARE WE ON SUSTAINABLE CONSTRUCTION? THE ROLE OF THE QUANTITY SURVEYOR

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ABSTRACT

Sustainable construction is now a part of the mainstream in most developed economies. Sustainable construction is achieved through the inputs of various professionals of which the Quantity Surveyors (QS) role cannot be down stated. Further still, quantity surveyors in these economies are known to offer dedicated sustainable construction services. Thus, we are confronted with the question of “where exactly, in implementing sustainable construction are their counterparts in the developing economies towards offering these services?” Given that the nature of knowledge sought is more of an objective truth, a questionnaire survey was administered and the data analysed based on descriptive and inferential statistics. It revealed that though QS are very much in tune with the concept of sustainable construction, they however slightly misrepresented the sustainable construction related duties of the other construction participants, and are of the opinion that they are more of co-operators than initiators compared to designers. These findings are indicative of the fact that QS within this study context would need specific and continuous education about their sustainable construction role in terms of expectations, clarity and specificities. This will better prepare them for sustainable construction specific problem-solving and decision-making. It is recommended that QS should rigorously embrace their Sustainable Construction duties through continuous development and participation.

Keywords: Quantity surveyor, role, sustainable construction, developing economies, professional.

INTRODUCTION

The construction industry is considered as one of the main sources of environmental pollution in the world. The activities of the construction industry from its design, construction, use, refurbishment and dismantling of built assets is a major consumer of resources and generates considerable waste (Ashworth, 2010). This has geared great attention towards sustainable construction. The objectives of sustainable construction are to reduce, or completely avoid depletion of critical resources like energy, water, raw materials and prevent environmental degradation caused by facilities and infrastructure throughout their life cycle, promote economic growth and create built environments that are comfortable and productive (Hartenberger, Lorenz & Lützkendorf, 2013; Oni, 2015; Wong, 2016). The Quantity Surveyor (QS) is the cost expert in the construction industry and the participation of the QS in achieving sustainable construction is of utmost importance hence the skills of the QS have to be developed to accommodate

sustainable construction in conjunction with the ever changing construction trend to make themselves stay relevant in the industry (Kuntal, Wang & Payam, 2016; Opoku & Egbu, 2017). The understanding of the concept of sustainable construction is one of the key advantages of a Quantity Surveyor to remain effective in the industry.

Cartlidge (2011) made a case for three broad areas in which the core skills of Quantity Surveyors can play a central role in achieving sustainability in the contemporary built environment namely; Sustainability assessment, Sustainability performance and sustainability value.

Various researchers have identified new functions and services that Quantity Surveyors can offer in achieving sustainable construction; they include but not limited to Green Costing, Carbon Footprint, Property Performance Reporting, Green Building Rating Assessment and cost of achieving green rating (Heffernan, Liang, 2012; Ma & Luu, 2015; Wong, 2016; Opoku & Egbu, 2017). According to Letchmiah (2015), sustainable construction presents new challenges as well as important new opportunities to Quantity Surveyors. How well are the Quantity Surveyors embracing the new challenges and opportunities of sustainable construction?

THE SUSTAINABLE CONSTRUCTION ROLE OF THE QUANTITY SURVEYOR

There has been great attention towards sustainable construction around the globe and with the use of non-traditional procurement methods, the quantity surveyor's role continues to evolve. Thus, evolving duties of a Quantity Surveyor towards achieving sustainable construction are discussed below:

1. Sustainability assessment: Sustainability optioneering (i.e. comparison of design options in light of sustainability value) need to be underpinned by a logical, transparent and evidence-based system of life-cycle cost assessment. The 'cost' in question ought to be informed by sustainability value, rather than by mere economic value (Cartlidge, 2011).
2. Sustainability performance, zero carbon and property value – both in new and existing stock: There is a great need for the core skills of a quantity surveyor to have a bearing here. As many of the decisions that ultimately influence building sustainability performance are made early on in the project, the building's design, construction, operation and procurement processes need to be assessed for whole-life sustainability in ways that facilitate early optioneering. (Cartlidge, 2011)
3. Achieving sustainability value in construction procurement, especially public sector: Quantity surveyors have a specific role to play in the procurement of sustainable public

buildings. Publicly procured exemplar sustainable buildings offer possibilities to drive the step-change needed for built environment sustainability. (Cartlidge, 2011).

4. Green Costing: With the increasing prevalence of green building ratings, the Quantity Surveyor has to be adept in the knowledge of new and emerging technologies that are being utilized in green buildings (Ogunbiyi, Goulding & Oladapo, 2014; Ashworth, & Perera, 2015).

5. Carbon Footprint: With an established methodology, the Quantity Surveyor will be equipped to measure the carbon footprint as well as to create various carbon models for different developments which are similar to that of cost plans format. Costing benchmarks such as \$/m² GFA may be compared against carbon benchmarks such as kg/m² of CO₂ with carbon offset factors for green cover and carbon credits (Dastbaz, Gorse, & Moncaster, 2017; Haron, Ibrahim, & Rawi, 2017; Oke, Aigbavboa, & Ibitoye, 2017; Windapo, 2017).

6. Life Cycle Costing / Life Cycle Assessment: The field of Life Cycle Costing (LCC) will continue to grow in importance and the Quantity Surveyor, who is an expert in cost management, is in an excellent position to gear itself for this role. LCC is a technique to establish the total cost of the building throughout its functional lifespan (Oke *et al.*, 2017). LCC can be used to produce a spend profile of the building over its anticipated life-span and the results can be used to assist the management in the decision-making process to go green. (Udeaaja & Aziz, 2015; Dastbaz *et al.*, 2017).

7. Property Performance Reporting: The emphasis on energy efficiency and the changing demand of today 's tenants require building owners to work their way through the existing performance measurement tools to understand where they fail to meet new standards. In the first instance what is needed is an assessment process that provides a clear gap analysis that takes the owner towards a balanced improvement strategy (Olanrewaju, 2016; Cartlidge, 2017; Dastbaz *et al.*, 2017; Towey, 2017; Windapo, 2017).

8. Green Building Rating Assessment: The prevalent use of green building rating systems such as LEED and Green Mark in international projects has created new inroads for the quantity surveyor to exploit. Courses such as the LEED Accredited Professional and the Green Mark Manager certification have been created to enhance the understanding of the relevant Green Building rating system and environmentally sustainable designs. With a greater understanding of the green building rating systems, the QS would be able to in a better

position to advice the Client both on the costing and sustainable designs (Oke, *et al.*,2017; Tan, Udeaaja, Babatunde & Ekundayo, 2017; Towey, 2017; Windapo, 2017).

9. Building Information Model: Building Information Modeling (BIM) is an integral platform for the management of information throughout the project lifespan. The BIM model is best suited for use where visual presentation is required. With the advancement in building information modelling (BIM) systems, the use of object orientated CAD may be able to contain information such as Green Assessment points, intelligent advice on usage, LCA with carbon and specifications and real time costing as well. (Wao, & Flood, 2016; Ward, 2016; Cartlidge, 2017; Dastbaz *et al.*, 2017; Oke *et al.*, 2017; Towey, 2017; Windapo, 2017).

RESEARCH METHOD

Current researches have shown that there is need of participation of all professionals in sustainable construction including the Quantity Surveyor (Akadiri & Olomolaiye, 2012) thus various duties which are specific to the Quantity Surveying profession was identified. To achieve the aim of this study, the quantitative approach was used. The sample used in this survey was drawn primarily from the Quantity Surveyors Registration Board of Nigeria (QSRBN), and the total number of registered surveyors in Nigeria is **2774** (www.qsrbn.gov.ng August, 2018). Because it was impractical to collect data from all these professionals in the population, sampling was necessary to make the survey possible. In order to determine a suitable size for the sample, Krejcie and Morgan's (1970) formula was used to deduce the sample size as shown below:

$$S = \frac{\chi^2 NP(1 - P)}{d^2(N - 1) + \chi^2 P(1 - P)}$$

Where;

S = Required Sample

χ^2 = Table of value of Chi-Squared for 1 degree of freedom at the desired confidence level (taken as 3.841)

N = The population size

P = The population proportion (assumed to be 0.1)

d = Degree of accuracy expressed as a proportion (taken as 0.05)

The arrived sample size for the questionnaire survey was 246. The questionnaires were administered during the biannual Research conference NIQSReCon3 where quantity

surveyors are gathered from across the country. Questionnaires were distributed and returned in person. A total of 91% of the questionnaires distributed was received, only 87% of the questionnaires were properly filled and analyzed for the purpose of this study.

RESULTS AND DISCUSSION

Involvement of the Qs towards achieving Sustainable construction

The duties of the QS required for Sustainable construction to be achieved as discussed earlier are presented in Table 1. Table 1 shows the mean value of each of the importance the QS places on these duties and the extent to which the QS are willing to carry out these duties as the professional responsible for its execution. The traditional role of the QS has expanded to include these sustainable construction duties and they are all important duties of the QS. The table also shows the level of contribution that the QS are willing to participate in carrying out these duties as indicated from the respondent's choices. The QS were also asked to identify the role that the QS shoulders in carrying out these duties, The QS could either act as the Initiator, a Participant or a Co-operator. The initiator simply implies the professional that brings about the idea and concept to be carried out in order to achieve sustainable construction. The participant simply means the ability of ensuring that ideas and plans that have been generated are executed and conducted in the right manner while following the acceptable standard. While the co-operator ensures that the ideas and concepts that are necessary to ensure sustainable construction are carried out.

Table 1: Descriptive Statistics of Sustainable construction duties of the Quantity surveyor

Duties of the QS	Mean		Participation of the QS	Rank
	Statistic	Std. Error		
Involvement of the Q/S in selection of recommended procurement route.	4.593	0.108	Participant	1
Carrying out a life cycle cost appraisal of a sustainability project.	4.542	0.111	Initiator	2
The use of BIM to generate cost that will help the Q/S to focus on higher value-added cost estimating activities.	4.474	0.106	Initiator	3
The involvement of the Q/S in comparing alternative design options in light of sustainability value before adoption of design.	4.423	0.116	Participant	4

The ability of the Q/S to give advice to client on both costing and sustainable design.	4.424	0.111	Initiator	5
Adjustment of high-level models at feasibility stage to fit the budget.	4.390	0.111	Participant	6
Updating cost models to cater client's needs in regards to the extra over cost for achieving the different levels of green building certification.	4.356	0.132	Initiator	7
Assessing building design, construction, operation and procurement processes for whole life sustainability.	4.288	0.119	Participant	8
Making decisions that ultimately influence building sustainability early on in the project.	4.254	0.098	Participant	9
Set targets – measure and compare your performance with others. Set targets for continuous improvement	4.220	0.103	Initiator	10
Making decisions that ultimately influence building sustainability early on in the project.	4.186	0.117	Cooperator	11
Facilitate building owners to maximize energy efficiencies and returns through identification of energy inefficient areas.	4.153	0.961	Cooperator	12
Greater standardization of building assessment methodologies to assist comparability and increase transparency in decision making.	4.102	0.113	Initiator	13
Aim for lean construction work on continuous improvement, waste eliminate, strong user focus and value for money.	4.085	0.124	Participant	14
Using LCC to produce spend profile of the building over its anticipated lifespan	4.051	0.112	Participant	15
The ability of the Q/S to demonstrate greater understanding of green building rating systems	4.051	0.131	Participant	16
Having an understanding of the certification process of green buildings.	3.966	0.116	Cooperator	17
Engaging in activities that require assessment of the environment impact of the design solution.	3.966	0.097	Cooperator	18
Respect for people and their local environment	3.949	0.124	Participant	19
The Q/S involvement in assessment process that provides a clear gap analysis that takes the owner towards a balanced improvement strategy.	3.898	0.115	Participant	20
Minimize energy in construction	3.797	0.115	Participant	21
Minimize energy in use	3.763	0.117	Participant	22
Executing the role of a cost and carbon management consultant through integration of cost and carbon footprint.	3.746	0.101	Cooperator	23
Property Performance Rating on building condition and compliance.	3.729	0.096	Cooperator	24

Re-use existing built assets for alternative function	3.712	0.097	Participant	25
Development of carbon management strategy (i.e to accurately measure the current level of carbon emissions).	3.678	0.120	Cooperator	26
Property Performance Rating on social Equity indicator	3.678	0.112	Cooperator/p articipant	27
Property Performance Rating on environmental performance	3.661	0.104	Participant	28
Use of recycled materials	3.644	0.127	Participant	29
Preserve and enhance biodiversity	3.644	0.118	Participant	30

Table 1 presents the ranking according to the level of importance the QS placed on their sustainable construction duties. The involvement of the Q/S in selection of recommended procurement route ranked highest with a mean score of 4.590. This signifies that the selection of appropriate procurement route is a positive direction towards achieving sustainable construction. The findings also show that the Quantity surveyor has demonstrated the role of an initiator to some sustainable construction duties such as Carrying out a life cycle cost appraisal of a sustainability project. The use of BIM to generate cost that will help the Q/S to focus on higher value added cost estimating activities and The ability of the Q/S to give advice to client on both costing and sustainable design amongst others. The duties representing the QS as Participant/Cooperator are indicators for additional input from the QS to take a lead role as the initiator thus leading to improvement in Sustainable Construction.

CONCLUSION

This study appraised the level of participation of the Quantity surveyor towards achieving sustainable construction and it was clearly established that the Quantity Surveyor has a significant role to play in ensuring the advancement and benefits of sustainable construction for it to be delivered successfully. Although the participation of the Quantity Surveyor towards achieving sustainable construction in developing economies is somewhat low. The findings show that the Quantity surveyor has demonstrated the role of an initiator to some sustainable construction principles such as adjustment of high models at feasibility stage to fit the budget and preservation and enhancement of biodiversity. Obviously, the QS has a lot to do. Since all the duties identified are all duties peculiar to the Quantity Surveying profession, it is recommended that the Quantity Surveyor should rigorously embrace these

duties through continuous development and participation of these sustainable construction duties.

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ASSESSMENT OF PRIVATE SECTOR PARTICIPATION IN INFRASTRUCTURE DEVELOPMENT IN SOUTH-EASTERN GEO-POLITICAL ZONE, NIGERIA

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ABSTRACT

The need for infrastructure in any developing country cannot be overemphasized as it constitutes the backbone of the country's national economy. Considering the importance of infrastructure development, government at all levels has always borne the full responsibility of providing infrastructure. The study however assessed private sector participation in infrastructure development in Nigeria with emphasis on South Eastern Nigeria. The study has two objectives which were to determine the level of awareness about private sector involvement in Public Private Partnership (PPP) for infrastructure development and to assess the areas of involvement of the private sector in PPP for infrastructure development in the economy. From the firms and agencies involved in the execution of the various PPP projects in south eastern Nigeria, a sample size of 105 respondents were employed based on non-probabilistic sampling. The instrument for data collection is structured questionnaire and the method of data analysis is descriptive statistics of frequency, percentages and charts. The study concludes that the involvement of the private sector in infrastructural development is very insignificant as there is a great concentration on a particular sector while other sectors are left unattended to. The study recommends that government should put more efforts to improve the level of awareness on the involvement of the private sector participation in the provision of infrastructure through public enlightenment stating the benefits that are obtainable.

Keywords: Involvement, Participation, Private Sector, Public Private Partnership

INTRODUCTION

A country's level of social and economic infrastructure constitutes the bedrock of the national economy; it increases human health, contributes to economic activities and has significant capacity for directly reducing poverty (Agbibe, 2016). It also largely defines the type of operational environment that is open to the economy's development sectors. The extent of construction of these facilities is an indicator of the living index for their persons. (UNDP, 2019). To improve the efficiency and productivity of an economy, it is therefore important to provide adequate and reliable infrastructural facilities.

Knowledge levels are an important factor in ensuring that any new initiative, such as the participation of the private sector in the provision of infrastructure, is effectively enforced. The level of knowledge is obviously too poor due to the lack of appropriate literature and minimal experience available on this form of partnership (Ikechukwu, 2017) and this may hinder the full productive implementation of the concept as awareness of a process is the first step at endearing the concerned construction

industry professionals and the citizens (Akintola, 2016) about the possible benefits of its acceptance. Individuals appear to associate private sector involvement in the development of utilities with privatization that is not widely agreed because the people of Nigeria have earned a great uproar (Momoh, 2019). In the words of Andrew Porter of Price Waterhouse Cooper (PWC) Corporate Finance PPP specialist in Johannesburg, as cited in Nedozi, Obasanmi and Ighata (2014), “the initial reaction to public private sector collaboration in service delivery resulted from the belief that it is a new ploy by the capitalist to corner public resources”.

According to Ehebha (2011), the construction of infrastructure has recently taken on a central role in Nigeria's struggle to maintain social and economic stability. As the focal point of their administrations and legislative enactments, the federal government and all state governments use facilities. Generally, infrastructure has to do with the fixed provision of physical properties on which it is possible to construct other intangibles. The provision of accommodation, power (electricity), transport, education, connectivity, and technology are not limited in scope.

Statement of problem

Essentially, the need for infrastructure provision in any developed country cannot be overemphasized, because it constitutes the bedrock of the national economy of the country. Considering the importance of infrastructure, government at all levels (local, state and federal) has always borne the full responsibility of providing infrastructure via dependence on loans and credits from financial institution not recognizing the fact that the investment requirement for the infrastructure deficit is such that cannot possibly be met by relying on the public sector to boost public investment without increasing public borrowing. So as to achieve the aim of introducing private investors into the development of public infrastructure, the level of the public's awareness of private sector involvement in infrastructure development must be assessed in addition to the areas of private sector involvement infrastructure development. As a result, this work seeks to appraise the private sector involvement in PPP for infrastructure development.

Specifically, the study is set out to pursue the following objectives:

1. To determine the level of awareness about private sector involvement in PPP for infrastructure development.
2. To assess the areas of involvement of the private sector in PPP for infrastructure

development in the economy.

LITERATURE REVIEW

The Concept of Public Private Partnership

The Public-Private Partnership (PPP) is developing in various parts of the world as an alternative mechanism for providing infrastructure and services (Cheung & Chan, 2011; Forrer, Kee & Newcomer, 2010; Sarmiento, 2010; Dada & Oladokun, 2008). PPP defines a government service or private business enterprise financed and run by a government partnership and one or more firms in the private sector. Often such schemes are referred to as PPP or P3 (Harris, 2008). Usually, to construct and manage the asset, a private sector consortium forms a separate entity called a special purpose vehicle (SPV). Usually, the consortium consists of a construction contractor, a repair firm and a bank lender. It is the SPV that signs the deal to create the facility and then operate it with the government and with subcontractors. A hospital building funded and designed by a private developer and then rented to the hospital authority will be a traditional PPP example. The private developer then serves as the landlord, delivering household and other non-medical facilities, while the hospital itself offers medical services (Adeniyi, 2018). Initially, as one-off agreements, most public-private partnerships were privately negotiated. However, in 1992, the Conservative government of John Major in the United Kingdom launched the first comprehensive policy to promote public-private alliances, the Private Finance Initiative (PFI) (UNISON, 2007). The primary focus of the 1992 initiative was on reducing the Public Sector Borrowing Obligation, while the effects on public accounts was, as already noted, largely illusory.

History of Private Sector Participation in Infrastructure in Nigeria

According to Adekunle (2011), PPPs in the infrastructure market are a post-1999 reform driver for Nigeria, reflecting a radical economic ideological change as it allows the private sector a greater stake in economic management. PPPs also bring immense relief to the government from the biting impact of the global financial crisis. Ohia (2011) claims that the legislative system for the service of infrastructure concessions in Nigeria was enforced through the implementation of the Infrastructure Concession Regulatory Commission Act 2005 and the Public Procurement Act 2007, which laid down the conditions for competitiveness and involvement of the private sector in all public

procurement contracts and specified the permissions required for all PPPs. According to the Federal Ministry of Health (2005), however, PPPs in Nigeria were not a recent idea as there were numerous efforts to establish a public private partnership arrangement. The Chamber of Commerce and Industry of Lagos was founded in 1888 prior to independence, with the goal of supporting and supporting legislative or other initiatives affecting trade, industry, trade and agriculture as well as reflecting the view of the business community (Lagos Chamber of Commerce and Industry, 2013). The emphasis was on state-led construction programs at independence and up to the late 1970s, based on the simple premise that the state is the principal agent for construction with little or no role assigned to the private sector in the development process. Consequently, involvement by the private sector in the growth of infrastructure was not seen as important even though the sector was not entirely matured (Mabogunje, 2007; and Sagagi, 2007). While the formation of the Manufacturers Association of Nigeria (MAN) in 1971 provided the state with an adequate counterweight or encouraged successful dialogue between the public-private sector, the government was still the dominant player in the economy until the 1980s, when the Structural Improvement Program (SAP) was implemented in 1986. This was an effort to fix some of the system's imbalances and thus build a larger space for activity in the private sector. The National Committee on Industrial Development (NCID) was founded by the government in 1989 as the key forum for consultation with the private sector (Ahmed, 1999). The first national economic forum and the subsequent implementation in 1993 of the National Planning Commission Act became the key outcomes of the discussion with the private sector. Consequently, the National Planning Commission (NPC) became the federal body responsible for fostering productive dialogue with the private sector (Agboli & Emery, 2005; and Sagagi, 2007). In their report, Udah and Obguagu (2011) argue that while Nigeria is internationally regarded as a nation with great potential for investment in infrastructure, the overall image that emerges is that Nigeria has over-invested in physical resources and suffered from low productivity. They find in their report that all major economic and social indices painted Nigeria in the image of, among others, one of the biggest paradoxes in the world, making Nigeria 's low delivery of public infrastructure services a topic of significant debate (Sala-i-Martin & Subramanian, 2003; Ariyo & Afeikhena, 2004; and Hassan *et al.*, 2012). However, Sotola and Ayodele (2011) argued that the milestones reported in the 1980s during the privatisation program and the traction achieved in telecommunications and waste management services concessions after 1999, which culminated in improved access and quality services, forced the change in government thinking to public-private infrastructure provision. This policy reform is a reaction to the past difficulties in which public

authorities are the pioneers and dominant participants in the granting of PPP services and services, as well as being free to withdraw at will. Among several other examples, the danger in this leader-follower partnership culminated in the collapse of numerous previous concessions at the Nigerian Port Authority (NPA), Ajaokuta Steel Rolling Mill and Nigerian Telecommunications Limited (NITEL). The Government of the Federation has enacted the Infrastructure Concession Regulatory Commission Act 2005 to resolve these issues described by Sotola and Ayodele (2011), with the goal of establishing regulatory and oversight institutions so that the private sector will play a greater role in the provision of infrastructure, while ministries and other public agencies can focus on planning. This was important because "current statutes do not have sufficient provisions permitting funding for private investment." This is especially true in Nigeria, where the system is new and there are few laws that govern implementation (Sotola & Ayodele, 2011).

The Construction Industry and Suitable Sectors for Private Sector Participation in Infrastructure Development (A look at Developed Nations)

The construction industry can be defined as that section of the economy responsible for planning, designing, procurement, construction and delivery of building, civil engineering and public works for government and private institutions as well as individuals (Adewuyi, 2014). The construction industry embraces a wide range of loosely integrated organization that collectively constructs, alters and repairs a wide range of different building and civil engineering structures. Also, Willis (1987) supported that the construction industry is a company organization, which centers on the project under construction or adaptation.

Suitable sectors

A PPP approach is suitable for any sector where it is possible to develop a service based on an output specification. In the United Kingdom (UK), the following sectors are being patronized: Health (hospitals and clinics), Education (Schools and University accommodation), Justice (prisons and courthouses), Transport (light rail, roads, bridges), Utilities (water, waste disposal and street-lighting), social housing, defence (training simulators, sea and land tank transporters) and government buildings. The only sector where it has not really worked and where the UK government has recommended that no more projects take place is in Information Technology (UN/ECE2000). This for a number of reasons that include: (1) the speed of change in the sector making it difficult to define effective long-term outputs;(2) the high level of integration of IT into other business systems

makes it difficult to delineate areas of responsibility and effectively allocate risk; and(3) the nature of the capital investment with IT project costs dominated by operating costs not up-front investment. Areas where PPPs have been used include:

Transportation

Public-private partnerships have played an increasingly central role in answering the pressing need for new and well-maintained roads, tunnels, bridges, airports, ships, railways, and other forms of transportation. Internationally, transportation has been far and away the largest area of PPP investment (Doyin, 2016).

Water and Waste Water

The largest European water PPP is in the Netherlands, where the Water Board of Delft land awarded a 30- year concession, with a total contract value of €1.58 billion. The project includes the design, construction, and operation of a new wastewater treatment plan and, to comply with more stringent discharge requirements, the refurbishment and operation of an existing wastewater treatment plant. Water and Wastewater PPPs (Doyin, 2016).

Education

PPPs can deliver substantial innovation to education infrastructure and service delivery. While arrangements differ, the private sector typically finances, designs, constructs, and operates a public-school facility under a contract with the government for a given time period, for example, 20 to 30 years. At the end of that concession period, ownership of the school facility transfers to the government. Under typical education PPPs, the private sector invests in the school infrastructure and provides related non-core services (school transport, food services, cleaning, and so on), under contract while the government continues to provide core services, namely, teaching.

Health/Hospitals

In recent years, a number of countries have aggressively moved to diversify the sources of health care funding by using PPP arrangements to meet the growing demand for health care infrastructure. Typically, a private consortium designs, builds, owns, and operates a hospital and leases it back to the relevant government entity—such as a hospital board—for a period of 20 to 60 years. In Portugal, 31 hospitals will be built using PPPs. The entire program, at an estimated cost of \$37 billion, and

was completed in 2014, with 10 new hospitals launched in 2006 (Deloitte, 2016). The contract covers the design, construction, financing, maintenance, and operation of the facilities as well as hospital management and some clinical services.

Public Housing, Land and Area Development

In Australia and Ireland, the central governments have encouraged the use of concession models in their pilot PPP public housing projects. But the country with the deepest experience in this sector remains the Netherlands, which has been applying PPPs to social housing and regeneration projects for nearly two decades. This model proved quite successful for more than 100 locally initiated projects in the Netherlands (Nijkamp, VanDer Burch & Gabriella, 2012) Joint venture, the most commonly used PPP arrangement for these projects, suits the local governments' need to retain control over planning and development while utilizing the private partners' available resources and expertise. Housing and Development PPPs.

Defense

PPP projects in the defense sector include equipment maintenance and installation, supply chain integration and operational support, depot maintenance, specialized military training and real estate management (land development, privatized housing and base closures and development). The projects typically are designed to overcome fiscal constraints, manage life-cycle costs, and reduce pressure on military personnel. The UK Ministry of Defense has employed various PPP models for more than 56 defense projects—everything from building military accommodations to training personnel to putting up satellites. Total value: £4.65 billion.

Justice/Prisons

Herizonte (2016) reported that Britain currently has 10 prisons run by private companies, 8 of them built under the PFI. These buildings are leased back to the prison service for a period of 25 years after being designed and constructed by commercial groups. The results have been generally positive, as construction times have dropped by more than 40 percent; costs by 20 percent.

Areas of Involvement of Private Sector Participation in Infrastructural Development in Nigeria (1990-2020)

Over the years, government has played the sole or dominant role in all spheres of the economy, including ensuring public service delivery, according to Abdullahi and Aziz (2010). While this model yielded some desirable outcomes initially, there is, sadly, a much greater funding demand for urban planning programs than the conventional public purse alone would provide. This has led, especially in developed countries, to serious problems. These concerns included underinvestment exacerbated to a large degree by underpricing, low competitiveness, inadequate delivery of facilities, lengthy queues, lack of access to public services, lack of transparency and adverse political intervention in the activities of these infrastructure agencies (World Bank, 2014). When Nigeria became independent in 1960, according to Agboli and Emery (2015), the prevailing economic policy course and thought was to broaden the role of the government through direct involvement and ownership in the economy. The government achieved commanding heights and dominated economic life in the country with the assistance of foreign donor organizations and enhanced revenues resulting from the oil boom of the 1970s. This has resulted in lower growth in the developing private sector, triggering a significant change in private sector investment from agricultural and industrial development to government procurement and trading. Thus, decades of inadequate maintenance and underinvestment have left the nation with a startling lack of infrastructure, hampering economic development. The experience of the last two decades suggests that most countries would be best off forming a relationship with the private sector to achieve sustainable productivity gains and reduce fiscal financing requirements, combined with the new thought that building an atmosphere that encourages and facilitates entrepreneurship and private investment was a primary role of governments (Agboli & Emery, 2015; Ohia, 2011). Therefore, the implementation of diverse types of PPPs has resulted in fiscal problems and the recognition that the private sector will provide assets and resources at lower prices and in a more productive manner (Alasad, 2011). For Nigeria, the experience of private investment in the provision of infrastructure has been noteworthy, especially between 1990 and 2019. In the time under study, the total number of infrastructures listed and the financial closure achieved in Sub-Saharan Africa amounted to 502 projects for a total investment value of US\$ 78 billion. Out of this, 54 (forty-nine) projects with a reported valuation of around US\$ 12 billion (twelve billion dollars) comprising 9.76 percent and 14.9 percent respectively in the electricity, information and communication technology and transport sectors accounted for the portion attributable to Nigeria, which had the first registered private participation in infrastructure in 1992, although cancelled (Momoh, 2019)

The transport sector had the largest investment of more than US\$ 7 billion during this time, representing over 65%, followed by the energy sector with 11 (eleven) projects, with an investment value of more than US\$ 3 billion, representing 27% of the investment activity. However, with 11 (eleven) projects such as the energy sector, the ICT had a lower investment value of US\$ 957 million with no project and investment reported during the time by the water and sewage sector. When divided into sub-sectors-airports, power, ICT, natural gas, ports, railways and highways, the port sub-sector (transport) accounted for approximately 60% of the overall expenditure in the time under study, followed by approximately 22% for the power sub-sector (energy). With an aggregate of less than 18 percent of the total investment of US\$ 11,972 billion, the other subsector, Airports, ICT, Natural Gas, Railways and Highways, each had less than 10 percent investment reported during the time under review. An analysis of the transport sector shows that the investment in the sub-sector Ports (Sea and Airports) which peaked in 2005 and 2013 was largely due to the massive contract for the reconstruction, lease or rental and transfer (RLRT) and the development, reconstruction, service and transfer (BROT) of the flagship seaports and airports of the country, all in the commercial capital of Lagos. The port investment was also boosted by the latest Build, Operate, and Transfer contract for Murtala Muhammed Terminal Two, PTML Lagos Ro / Ro Terminal, Lekki Deep Seaport, and Build, own, and run for the expansion of Onne port, Phase 4B in the Niger Delta region. The construction, renovation, service and transfer of the Lekki-Epe Expressway and Bullnose Port Facilities in Lagos in 2008 and 2011 have improved the transport industry, respectively. The energy market, split into the natural gas and electricity sub-sectors, accounted for 27% of the second largest private involvement in infrastructure spending. The investment in this sector especially the electricity subsector with about 22 percent of total, recorded its highest single investment share in 2015 with the US\$880 million Azura-Edo Gas-Fired Power Plant, Phase 1 in the Niger Delta region on a Build, own, and operate basis as well as prior investment of about US\$1.6 billion between 2001 and 2005 in Greater Lagos gas distribution pipeline, Okpai Independent Power, West African Gas Pipeline and other project which had tremendous impact and contributed to the growth of the sector.

In addition, with an aggregate investment of less than \$1 billion, US\$ 957 million representing 8% of overall investment, although small in aggregate terms, some milestone milestones were reported by information and communication technology, culminating in the evolving face of telecommunications in Nigeria. The deregulation of the telecommunications industry in 2001 was

the catalyst of investment in this sector. This is obvious by the rise in investment in the sector by more than 1000 percent between 2000 and 2003, when the Global Mobile System (GSM) connectivity was launched and up to 2006 in subsequent years, as well as the divestment of government participation in the national telecommunications business (PPIAF, 2014). Sadly, during the time under study, the water and sanitation market did not draw any investment (PPIAF, 2014). Although no projects or investments in the water and sewage sector have been registered, the Public-Private Infrastructure Advisory Facility has funded the Federation's national and sub-national (Lagos, Kaduna, and Ogun) governments since 1999. According to the World Bank's Public-Private Infrastructure Advisory Facility (2012), PPIAF offered technical assistance to the Nigerian Ministry of Water Supplies in 2006 to pave the groundwork for private investment in the supply of water to urban and small towns in states that are serious about engaging the private sector in the supply of water through policy and structural reforms. Nigeria was rated as low middle income under the Income Group during the analysis period, according to the World Bank Private Participation in Infrastructure Projects Database (PPIPD), with 6 projects and 3 percent of assets cancelled or in distress. Compared to the Sub-Saharan African region, the scrapped or failed project constitutes approximately 10% of the area total in the aggregate (PPIAF, 2014). The private participation contract framework showed that during the time, the Greenfield ventures dominated the transaction dynamic. With a reported valuation of more than US\$ 7 billion, Greenfield made up 60 percent, while power, natural gas, port, ICT and airports were prevalent below the sub-Saharan regional average of 69.70 percent. "Build, Operate, and Transfer" (BOT) and "Build, Own, and Operate" (BOO) were the most prevalent modes of exchange. Build, Own and Operate "accounted for 66 percent of the greenfield deal, with the bulk of the investment (64 percent) being channeled to the Lekki Deep Seaport channel dredging and terminal in the transport business, while the remainder was in the Afam VI power generation project. Also, about 60% of the "Build, Operate and Transfer" transactions were invested in the seaport scheme, while about 36% of the balance was invested in the Greater Lagos gas distribution pipeline, West African Gas Pipeline Company Ltd, Okpai Independent Power Scheme, Agbara/ Ota Natural Gas Pipeline, Murtala Muhammed Terminal 2 projects.

In general, experience with infrastructure construction by PPPs such as in Nigeria has been encouraging, although the purpose of a PPP agreement is not fulfilled in all situations, considering the government's limited capacity to sustain long-term capabilities (Zheng & Caldwell, 2008). It has

also contributed to expensive disappointments and even further cases of renegotiating contracts in favour of the concessionaire. Often, because of the unavailability of long-term financial evidence or because of political abuse of accounting practices, analytical testing of the statements of greater productivity has been very difficult (Guasch, 2004; Grimsey & Lewis, 2005; Shaoul, 2005; Eduardo *et al.*, 2009; and Khadaroo, 2008). Given the time under study, Nigeria's history has been somewhat mixed. This includes the successful introduction of the Bus Rapid Transit System, the Lagos Urban Light rail schemes, the increased removal of waste and the partial completion of the 49.4 km extension and renovation of the Lekki Epe express route in Lagos, which opened up the southern part of Lagos and culminated in major housing projects never experienced in Nigeria. Among the success stories of PPP in Nigeria are also the Akamkpa Toll Road Project and Tinapa Free Trade Zone in Cross Rivers State, the Greater Port Harcourt Housing Scheme in the Rivers State in the South-South part of the country and the large water scheme in the southwestern state of Ekiti and the Teragro Benfruit Farm in Benue State. However, although successfully enforced, the concession of one of the busiest domestic airports in Nigeria, Murtala Mohammed Domestic Airport, had problems with the terms that resulted in litigation. The concession of one of the busy highways, the entrance to the commercial capital of Lagos from other parts of the world, was also so. This concession was finally cancelled and the government took over. Interestingly, both two-troubled transactions were done by the same firm. Another is the unilateral termination of the concession arrangement between the Federal Airport Aviation Authority of Nigeria (FAAN) and Maevis Ltd. to upgrade, build and operate integrated airport service systems. There is no question that it is necessary to adequately supply the facilities. Infrastructure projects are consumption-free and create externalities, promote sustainable development and encourage improvements in economic conditions, increase the quality of life, and are vital for national security and global economic integration. Infrastructure is important not only for economic benefits, but also for its effect on health, safety, recreation and general aesthetics (Aschauer, 1990; Maffei & Meredith, 1995; Dasgupta, 1999; Buhr, 2003; UNCTAD, 2008; Morimoto, 2010).

METHODOLOGY

The study was carried out by an analysis of the related literature and the application of field investigation. Based on non-probabilistic sampling, a sample size of 105 respondents were employed from the companies and agencies engaged in the implementation of the numerous PPP projects in Imo State. The cross-sectional sample analysis method was used with the help of questionnaires and

interviews as the research instruments for the analysis. In addition to personal interviews with experts representing specialist companies or organisations (i.e. builders, quantity surveyors, architects, engineers and estate surveyors), financial institutions and concessionaires, a well-structured questionnaire was used after the research objectives. Biographical information on respondent entities was sought in the questionnaires. It also sought to know the level of awareness of respondent organisations about the involvement of the private sector in PPP for infrastructural development. The levels of measure were from 1= 'not aware' to 5 = 'strongly aware'. Areas where the private sector has also been involved in infrastructural provision were also requested. The level of involvement of the private sector in infrastructure provision was also used. The levels of measure were from 1= 'not involved' to 5 = 'highly involved'.

A total of 78 questionnaire based on simple random sampling were distributed to professional establishments (Quantity Surveying (26), Architectural (12), Building (8), Estate Surveying (2) and Engineering (30)). Financial institutions received 18 and concessionaires received 9 so as to obtain information from a good size of the sample frame. At some points during the course of this study, when given the chance, the researchers were obliged to seek information on the subject through interviews with certain respondents. In this way, the researchers were able to consider the responses provided to the respondents to both open and closed-ended questions. Since some of the questions in the questionnaire were left unanswered by some respondents, along with the fact that some of the questionnaires were presumably incomplete as a result of carelessness on the part of the respondents, the breakdown of the correctly completed questionnaire, reflecting 62.85 percent of the correctly completed total questionnaire, is provided below: The analysis of the collected data was carried out using descriptive statistics of frequency, percentages and charts. Tables 1 to 10 indicate some aspects of the results of the descriptive statistical analysis.

RESULTS

Analysis of Respondents Profile#

Table 1 shows that 4.50% of responses were obtained from Building firms, 27.30% of them are Quantity Surveying firms, 15.20% of the sample are Architectural firms, 36.40% of the respondents are engineering firms, and 9.10% of them are Concessionaire while the remaining 6.00% of the respondents are Bank representatives.

Table 1: Type of firms/Agencies

Firms/agencies	Frequency	Percentage
Building	3	4.50
Quantity Surveying	18	27.30
Architecture	10	15.20
Engineering	24	36.40
Estate Surveying	1	1.50
Concessionaire	6	9.10
Bank	4	6.00
Total	66	100.00

Table 2 indicates the number of years of experience of respondents. In terms of years of working experience, it was discovered that 54.5% of the respondents have worked for between 1 – 5 years, 30.3% of them have worked for between 6 – 10 years while the remaining 15.2% of the respondents have between 11 – 20 years of working experience.

Table 2: Number of years of experience of respondents.

Years of experience	Frequency	Percentage (%)
1 -5 yrs	36	54.50
6 -10 yrs	20	30.30
11 - 20 yrs	10	15.20
21 - 30 yrs	-	-
above 30 yrs	-	-
Total	66	100.00

Table 3 reports on the level of awareness of respondents about PPP as a method of project delivery. Table 3 shows that 81.8% of the sample is slightly aware of the public –private partnership which was defined as a method of project procurement that entails a cooperative venture between a government service and a private sector company, 10.6% are aware while the remaining 7.6% of the sample are strongly aware.

Table 5 indicates the awareness of respondents about parties involved in PPP projects.

Table 3: Awareness about Public-Private Partnership as a method of project delivery

	Frequency	Percentage (%)
Slightly aware	54	81.80
Aware	7	10.60
Strongly aware	5	7.60
Total	66	100

From Table 4, it is observed that 3% of the respondents are strongly aware that government and a private company are always the parties involved in any public-private partnership arrangement, 25.8% of them are aware while the remaining 71.2% are slightly aware.

Table 4: Awareness about parties involved in PPP arrangement.

Level of awareness	Frequency	Percentage (%)
Slightly aware	47	71.20
Aware	17	25.80
Strongly aware	2	3.00
Total	66	100

Table 5 indicates the level of awareness about various models of PPP. In terms of the various models of public private partnership, 95.50% said they are strongly unaware of the various models, 1.5% are unaware, 1.5% are aware while the remaining 95.5% of the sample said they are strongly aware of the various model of public – private partnership.

Table 5: Awareness about various models of Public-Private Partnership.

Level of awareness	Frequency	Percentage (%)
Strongly unaware	63	95.50
Unaware	1	1.50
Aware	1	1.50
Strongly aware	1	1.50
Total	66	100

Table 6 indicates level of awareness about concession as a way of government granting an entity exclusive right. On collating the respondents' definition of concession as a process whereby the government grants a private entity exclusive right to provide, operate and maintain an asset over a long period of time in accordance with performance requirements set forth by the government, it was discovered that 1.5% are slightly aware of the definition, 6.1% of them are aware while the remaining 92.4% of the respondents are strongly aware of the definition.

Table 6: Awareness about concession as a way of government granting an entity exclusive right

Level of awareness	Frequency	Percentage (%)
Slightly aware	1	1.50
Aware	4	6.10
Strongly aware	61	92.40
Total	66	100

Table 7 indicates the awareness about employing private sector in infrastructure provision in only few sectors. Table 7 below reveals that 69.7% of the respondents are strongly unaware of the fact that private sector can only be employed in infrastructure provision in only a few sectors, 16.7% were unaware, 12.1% are slightly aware while the remaining 1.5% said they are aware.

Table 7: Awareness about employing private sector in infrastructure provision in only few sectors

Level of awareness	Frequency	Percentage (%)
Strongly unaware	46	69.70
Unaware	11	16.70
Slightly aware	8	12.10
Aware	1	1.50
Total	66	100

Table 8 indicates level of awareness about the concept of privatization as a process of transferring a public service to the private sector.

The responses on the definition of privatization were collated from which it was observed that 68.2% of the sample was strongly unaware of the definition, 19.7% are unaware, 6.1% of them are slightly aware, and 4.5% said they are aware of the definition while the remaining 1.5% did not answer the question.

Table 8: Privatization as a process of transferring a public service to the private sector

Level of awareness	Frequency	Percentage (%)
Strongly unaware	45	68.20
Unaware	13	19.70
Slightly aware	43	6.10
Aware		4.50
No response	1	1.50
Total	66	100

One of the questions was structured to establish the extent of involvement of respondents identified in the study population in the use of PPP. Table 9 shows the results.

Table 9 shows that 86.4% of the respondents have been involved in PPP projects ranging from a minimum of 1 to a maximum of 5 while the remaining 13.6% of them have been involved in such projects ranging from a minimum of 6 to a maximum of 10 projects. It is worthy of note that the involvement of this respondents is at any stage of the construction/building process and it is also possible for 2 or more professionals to be involved in the same project.

Table 9: Number of PPP projects respondents have been involved in

Project	Frequency	Percentage (%)
1-5 Projects	57	86.40
6-10Projects	9	13.60
Total	66	100.0

Table 10 shows areas of private sector involvement in infrastructure development. In terms of the frequency of private sector participation in infrastructural development in Lagos state, it was discovered that the private sector has been most involved in the educational sector which ranked 1st, in the 2nd position is the transportation sector, rated 3rd is the tourism sector of the economy. For the three sectors that respondents have experienced least participation, it was observed that Judiciary was rated least with a ranking of 13, next was the water sector ranked 12th, in the position of third least sector of PPP involvement in infrastructural development is the communication sector with 11th position.

Table 10: Areas of private sector involvement in infrastructure development

Sectors of Involvement	N	Mean	Ranking
Education	23	4.26	1
Transportation	64	4.08	2
Tourism	47	3.38	3
Housing	45	2.89	4
Security	59	2.76	5
Agriculture	49	2.10	6
Sport	41	2.10	6
Commerce/ industry	56	2.09	8
Health	46	1.59	9
Power/Electricity	64	1.59	9
Communication	51	1.47	11
Water	56	1.36	12
Judiciary	52	1.00	13

DISCUSSION OF FINDINGS

It was revealed that only few professionals have handled projects under the delivery system which is as a result of the government poor attitude of enlightening the citizenry on the benefits of engaging the private sector in infrastructural development as well as providing the needed legislation guiding private sector involvement so as to encourage the private sector, this

concurred with Akintola (2006) who in a research conducted found out that that lack of legislation and adequate enlightenment hinders the full productive implementation of any concept as awareness of a process is the first step at endearing the concerned construction industry professionals and the citizens about the possible benefits of its acceptance. Furthermore, the level of awareness is an essential factor in ensuring a successful implementation of any new policy like the private sector participation in infrastructure provision. This is in agreement with Ikechukwu (2007) who in a research carried-out establish that the level of awareness is seemingly too low going by the scarcity of available relevant literatures and limited experience. It was further observed that there is no significant awareness of private sector involvement in infrastructural development.

The study revealed that education and transportation received the highest patronage i.e. projects like road, airport, seaport, bus terminus, hostels, and similar ones are more attractive to the private sector presently due to the return mechanism put in place as both the public and private sector have established ways of recouping their capital via toll and rent within a specified period. This finding corroborated Olaloku, Adejugbe, Fajana and Tomori (1979) who in their work submitted that the private investor is traditionally profit oriented and are interested in Directly Productive Activities (DPA). It was observed that investors were not involved in almost all sectors due to the substantial procurement cost with relatively small returns compared to the investment in-addition to the possibility of future changes in policy and demographic shift. This also supports one of the findings of Forrer *et al.* (2011) where costs and benefits were part of the factors in a model on PPP performance. Furthermore, in a bid to encourage investors into more of the sectors there must be flexibility as well as paying careful attention to lifecycle costing. In addition, this research indicates that the private sector was not significantly involved in infrastructural development in Imo state.

Summary of findings

The study was centered on private sectors involvement in infrastructure development in Imo state. The study revealed the following:

1. Most professionals had idea about the concept as they have been involved in at least one project where any of the PPP model was employed as a means to delivering infrastructure.
2. The private sectors participation is mainly in two sector of the economy they are

education, transportation and partially in tourism sector.

3. The level of awareness of PPP is still insignificant despite government effort to get the private sector involved in the provision of infrastructure.
4. The involvement of the private sector in infrastructural development is very insignificant as there is a great concentration on a particular sector while other sectors are left unattended to.

CONCLUSIONS

The study investigated the level of awareness about, and the areas and the extent of use of the private sector in PPP for provision of infrastructure in Imo State, Nigeria. The point that private participation in the provision of infrastructure is not fresh in Nigeria was further clarified. Overtime, despite government's effort to get the private sector involved in the provision of infrastructure, the level of awareness about and use of private sector involvement in infrastructural development has not significant in south-eastern part of Nigeria. In many low-income countries, the scarcity of infrastructure, as noted by Age'nor (2010), continues to be a primary obstacle to growth and development. However, the theoretical rationalization of X-inefficiency is illustrated by the Nigerian experience, rendering the possibility of private involvement for infrastructure procurement appealing.

With inefficient bureaucracy, weak maintenance, underinvestment, growing development costs and increasing urban growth, combined with fiscal problems, the PPP alternative was introduced by Nigeria, as other developing countries, and policies were implemented to allow the private sector to take over responsibility for the construction of infrastructure and then manage it to provide public goods or services. Stakeholders expressed opinions that Public Private Partnership model remained an initiative that can best be employed in tackling the growing complex and multifunctional issues in building infrastructure projects as well as to help meet the demands for creative, functional and efficient delivery of projects. It was also viewed that the strategy also allows private investors to participate in profitable social development projects through partnership with the public sector.

Recommendations

Based on the conclusion drawn above, the following recommendations are hereby proposed:

1. The government should put more efforts to improve the level of awareness on the involvement

of the private sector participation in the provision of infrastructure through public enlightenment both locally and internationally stating the benefits that are obtainable both for citizens and investors.

2. Government should demonstrate a sure touch in assessing the return that is required by the private sector in return for taking responsibility for risk considering the fact that if expected returns from a project are too low bidders will divert their skills and resources to other more attractive projects in different countries and jurisdictions. The government and the private sectors should fashion out adequate and improved means of generating income from every sector of the economy so as to encourage private sector involvement considering the fact that no investor would invest in a sector where their investments cannot be recouped. This can be achieved via adequate training and development of contributing parties more especially the local talents in the area and structuring of competence.
3. Government should modify the traditional relationship between infrastructure and profit making as the desire of every private investor is a worthy return, thereby turning a traditionally indirectly profitable activity into a directly profitable activity and to the satisfaction of all parties involved.

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DEVELOPING CONCEPTUAL PROCESS MODELS FOR THE NIGERIAN MANUAL BASED PROCUREMENT PROCESS TOWARDS DIGITIZATION

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ABSTRACT

Studies have revealed the rapid automation of processes within the public procurement lifecycle. However, most of this process are still being conducted using manual method despite the numerous benefits associated with automated process. The manual-based method has been characterized to negatively impact project outcome as it is known to be inefficient, less transparent, less competitive and prone to manipulations. This study is part of a larger study aimed at identifying the manual-based procurement process that are mature for the deployment of digital equivalence (Web-based system). The study adopted a qualitative research method where a critical review and synthesis of current manual procurement best practices. Also, a review of some existing E-Procurement solutions available was conducted and the various implementation challenges. The research found that there are several processes that forms the manual procurement lifecycle. However, this is different between countries, organization and agencies. The major rationale behind this difference is as a result of the guiding principle that guides and regulates procurement practice. In Nigeria, the Public Procurement Act (PPA) 2007, is the standard document that regulates procurement practices in the country. It outlined Procurement Planning, Tendering, Contract Management and Disposal as the 4 main process that form the Nigeria Public procurement Lifecycle. It also identified 37 sub-processes or process areas. Based on the research findings, the study developed process models for the manual-based procurement practices using the Business Process Modelling Notation (BPMN). The BPMN is a graphical notation developed by Object Management group in the 1980s. It was used in modelling the identified manual based procurement process and also in portraying the various key stakeholders and their relationship throughout the procurement cycle. Hence, the research findings will aid the design and deployment of digital solutions within the Nigerian public procurement sector.

Keywords: Procurement, Processes, Model, Lifecycle, and Public Procurement Act.

INTRODUCTION

In most countries of the world, public procurement has been described as the process of acquiring goods, works and services for the masses in a timely and transparent manner at a reasonable cost (Olatunji, 2016 & Bello *et al.*, 2019a). Traditionally, most of the procurement process are carried out using manual based format which are usually error prone, tedious and time consuming (Adebiyi *et al.*, 2010; Song, *et al.*, 2014 & Bello *et al.*, 2019a). This manual process has negatively impacted the construction industry output especially when it comes to public sector procurement, as it has greater impact on national development. Studies by Ogbu & Asuquo (2018) and Bello *et al.* (2019a, 2019b, 2019c) pointed out some of the unethical practices associated with the manual-based public procurement process such as lack of transparency and

efficiency, supports corruption, complicated procedures, less competitive and interference among many others.

The aim of the study is to identify the current manual-based procurements processes as stipulated in the Public Procurement Act (2007). This will aid the smooth transition from the manual-based format to an electronic based protocol. Several studies have found that the construction industry has been exploring ICT systems and it relating technology for over 3 decades, yet organizations within the industry a yet to fully harness the potential of this technology (Afolabi *et al.*, 2017). However, recent research has showed how this system are increasingly being adopted by government and organizations across the globe for the effective procurement of public works, goods, and services (Adebiyi *et al.*, 2010; Expert Group Meeting Report (EGMR), 2011; Afolabi *et al.*, 2017; Bello *et al.*, 2019a & Bello *et al.*, 2019c). Traditionally, most of the procurement process like needs assessment, procurement planning, tendering and contract management are carried out using manual based format which are usually error prone, tedious and time consuming (Adebiyi *et al.*, 2010; Song *et al.*, 2014 & Bello *et al.*, 2019a). In Nigeria, attempts have been made by Adebiyi *et al.* (2010), to develop a prototype electronic Government Procurement (eGP) system for the public sector. The system allows potential bidders to register & update their profile, see tender advertisement, download tenders and receive tender award notification. Afolabi *et al.* (2017) also developed a web-based tendering system for procurement of construction works in a tertiary institution in Nigeria. Despite this development, the systems have limitation of not supporting many critical tendering processes such as procurement planning, tender evaluation and contract management. Another major challenge found is that most of these protocols fail to meet the provisions of the Act.

However, a more recent research by Bello *et al.* (2019a, 2019b & 2019c) have proved the feasibility of developing systems that captures the entire processes within the procurement lifecycle and also towards meeting the provisions of the Public Procurement Act 2007. Hence, it becomes necessary to identify the various processes that forms the Nigerian procurement lifecycle for smooth transition from manual based format to a digitized electronic format.

LITERATURE REVIEW

Public Procurement Lifecycle

Global Literature review have established that they are several processes that forms the procurement lifecycle. In the United Nation Public Procurement Handbook (2006), they are 10 processes which constitute the procurement lifecycle which are; Operational procurement planning, Requirement definition, Sourcing, Selection of procurement strategy, Preparation & issuance of solicitation documents, Receipts and opening of offers, Evaluation, Contract review & award, Contract finalization and issuance, and Contract management (Figure 1). The United Nations Commission on International Trade Law (UNCITRAL) Model Law on Public Procurement (2014) also listed Procurement solicitation, Tendering (solicitation, presentation and receiving of tenders), Tender opening, evaluation and award as the key processes. In the World Bank Procurement Regulations for IPF borrowers (2018) Procurement planning, Procurement notices, Tendering (preparation and presentation of tendering documents), Evaluation, Award and contract Management are the main processes that forms the lifecycle. However, in the European Unions' Public Procurement Guidance for Practitioners (2018) a more robust and harmonized process grouping was established for the public procurement lifecycle. It

captured Preparation and planning, Publication and transparency, Submission and selection of tenders, Evaluation and award, and Contract Implementation as the 5 (five) main process and with a total of 26 (twenty-six) subprocess forming the procurement lifecycle. Some of the common processes identified from the global review includes; Needs identification, Procurement planning, Tendering and Award and Contract Management and Monitoring.

In Africa, Acts like the Ghanaian Public Procurement Act (2003); Kenyan Public Procurement and Asset Disposal Act (2015); and Nigerian Public Procurement Act (2007) also outlines Procurement planning, Tendering, Contract administration, Disposal of public property as the main processes that form the procurement lifecycle. It's also includes needs assessment, cost analysis, prioritization, advertisement, prequalification, evaluation, award, monitoring and evaluation as some of the subprocesses within this major groups. **Table 1** summarise the various processes within a typical procurement cycle.

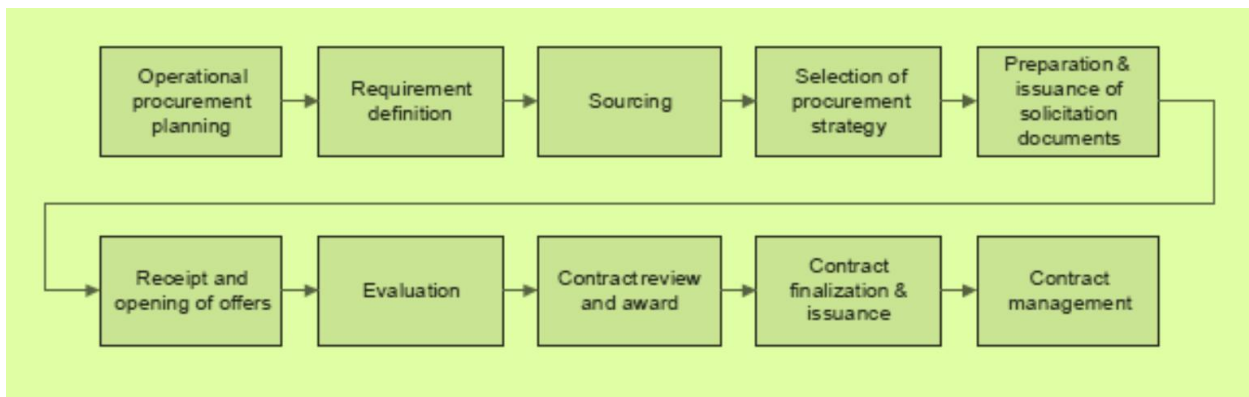


Figure 1: Generic Flowchart for a Typical Procurement Process (UNPPH, 2006).

Table 1: Manual Procurement Process and Process areas (sub-processes)

S/N	Processes and Key Process Areas	Sources
1	Procurement Planning	
2	Needs Identification	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
3	Determining stakeholders	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
4	Market Analysis	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
5	Cost Analysis	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
6	Needs Prioritization	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
7	Selection of Procurement method/strategy	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
8	Development of timelines & Cost plans	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
9	Key Performance Indicators	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
10	Tendering	
11	Sourcing/Advertisement	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
12	Receipt of Advert response from both consultants and contractors	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
13	Evaluation of Contractor prequalification documents (Including verification of documents)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)

14	Evaluation of Consultants Expression of Interest	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
15	Request for proposal (Quotations)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; EUPPGP, 2018)
16	Evaluation of quotations	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; EUPPGP, 2018)
17	Appointment of consultant (Review, signing & sealing agreement)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
18	Preparation of solicitation documents (Tenders, specification, agreements etc.)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
19	Clarifications on solicitation documents	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
20	Issuance/distribution of documents	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
21	Receipt/opening documents	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
22	Evaluation of documents/tender (Detailed financial tender evaluation)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
23	Tender evaluation reporting	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
24	Negotiations	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015)
25	Contract award (Notification)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
26	Contract execution (Review, signing & sealing)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; UNCITRAL, 2014; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
27	Contract Management/Administration	
28	Mobilization (Performance bond, Advance payment etc.)	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
29	Work Valuations	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
30	Progress Reporting	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
31	Payments	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
32	Complaints	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
33	Monitoring & Evaluation	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
34	Reporting	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
35	Contract review	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
36	Amendments	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
37	Contract closeout	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015; WBPR, 2018; EUPPGP, 2018)
38	Disposal	
39	Disposal planning	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015;
40	Appointment of independent evaluator	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015)
41	Selection of disposal method	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015)
42	Approval and documentation	(GPPA, 2003; UNPPH, 2006; NPPA, 2007; KPPADA, 2015)
43	E-Reverse Auction	(UNPPH, 2006; UNCITRAL, 2014; KPPADA, 2015)

In most nations, procurement is one of the main instruments used in the achievement of development goals as it outlines the various procedures to be followed in acquiring the necessary facilities and services required for human development (UNCITRAL, 2014 & Komakech, 2016). A government's procurement process should enable cost-effective service delivery and also play

a wider strategic role in the country's sustainable development (MENA, 2012). However, review of existing literature has revealed that public procurement practice differs between countries, organizations and agencies. The major rationale behind this is because of the guiding principles and laws governing the practice. Since it mostly involves the use of tax payer's money to provide the necessary amenities, for it to be effective it has to immensely contribute to the utilization of public resources towards the successful delivery of projects. In other to ensure effectiveness it is typically guided by standard principles which include; Transparency, Accountability, Efficiency, Competitiveness and value for money throughout the acquisition process (UNPPH, 2006; UNCITRAL 2014; Olatunji, 2016; Komakech, 2016; EUPPGP 2018; Edosa 2019).

Electronic Government Procurement (e-GP) Systems

The term E-Procurement and E-tendering system have been used synonymously by different authors. To clarify this misconception, one needs to first understand the various processes that forms the procurement lifecycle. A typical procurement cycle comprises of several process ranging from needs assessment, procurement planning, tendering, contract management and the subsequent disposal as the case may be, making tendering a sub-process within the procurement lifecycle. Web-based e-Procurement systems are increasingly being adopted by government organizations across the globe for the delivery of public works, goods, and services. Recent research has showed how this system are increasingly being adopted by government and organizations across the globe for the effective procurement of public works, goods, and services (Adebiyi *et al.*, 2010; EGMR, 2011).

Table 2: Global review of E-Procurement system and automated processes (OECD, 2016)

	Announcing tenders	Provision of tender documents	E-submission of bids	E-reverse auctions	Notification of award	E-submission of invoices	Online catalogue
Australia	●	●	●	○	●	○	○
Austria	●	●	●	●	●	●	●
Belgium	●	●	●	●	●	●	●
Canada	●	●	○	○	●	●	●
Chile	●	●	●	○	●	○	●
Denmark	●	●	●	●	●	●	○
Estonia	●	●	●	●	●	●	○
Finland	●	●	●	●	●	●	●
Germany	●	●	●	○	●	○	○
Greece	●	●	●	●	●	○	○
Hungary	●	●	○	○	●	○	○
Iceland	●	●	○	○	●	●	○
Ireland	●	●	●	○	●	○	○
Israel	●	●	○	●	●	●	○
Italy	●	●	●	●	●	●	●
Japan	●	●	●	○	●	●	●
Korea	●	●	●	○	●	●	●
Latvia	●	●	●	○	●	○	○
Mexico	●	●	●	●	●	○	○
Netherlands	●	●	●	○	●	○	●
New Zealand	●	●	●	●	●	●	●
Norway	●	●	●	○	●	●	●
Poland	●	●	○	●	●	○	●
Portugal	●	●	●	●	●	○	●
Slovak Republic	●	●	●	●	●	○	○
Slovenia	●	●	○	●	●	●	●
Spain	●	●	●	○	●	●	●
Sweden	●	●	●	●	●	●	○
Turkey	●	●	●	○	●	○	○
United Kingdom	●	●	●	●	●	●	●
OECD Total							
● In a national central e-procurement system	29	26	21	11	29	10	11
◆ Only in e-procurement systems of some specific procuring entities	1	4	3	5	1	7	5
○ No	0	0	6	14	0	13	14
Colombia	●	●	●	○	●	●	●
Costa Rica	●	●	●	●	●	●	●
India	●	●	●	●	●	○	●
Lithuania	●	●	●	●	●	●	●

In recent times, technology has now become an integral part in increasing efficiency and effective service delivery. The challenges relating to the manual ways of doing things are now

being addressed globally with the development of several web-based system especially in the area procurement (EGMR, 2011; Afolabi et al., 2017; Bello et al., 2019a; Bello et al., 2019b; & Bello et al., 2019c). Korea with its KONEPS are leading the implementation of a fully integrated e-procurement solution as it integrates other electronic government operations, including financial management systems, company registrations and tax payment systems (EGMR, 2011). In the Philippines, PhilGEPS e-procurement initiative has focused more on e-tendering with the initial objective to improve transparency, open access and competition (Table 2). Other examples of such systems include Canada's MERX, Scotland's ePS, JEPP of Belgium, Malaysia's ePerolehan, Japan's JETRO, DOIP of Denmark, FACNET of the United States, and UK Tender Direct (EGMR, 2011 & Bello et al., 2019b).

In Nigeria, Adebisi et al. (2010) developed a prototype electronic Government Procurement (eGP) system for the public sector. The system allows potential bidders to register & update their profile, see tender advertisement, download tenders and receive tender award notification. Despite this benefit the system have a major limitation of inability to support many critical tendering processes such as tender evaluation. Afolabi et al. (2017) also developed a web-based tendering system for procurement of construction works in a tertiary institution in Nigeria. Furthermore, Ministries, Departments and Agencies (MDAs) like the Nigerian National Petroleum Corporation (NNPC), and the Nigerian Port Authority (NPA) have also developed system to support some of their procurement process with the attempt to ensure value for money, transparency, competitiveness and the overall efficiency of procurement process. Most of these researches and deployed protocols fail to address key areas within the lifecycle like needs identification & prioritization, procurement planning, tendering, contract management and also meeting the requirement of the Public Procurement Act (2007).

Challenges of Implementing E-Procurement System

E-Procurement is considered to be one of the fairest and transparent means of disbursing government contracts and the method most likely to secure a favourable outcome for a government in its spending of public money (Betts et. al., 2006; KPSS, 2008). However, the uncertainty resulting from a lack of sufficient understanding of the legal rules and principles likely to be applied to and electronic tendering systems makes both the legal and security compliance for an e-tendering system paramount. Inadequate security opens significant opportunities for fraud and collusion by parties inside and outside of the process (Betts et. al., 2006).

Also, another major challenge is the fear by contractors/suppliers and other stakeholders to participate in a process where they don't fully understand the legal and security implications that their tender may be going through. This was also buttressed by the world bank (2000), who identified minimum requirements that an electronic system must meet for it to be acceptable by practitioners and contractors in the construction industry, which are; the security of the process i.e. the sender must be convinced that the e-system environment is as secured as in paper-based or the manual system and secondly, they must be clear of the law applicable to the various stages of the process i.e. legality of the process. In Nigeria, most of the security challenges is linked to the E-Systems not having the ability to carry out some critical process like needs assessment, procurement planning, tender evaluation, contract administration among others (Bello et al., 2019a). The legal limitation is that most of the system do not comply with the provisions stipulated in the procurement Act. However, the Act currently permit the publishing of tendering opportunities including on procuring entities websites or other electronic media only.

In developing a web-based e-procurement system; a working paper from the UNCITRAL Secretariat suggest that, if a procuring entity uses a particular technology for procurement, apart from being open, compatible, interoperable and with those in general use, the system should also be a reflection of the manual based process and as guided by the regulating law. As this will facilitate the design, deployment and implementation of the web-based procurement protocols.

Nigeria Public Procurement Act Reforms

Nigeria is one of the countries in African with a legal framework for public procurement that meets the benchmarks described by the African Development Bank Concept note (Olatunji *et al.*, 2016). Prior to the reform of the public procurement system in Nigeria, the country faced many problems such as lack of transparency, corruption, contract inflation and over invoicing in the process of (Oguono, 2012; Shwarka & Anigbogu, 2012 & Eze, 2013). However, public procurement was then guided by the Finance (Control and Management) Act of 1958 and other Financial Regulations it still experienced serious accountability issues, as the Country Procurement Assessment Report (CPAR) by the World Bank revealed that Nigeria was losing an average of \$10 Billion annually due to various abuses associated with public procurement and contract awards (World Bank, 2000 & Aboki, 2006).

Procurement reforms in Nigeria have been part of the broader public sector reform effort, seeking to improve government effectiveness in service delivery. The current Public Procurement Act was established in 2007, it was modeled after the United Nations Commission on International Trade Law (UNCITRAL) of 1966 with the aim of ensuring the public disclosure of the rules that apply in procurement processes, publishing of procurement opportunities, prior determination and publication of what to be procured, how is to be procured, by who, how much it should cost, when it should be delivered and to what quality (Bello *et al.*, 2019a & Eze, 2013). It NPPA 2007 also outlines the guiding policies, implementations, and contract administrations of public procurement, including the procedures and processes for selection of contractors, consultants, and suppliers. The NPPA (2007) since its establishment has had some key impact in the Nigerian public procurement sector as highlighted by Eze (2013); Savings of 420 Billion to date through the price review efforts of BPP, Reduction in corruption through the effort of BPP and Economic and Financial Crime Commission (EFCC) (ongoing investigation of 18 cases of infraction of PPA, 2007 and Increased transparency, accountability, and timeliness of the procurement process.

Since 2007, the law has not received any significant review especially towards supporting the digitizing of procurement practice. The current law only supports the publication of procurement opportunities without given consideration to other critical processes within the procurement lifecycle. Hence, this call for the need to review the current procurement law to support e-procurement.

Case study of an e-complaint procurement law

A modernized legal framework supports key reform and innovations in a government's procurement system through: Mandating professionalization of a government's procurement system and capacity building, modernizing procedures and practices such as planning, bid evaluation, e-procurement, centrally established framework agreements for common use procurement, public-private partnerships (PPPs), and SME participation, ensuring accountability and supporting procurement modernization via development of ancillary areas of the law (MENA, 2012). In the early stages of KONEPS application, most government agencies'

procurement administration was paper-based, so there was a lack of institutional basis for electronic processing (KPPS, 2016). A specialized law and institution amendment team consisting of experts was formed to review and amend any regulations relating to the implementation of the system. Amendments were necessary for Enforcement Decree of State Contract Act, Enforcement Decree of the Government Procurement Act, Enforcement Rule of State Contract Act, and Enforcement Decree of the Local Finance Act.

RESEARCH METHODS

Research Approach

Given that the research reports a preliminary phase of a larger study towards the development of an integrated Web-based e-procurement system. The research strategy at this phase quantitative approach where critical review of existing literature was conducted to identify the various manual procurement processes as practiced by different countries, organisations and entities around the globe. A synthesis of the reviewed literation was also conducted to streamline the various processes that forms the procurement lifecycle.

Process Modelling Technique

The research adopted the Business Process Modelling Notation (BPMN) in modelling the identified manual based procurement process and also in portraying the various key stakeholders and their relations throughout the procurement cycle. The BPMN is a graphical notation developed by Object Management group in the 1980s. Although, they have been several versions since the first publications. For the purpose of this study the research adopted the 2004 BPMN modelling version. It consists of designated symbols that represent actions, flows, or process behaviours. Figure 2 give an overview of some basic modelling elements in the BPMN Modelling technique.

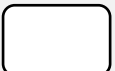
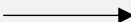
Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
	Start Event		Cancel or End Event		Process or Activity
	Collapsed subprocess		Data Store		Data Event
	Gateway		Exclusive Gateway		Sequence Flow

Figure 2: Basic Modelling Element for the BPMN Modelling Technique.

RESEARCH FINDINGS

The Nigerian Public Procurement Life Cycle

In Nigeria, the standard document that regulates and guide public procurement practice is the Public Procurement Act (2007) and the Public Procurement Manual. The provision of the Act is binding on all Federal Ministries, Departments, and Agencies (MDAs) including corporations as set up by the constitution of the Federal Government of Nigeria, especially those who derive at least 35% of it funds from the Federal budget allocations. The PPA (2007) defines the roles and

responsibilities of the various institutions and committees involved in the procurement process. While manual explain in details the various policies and guidelines to aid practitioners in applying the law. Its also outline the responsibilities of the various stakeholders and committee at every stage of the procurement process.

The study identified 37 procurement process areas and were categorised into 4 major standalone groupings which include; Procurement Planning, Tendering, Contract management and Disposal of public property (Table 1). For the various processes identified, the procedures for selection of contractors, consultants, and suppliers as outlined in the PPA (2007) for the procurement of public works, goods and services were also considered in developing in the process models. The process models for the four key process areas that form the Nigerian procurement cycle are presented as follows;

Procurement Planning

Figure 3 summaries the procurement planning process. As required by the Public Procurement Act (2007), procuring entities from time to time under the direction of the council shall plan its procurement to identify goods, works and services required and prescribing any method for effecting the procurement subject to the council approval or any other relevant authority (Figure 3.0). However, procurement planning is much more than just choosing which items to be procured and the likely procurement methods to be used for acquiring the various goods, works and services. It also requires entities to constitute a team of stakeholders who are charged with this responsibility. As stipulated in the Nigerian Public Procurement Act 2007, Section 21 (I) and Nigerian Public Procurement Manual (2008) Section 4, Subsection 31 “for each financial year, the procuring entity shall establish a Procurement Planning Committee (PPC)”. The committee shall comprise of an accounting officer as the head of the team, the procurement unit/entity representative as the secretary and other members from the finance, legal, planning, statistics and user department.

As shown in **Figure 3**, the committee are charged with the responsibility of identifying goods, works and services required and are also expected to carryout appropriate market and statistical surveys liaison with the procurement unit/department and on that basis, prepare an analysis of the cost implications of the proposed listed procurement (PPA, 2007). Subsequently, all requirement shall be aggregated both within the procurement entity and between entities/departments, to obtain economy of scale and toward reducing procurement cost, considering the budget for the year and/or available funds. This is done by prioritizing those wants that are essential to the Employer. Having established this hierarchy of needs and economy of scale, it should be possible, in conjunction with the other decision-making criteria, such as the size and complexity of the project to identify the procurement method that is more suitable for each given need (NPPM, 2008).

The final outcome of the procurement planning process is the preparation of the procurement planning report, which contains a list of the various procurement divided into contract packages, selected procurement method, Source of finance, schedules and sequencing for the major contracts. They are two types of procurement plan; Consolidated and Individual procurement plan. The Individual procurement plan is carried out the department level within an entity, while the consolidated procurement plan is after all the departmental plans have been aggregated to form a central procurement plan for the entity i.e. at the PPC level.

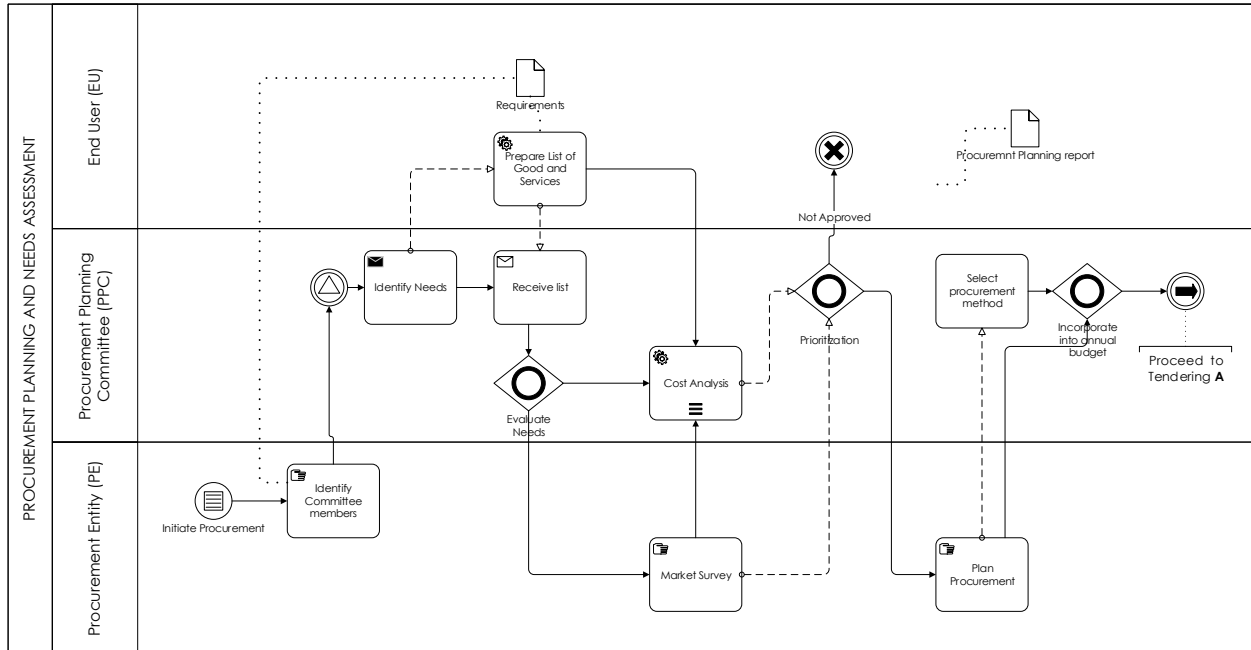


Figure 3: A Typical Process Model for Procurement Planning.

Tendering Process

After the procurement planning stage, the next line of action is to commence the tendering process by issuing out public procurement notice. According to the act, General Public Notice (GPN) and Specific Public Notice (SPN) are the two types of notice that can be issued (**Figure 4**). The GPN contains advance procurement opportunities, the SPN is mostly for specific contract opportunities i.e. Invitation for Prequalification (IFP), Invitation for Tender (IFT), Request for Expression of Interest (REoI) for consultants and other form of notification as may be required (NPPM, 2008). The IFP is required under the competitive bidding system for the prequalification of suitable contractors which is followed by Invitation to Tender (ITT) for the selection of suitable contractors. Each of this notice should be issued in at least two national dailies and the federal tender journal, government official gazette or official website (NPPA, 2007; NPPM, 2008).

The ITT stage commences the final selection stage of the tendering process, where prequalified bidders are invited to collect the tender documents at a fixed but reasonable price. The prequalified bidders are expected to fill and subsequently make submissions at the designated venue and within the stipulated time frame as contained in the tender notice (NPPM, 2008). During the IFP and the ITT phases, bidders who meet the submission requirement usually proceed to the next stage. For IFP the prequalified bidders proceed to the Invitation to tender and for the ITT it is the Technical evaluation stages and bidders who fail to meet the outlined requirements shall have their bids rejected. The Technical Evaluation committee conducts the Technical Evaluation for the IFP technical bids submissions against the advertised minimum eligibility requirements. Examinations of bids shall be for both Major and Minor deviations (**Figure 5**).

Major deviations mostly comprise of unacceptable sub-contracting, time schedule, alternative design and price adjustment and results to rejection of such bids. Minor deviations include the use of codes, difference in materials, alternative design, arithmetical errors and non-compliance

with some technical local regulation, payment terms and any other condition that has little impact on the bid (NPPM, 2008).

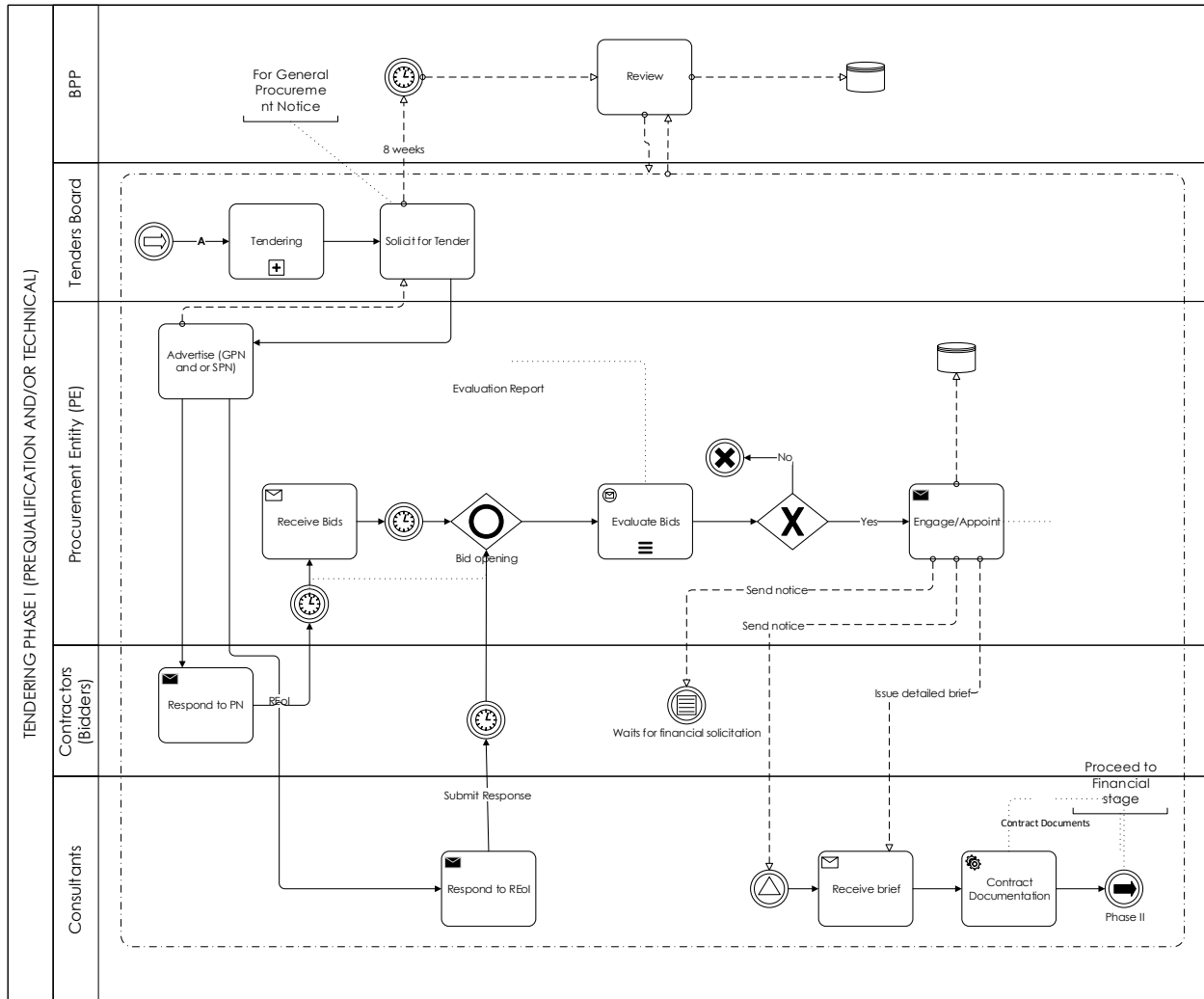


Figure 4: Process Model for Tendering (Prequalification).

Consequently, Section 5, subsection 52.1 of the manual states that only bids that have been determined to be substantially responsive to the bidding documents, i.e. do not contain material deviation, should be considered for detailed evaluation. The detailed evaluation consists of the evaluation of substantive responsive bid against a set of criteria. Some of the frequently used evaluation criteria include correction of arithmetic errors, applicable discount, unbalance bidding and the exclusion of VAT, contingency and provisional sum amounts (NPPM, 2008). At the end of the day the recommended contractor for the award is usually the “lowest responsive bidder” in terms of the budgeted estimate and in terms of economy. However, this clause has been given several interpretations by professional in the industry. After the completion of the evaluation process the Procuring Entity/Tender Evaluation Committee then prepares a Tender Evaluation Report (TER) setting out the process by which it evaluated the tenders, to be submitted to the Tenders’ Board for action (NPPM, 2008). Section 17 of the manual, outlines some key information to be captured in a typical tender evaluation report; information like key dates, tendering steps, deviations & adjustments, technical evaluation, names of rejected bidders and the proposed contract award details.

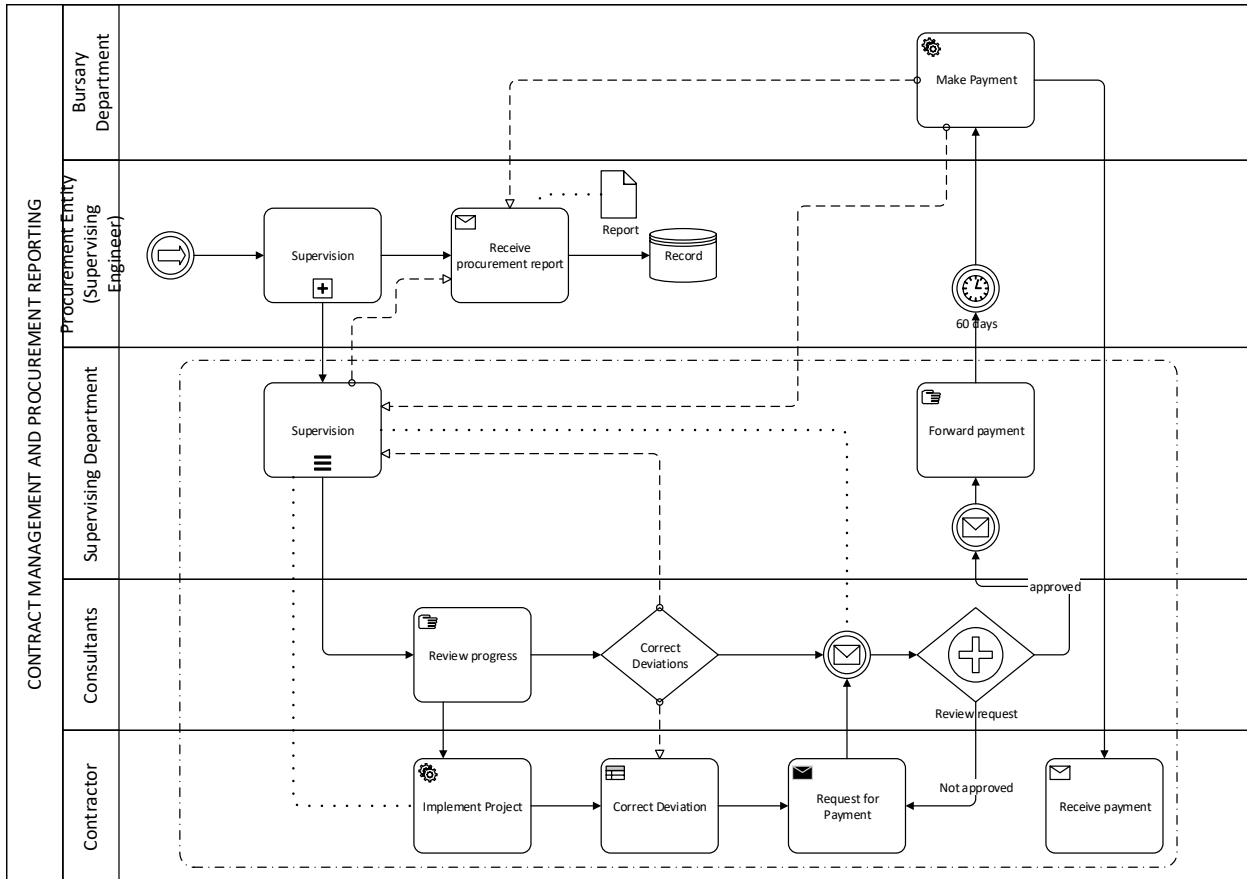


Figure 6: Process Model for Contract Management and Procurement Reporting.

The award and execution of the contract usually marks the end of the tendering process and initiates the contract management Phase. At this stage, the contractor will be handed over the site and upon request shall receive a mobilization amount as advance payment to facilitate the commencement of the works on site. During the implementation of the project, the daily monitoring and control of such works is usually the responsibility of a Supervising Engineer/Consultant appointed or hired by the Procuring Entity (NPPM, 2008). The supervising consultant shall provide daily report and shall seek for approval from the procuring entity concerning major decision like issuing variation orders, granting extension of time, approving additional payments, issuing and/or taking-over or defect liability certificates. For goods, the supervision and administration are undertaken by the Purchasing & Stores Department or the Technical Department as appropriate. As contained in Section 16 & 37 of the Act: Payment for the procurement of goods, works, and services shall be settled promptly and diligently. Payment for works are normally made against payment certificates and in strict accordance with the contract term. Any payment due for more than Sixty (60) days shall be deemed as a delayed payment and shall attract interest at the rate specified in the contract documents (NPPM, 2008).

As shown in (Figure 6), the supervising department of the entity have a mandate of ensuring contract performance in accordance to the contract documents. In case of any deviation, the department shall immediately in writing notify the contractors, supplier or service provider (consultant) of any failings in performance and seek an agreed solution/remedy (NPPM, 2008). Contracts may be amended when necessary either as a result of the application of additional or reduced requirements by the Procuring Entity, agreements to extend the time schedule, or from

accepted increases or decreases in prices. All of this must be properly documented, report and recorded by the procuring entity, as Section 10:96 mandates the routine reporting of procurement activity throughout the procurement lifecycle.

Disposal of Public Property

After the useful life of a property, it is expected that such property is to be disposed. However, before slating any public property for disposal, the relevant authority in charge of any public property shall authorize the preparation of a valuation report for such property by an independent Evaluator (NPPM, 2008). The Bureau shall with the approval of the council determine and issue guiding operational principles and standard document with respect to disposal. The manual further stipulates that the Bureau shall monitor implementation, enforce compliance and set reporting standards that shall be used by all procuring entities involved in the disposal of public property.

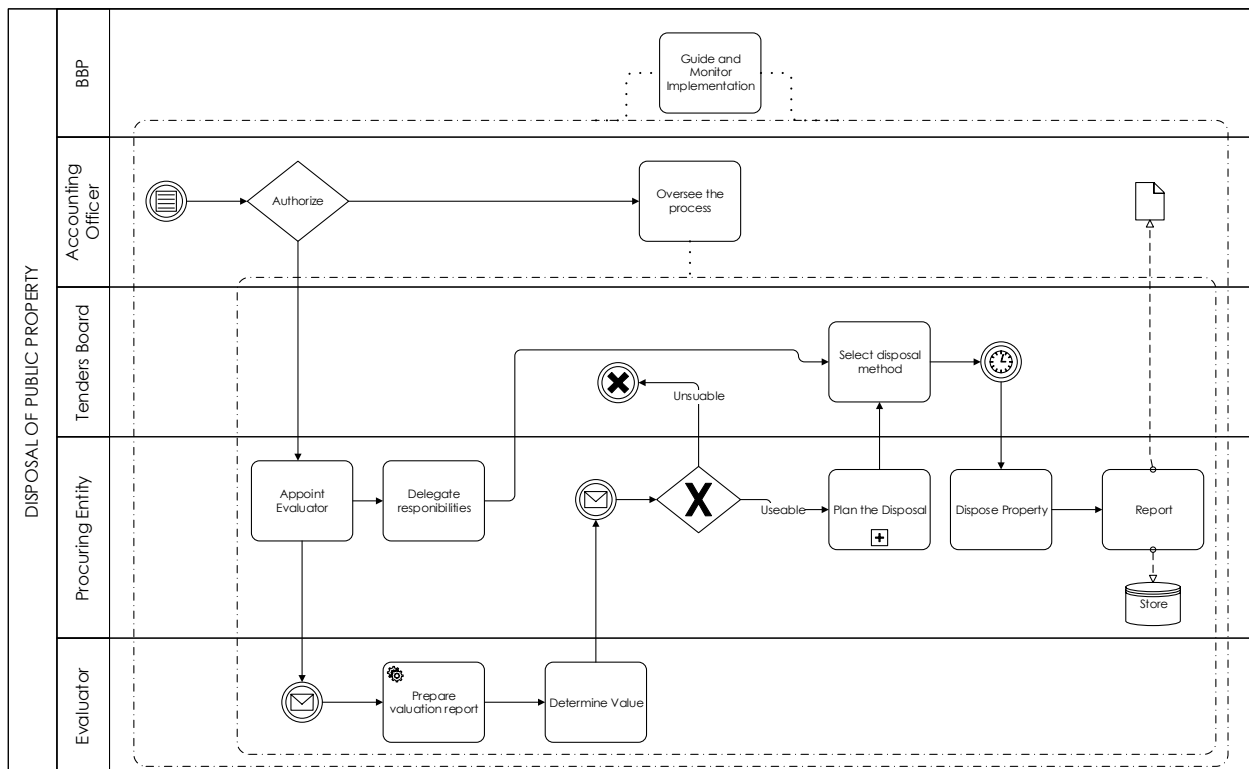


Figure 7: Process Model for Disposal of Public Property.

After the report has been received the next step is to plan the procurement (**Figure 7**). Subsection 92 outlines the various method that may be used for the disposal of public property. Some of the methods include Trade-in, Sale to other government agencies, Public auctions and Sales. Property which is unusable and determined to have no commercial value, or that the cost of sale would exceed the expected returns, may be destroyed or abandoned, but proper documentation must be done by the parties involved in the destruction to indicate the why, who, what, when, where and how of the transaction (NPPM, 2008).

CONCLUSION AND RECOMMENDATION

This research outlines manual procurement best practices, as it identified the various process that forms the procurement lifecycle. However, the number of processes that forms the cycle have been found to differ between countries, organization and entities. The major rationale behind the differences was found to be in the principle that guide and regulate the procurement practice. The manual process has been characterized as being inefficient, less transparent, less competitive and prone to manipulations. Due to this the study went further to identify the various digital solutions that have been deployed towards ensuring efficiency, transparency, competitiveness and value money in the procurement of goods, works and services.

The study also developed and presents conceptual process models (**Figures 3, 4, 5, 6 & 7**) that depicts the manual procurement practices for the Nigeria public procurement lifecycle as stipulated in the Public Procurement Act (2007). The models portray the various aspect within the procurement lifecycle and the respective key players with the aim of facilitating transition from the manual based processes to a digitized environment. Although, the digitization processes may be difficult as the current Act only support the advertisement on an online platform and prohibits any other procurement process from being carried out manually. Hence, the need to review and make the current Act an e-complaint procurement law also arises.

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FACTORS INFLUENCING THE CHOICE OF HOUSING FINANCING MODELS THAT ENHANCE DELIVERY OF HOUSING PROJECT IN NIGER STATE

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ABSTRACT

Focus on finance for housing projects has been more prominent due to huge financial resources that is required for provision of decent houses which is practically not at the disposal of low- income earners in Nigeria. Literature review revealed that Niger State Government, at all levels, accorded high priority to the provision of low-cost housing. Thus, the government adopted PPP as a procurement method for affordable housing development but it has not been fully realized. It is against this background that, this study aimed to identify the factors that influence choice of financial models for housing development in Niger state. Quantitative approach through questionnaire survey was used to collect data from Developers, Government representatives, Financial Institutions, Primary mortgage institution and Professionals in the build environment such as Architect, Quantity Surveyor and Builders. A total of 200 questionnaires were administered and 150 were retrieved and used for the analyses. The data collected were subjected to descriptive statistical analysis using mean score and data reduction techniques on SPSS. The results from quantitative analysis affirm the use of down payment grant financing model, Mortgage payment subside model, Mortgage interest deduction model and Credit enhancement as a viable alternative to financing model currently in use to finance affordable housing project by Niger State government. This study identifies factors such as: stringent condition, inadequate funding, research and development, Government programme and policies, and project to be financed. It concluded that stringent condition by primary Mortgage institutions, and inadequate funding are the most factors influencing the choice of financing model for successful delivery of housing projects in Niger State.

Keywords: Affordable housing, housing, financing models, housing construction,

INTRODUCTION

Housing is an integral element of a nation's economy and its backward and forward linkages with other parts of the economy closely bond people's needs, demands and social processes. These linkages allow housing to act as an important engine for sustainable development and poverty reduction in society and the economy. Without a functioning housing sector, urban centers cannot be established or developed. A functioning housing sector offers appropriate, affordable housing and sustainable patterns of urbanization which are critical for the future of the ever-urbanizing planet (Abdullahi, 2015). Housing has been universally recognized as one of the most essential necessities of human life and is a major economic asset in every nation. Adequate housing provides the foundation for stable communities and social inclusion (Lanrewaju & Oluronke, 2014) observed that there is a significant association between housing conditions, physical and mental health of an individual. People's right to shelter is thus a basic one and the provision of decent housing to all requiring them should be the hallmark of every civilized society and one of the criteria for gauging development. However, the provision of adequate housing in Nigeria and other developing nations alike still remains one of the most intractable challenges facing human and national development. Previous attempts by all stakeholders, including government agencies, planners and developers to provide necessary

recipe for solving the housing problem have yielded little or no success (Lanrewaju & Oluronke, 2014).

Public housing delivery for civil servants in Niger State started after the creation of the State in 1976 when some government quarters were constructed under the supervision of Niger State Ministry of Works, Transport and Housing. Later, Niger State Housing Corporation was created in 1979 for housing delivery in the state. However, between 1976 and 2007 less than 3,000 houses were developed by the public sector (Niger State Evolving Strategy for Sustainable Housing NSESSH, 2007). In order to improve on this, the government of Niger State in 2007 embraced the Public Private Partnership (PPP) as an alternative strategy for its housing delivery. This was in response to the 2nd United Nation (UN) Conference on Human settlement (HABITAT II) in Istanbul, in June, 1996 which advocated for the effective and affordable mass housing delivery through Public-Private Partnership (NSESSH, 2007). The goal of Sustainable Housing Development (SHD) initiative as contained in Goal 11 of The United Nations (UN) 2030 Agenda for Sustainable Development is to “increased access to sufficient, safe and low-cost housing for the world’s poorest people residing in slums by the year 2030”. Nigeria currently the most populous nation in Africa records the fastest urbanization as well the largest economy (Abdullahi, 2015).

Focus on housing finance has been more prominent because the provision of housing requires huge financial resources which most of the low-income earners in Nigeria are unable to afford (Sanusi, 2010). Omole (2010) corroborates that adverse legal, macroeconomic institutions and regulatory environment impact enormous effects in the provision of long-term finance for housing. However, various authors have studied challenges with housing financing in Nigerian, notable among them was that of Omirin (2007), Likewise Udoko *et al.* (2017) posit high interest rates as serious factor that discourages borrowers from accessing funds for housing development. Again, the low interest rate stipulated by the NHF, makes financial institutions especially banks reluctant to give out loan for housing development especially as it turns out to be an unprofitable investment. It is against this background that this study intends to identify the factors that influence choice of financial models for housing development in Niger state.

LITERATURE REVIEW

Overview of Sustainable and Affordable Housing Development

The concept of sustainable housing is synonymous with the sustainable growth and development of cities around the globe. Sustainable housing development (SHD) can be defined as the development and implementation of policies, programmes or initiatives designed to deliver safe, viable and affordable houses for individuals within a society. The concept typically adopts the tenets of sustainable social, economic and environmental factors in delivering national housing plans and policies for masses with minimal impacts on future generations and the environment (Ayedun & Oluwatobi, 2011).

The Working Group highlighted in its Issues Paper (Australian Bureau of statistic 2016) that there are multiple definitions of affordable housing. In their submissions to the Working Group, stakeholders generally referred to the concept of housing stress, which is often defined using either a ratio of the cost of rent to a household’s income; or residual income measures that consider whether the cost of housing impedes a household’s ability to meet other basic needs. Affordable housing reduces or eliminates housing stress for low-income and disadvantaged

families and individuals in order to assist them with meeting other essential basic needs on a sustainable basis, while balancing the need for housing to be of a minimum appropriate standard and accessible to employment and services. This definition combines the elements of a ratio approach and a residual income approach while seeking to capture broader issues around housing quality and household wellbeing. The Working Group notes that housing stress is not necessarily defined as a set proportion of a household's income and can at times be temporary. Responses are ideally prioritized to those facing enduring and severe housing stress (Australian Bureau of Statistic, 2016)

Factors influencing the choice of Housing Financing Models

Appropriate Collateral

The collateral such as titled land, government bonds, private shares, properties in urban or rural properties, and fixed deposit are collaterals often considered by financial institutions before granting loans to homeowners (Ojo 2005; Ojo and Ighalo, 2008; Kuma, 2015) For example, in Nigeria, issues related to land title remain a significant eligibility criterion applied by housing finance institutions for granting loans to prospective individuals who want to develop their properties. This is in line with Onyike (2009) assertion that the availability of collaterals and other vital inputs determine access to loan affordability. Thus, the decision of a household to finance housing development is dependent on the availability of collateral. According to Ojo (2005) issues related to land title in Nigeria remain a significant barrier to housing finance. In many cases, there are often legal impediments to the ability of a property owner to pledge residential property as collateral (Onuoha, 2011; Kuma, 2015).

Access and Affordability Criteria

Prospective homeowners feel reluctant to borrow loan from financial and mortgage institutions due to stringent conditions on access to loan and affordability. The decision to access loan for housing development in Nigeria and in particular Niger state is dependent on the income of the borrower, income security criteria viewed in terms of stability of employment and business, fixed annuity, method of repayment such as pensions and allowances, equity contribution of the borrower, cost of housing to be developed by individual (Ojo, 2005; Onyike, 2009; Onyike, 2007; Onuoha, 2011). When one's income is not even enough to meet one's immediate needs such as food, financing housing under stringent lenders requirements will not be included in the budget. Onuoha (2011) observed that affordability criteria of financial institutions in Niger are much hinged on the income profile of the applicants while accessibility is tied to the formal rules governing households' ability to obtain housing loan (Onyike, 2007).

Repayment Scheme and Criteria

Repayment criteria of a financial institution may well determine the propensity of prospective homeowners to apply for housing finance. As such, the repayment scheme has been observed to be one of the factors underlying a potential homeowner's perceived probability of securing a loan from banks. Applicants who do not agree for a stipulated amortization period for loan repayment are likely to have their application rejected. Ojo (2005) and Onuoha (2011) also found that the probability of homeowners securing housing finance is considerably higher if the repayment is to be made in a short or medium term. Besides, the preparation schedule for loan repayment

could have an input in the income of the borrower, interest rate, and loan amount (Ojo & Ighalo, 2008).

In Nigeria, amortization and repayment periods vary with the type and sources of housing finance. Onuoha (2011) observed that the payback period granted by banks is too short when one considers that housing development takes longer time to complete. While Ojo (2005) posits that long-term loan, agreement affords better opportunity for potential homeowners to complete their houses.

Formal Rules of Access

Studies have shown that experience of those who have attempted to borrow from financial institutions had their loan application rejected or suspended because of what Ojo (2005) and Onuoha (2011) described as formal rules of access. Some financial institutions give additional conditions for loan approval. These conditions are to be strictly observed by prospective loan applicants. These conditions include the age of account with a lending institution, approved building plan, current tax clearance certificate, and evidence of insurance of the property to be financed and bank service charges (Ojo, 2007; Onuoha, 2011). According to Ojo (2005), genuine applicants who wish to develop a house of their own are often denied access to loan due to the short period they have operated an account with banks. Most financial institutions believe that the age of account kept with them builds confidence and ensures quick repayment of the loan. On building plan and presentation of tax clearance, potential borrowers are expected to deposit the architectural plan of proposed building and present evidence of tax clearance to the bank. In some cases, banks require three to five years of tax clearance as a prerequisite for granting loan (Ojo, 2005).

Type of Loan Provided

Another commonly attractive motivation that determines the propensity of homeowners to initiate housing loan application is the type and nature of loan provided by the financial institutions. Most financial institutions provide short term, medium- and long-term finance for real estate development (Oke *et. al.*, 2019). However, every potential homeowner intends to leverage on these categories of real estate finance options to achieve his objectives.

Type of Project Financed

Subjective evidence suggests that borrowers consider the type of project financed by financial institutions before seeking for a housing loan. Housing construction and development is complex and involves many skills and resources including huge financial commitments. As such, financial institutions hardly provide loans for all the categories of housing development. There is evidence that prospective borrowers may want to borrow a loan for different purposes. For example, a borrower may want a loan for constructing a house or for outright purchase, repairs/renovations and improvement purposes (Okey *et. al.*, 2019) observe that the probability of borrowers securing loans depends to a large extent on the type of project the financial institution finances. It is for this reason that Ojo (2005) posit that a borrower is attracted to housing loan if such an arrangement helps him to achieve his purpose.

Location Factor

The site and location of the property such as neighborhood location, accessibility to popular places of employment, adequate availability of utilities and transportation as well as compliance with applicable federal, state or local land use law and zoning regulations improve the chances

of prospective borrowers to obtain housing loan (Okey *et al.*, 2019). According to (Okey *et al.*, 2019), location determines accessibility while accessibility determines demand and consequently profitability. The implication is that financial institutions may be reluctant to finance any project; its location would not add any economic value to the property owner. Perhaps, this is why Ojo (2005) observed that properties located in urban and rural areas are rated differently by financial institutions. For example, banks prefer properties located in urban areas than the rural areas (Ojo, 2005). This is because pieces of property may have different values just because of the difference in location. Moreover, financial institutions perceive that there is general apathy among insurance firms to provide borrowers with mortgage indemnity guarantee insurance premium for properties located in rural areas (Okey *et al.*, 2019). However, it has been argued that when the provision of housing loan is greatly and strictly hinged on location attributes, potential borrowers are often discouraged from accessing the loan (Okay, 2019). Specifically, those whose properties are located in rural areas or are not in good locations may have their loan application rejected (Okey *et al.*, 2019).

Housing Financing Models for Sustainable Development.

Below are potential models that could facilitate an increase in the finance available to housing providers to increase the supply of affordable housing.

Housing Loan/Bond Aggregators

A housing bond aggregator model provides a vehicle for affordable housing providers to aggregate their debt financing requirements, assisting them to obtain funding from the wholesale market at a better price and longer tenor than is available to them individually. The establishment of a housing bond aggregator would require the establishment of a specialist financing intermediary, whose function would be to liaise with affordable housing providers to determine the amount of debt they are seeking to raise. The intermediary, or entity acting on its behalf, would then source these funds in aggregate from wholesale markets by issuing bonds to investors. The funds generated would then be loaned to the relevant housing providers in return for ongoing interest payments. (Rowley & Ong, 2012).

Housing Trusts

Housing trusts have also been suggested as a means to overcome the current difficulties with scale and the geographic diversity of assets required to attract large scale investment into affordable housing. The creation of a housing trust would provide an additional vehicle for States and Territories to renew their existing public housing stock and boost the overall affordable housing stock. It would also provide a vehicle to develop sites that are currently underutilized by not-for-profit organizations. (Rowley & Ong, 2012).

Housing Co-operatives

Housing co-operatives are not-for-profit legal associations formed for the purpose of providing a housing product for members and are usually owned and controlled by members. Many housing co-operatives are organized and managed on principles of participatory democracy and a common purpose (Rowley & Ong, 2012).

Impact Investing Models Including Social Impact Bonds

Impact investing is an emerging form of finance aimed at addressing challenging social problems by harnessing private investors to back innovations in social service delivery that lead to proven reductions in government expenditure. Impact investing offers an opportunity to bring together capital and expertise from the public, private and not-for-profit sectors to deliver better outcomes for the community. Key features of an effective impact investment include robust measurement, value for money, a service likely to achieve social outcomes and appropriate sharing of risk and returns (Rowley & Ong, 2012).

Down payment grant

Down payment grant can be structured in a number of different ways, including grants and loans. Loans ideally result in the repayment of capital that is then re-used as a down payment loan for another borrower. These loans can be amortizing, but most often are designed as “silent” junior liens due at resale or refinance. Because these loans tend to be small, they must be monitored over many years and lose value with inflation. The costs of administering these loans are high relative to the loan amount. In addition, subsidies in the form of junior liens can limit owners from taking out additional loans. Instead of loans, some assistance programmes use down payment grants, which are administratively efficient but are strictly one-time in nature (Ergungor, 2010).

Mortgage payment subsidies

Mortgage payment subsidies are housing financing models that realistically lessen the interest rate and other periodic charges to be paid by an individual or organisation that has taken a loan for a housing project. According to Calomiris *et al.* (1994), Hui *et al.* (2009), Ergungor (2010) and Collins (2013), a mortgage payment subsidies programme is restricted to developers that do not have adequate initial capital to obtain housing loans and individuals that could not obtain private financing without this assistance, though in the case of a subsidy scheme, the recipients of mortgage subsidies apply for subsidy payment through developers or government agencies.

Credit enhancement

Credit enhancement is a financing model that does not provide direct financing for low-cost housing but can overcome financing barriers. It involves additional guarantees, insurance or collateral, to increase access to capital to finance a home. This housing financing model enhances the credit-worthiness of the person or entity seeking financing by reducing or eliminating some identified risk (Jaffee & Quigley, 2009).

Bundled Mortgage Finance System

Under a bundled mortgage finance system, a single actor/player performs roles in the mortgage process, acting as the loan originator, lender services provider and the risk manager, among others. As a sole investor, the portfolio lender has deposits as his major source of funding. The sole investor creates a close and long-term relationship with his clients. This gives him the opportunity to enter into transactions in other financial products. This model of mortgage financing however is characterized by liquidity and interest rates risks, as borrowers often expect long-term funding, but depository funds are traditionally short-term Central Bank of Nigeria (CBN, 2011).

Unbundled Mortgage Finance System

All the market players in this system play different roles in the execution of a mortgage process in contrast to the arrangements under the bundled mortgage finance system. Here, the borrower goes through a mortgage banker to source funds from investors, other depositories and the secondary market. The key benefit of this system is the assurance of specialization. Every loan goes through the necessary due diligence of underwriting, marketing, packaging, and risk management, among others. This procedure minimizes cost and promotes market discipline. However, where many entities/players are involved, there is the tendency for bureaucratic delays, which could add to cost as well (CBN, 2011).

Secondary Market Based Mortgage Finance System

The secondary market-based mortgage finance system is so far believed to be the system that best suits the long-term liquidity needs of the housing market. The market is regarded as an organized system that involves loan origination, warehousing, securitization and sale to investors. Funds realized from sale of mortgages are ploughed back into the system to create more mortgages, thereby deepening the system and increasing the housing stock in the economy. The secondary market system begins with the borrower, who takes a decision to access a mortgage loan and approaches a mortgage institution (primary market) to express his intention (CBN, 2011).

PPP models

Under this model, the public authority provides land to the selected private developer. This would effectively constitute a state subsidy for the project. The private developer will be responsible and held accountable for designing, building and financing of affordable housing stock and associated services of predetermined standards, at a pre-determined cost and within a pre-determined time. The public authority will undertake to compensate the private developer for the housing stock on the satisfactory completion and handing over of the units, as per prescribed standards, cost and time (Abdullahi, 2015).

RESEARCH METHODOLOGY

Two set of data were identified as being relevant to effective conduct of this research namely primary and secondary. The population is restricted to professionals, Developers, stake holder and financial institutions in the build environment in Niger State. A randomly selected technique was adopted in selection of sample size. The adoption of selection is based on information obtained in Table 1, which shows that the population of Architect in Niger State is 27, Quantity Surveyors 110, Builder 72. The Developers and financial institutions are justified on non-availability of their total population in the study area. This study used a questionnaire as Primary tool of data collection and it is divided into two (2) sections. The section A was designed to obtain relevant information to the respondents such as organisation of the respondents, qualifications, years of experience, profession affiliation etc. Section B focus on the objectives. A quantitative questionnaire was developed and administered to housing developers and construction professionals who practice in Niger State. Two hundred (200) questionnaires were distributed, twenty (26) was given to Architect, forty-five (45) to quantity surveyor, forty-three (43) each to Builders, Developers, and Financial institutions and one hundred and fifty (150) retrieved and found suitable for the analysis.

Table 1: Profession of Respondents

Professionals	Population
Architect	26
Quantity Surveyor	110
Builder	72

Source: Niger state NIA, NIQS AND NIOB.

Method of Data Analysis

The descriptive statistic using mean scores of each variable were determined based on the 5-point Likert scale used to collect data to establish the significant factors in each of the constructs. Mean scores entail allocating a point to the respondent's ratings to the variables e.g. strongly agree equal to 5 point and strongly disagree equal to 1 point, etc. Mean scores have been used extensively in researches like that of Assaf, et al., (2010). That has similar types of variables. The mean score is calculated for each construct using SPSS based on the underlying formula;

$$\text{Mean score} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1} \dots\dots\dots 5.1$$

Where; n_1 = number of respondents who answer is strongly disagree

n_2 = number of respondents who answer is disagree

n_3 = number of respondents who answer is neutral

n_4 = number of respondents who answer is Agree

n_5 = number of respondents who answer is strongly agree

RESULTS AND DISCUSSION

Present the result of analysis on data relating to the respondents. On the analysis of the position of respondents, the result of descriptive statistics shows that 21.3% of respondents were senior Q/S, 14.7% were site manager, 10.7% were project managers and 53.3% were others specified. The analysis of the type of organisation revealed the result as 31.3% were in public organisation, 18.7% were in private organisation, 15.3% were in financial institution, 26.0% were developers and 8.7% were cost consultant Q/S. The result shows that public organisation has the highest percentage of 31.3% of respondents. The respondent's education qualification indicates that out of 150 respondents, 10% were OND, 20.7% were HND, 36% were B.Sc/B.Tech, 27.3% Msc/M.Tech/PhD and 6% were others specified. The result revealed that the majority of respondents were B.sc/B.Tech. Analysis on respondents working experience showed that 12% has a working experience ranging between 0 to 5 years, 40% have a working experience of 5 to 10 years, 26.7% have a working experience between 11 to 15 years, and 21.3% have a working experience above 15 years. These shows that a vast majority (88%) of respondents has practice for a range above 5 to 10 years and considered suitable for the analysis. On the professional affiliation of the respondents, the result revealed that 17.33% of the respondents were Architect, 24.67% were quantity surveyors, 21.33% were Builders, 18% were ICAN/ANA and 18.69% were Developers/ Estate surveyor. The analysis of the respondent on project handled revealed that 50% of the respondent handle between 0 to 5 projects, 36% of the respondent handle between 5 to 10 project, 12.7% handle between 11 to 15 project and 1.3% handle above 15 projects. The result shows that between 0 to 5 projects have the highest percentages of the respondents. This

result proves further that the respondents are qualified, competent and highly experienced and that they are expertise on sustainable and affordable housing development

Factor analysis on SPSS application package was used to analyse the data of factors influencing choice of housing financing model. According to Pallant, (2011), Kiser- Meyer Olkin (KMO) and Bartlett's Test must be conducted to examine the sample adequacy and to ensure that the technique is appropriate for the variables, hence KMO and Bartlett's analysis. The first step in PCA analysis is to test the appropriateness of a study's data for PCA analysis hence the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's test of Sphericity were used to identify the factors influencing the choice of housing financing model to the delivery of sustainable housing project. Table 1 shows the results of KMO and Bartlett's test of Sphericity. These tests provide the basis for measuring the minimum standard that the data must meet before being considered adequate for further analysis. The KMO index ranges from 0 to 1, with 0.6 suggested as the minimum value for a good factor analysis (Pallant, 2011; Tabachnick & Fidell, 2012). The Bartlett's test of Sphericity indicates the strength of the relationship among variables and it should be significant at $p < 0.05$ for the PCA to be considered. However, the results in Table 1, display KMO value of 0.915 which is greater than 0.6 and less than 1, while the Bartlett's Sphericity value $p = 0.000$ (i.e. $p < 0.05$). Therefore, the data is adequate and suitable to be used for PCA.

Table 2 KMO and Bartlett's Test for Factors Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.915
Bartlett's Test of Sphericity	Approx. Chi-Square	1731.033
	df	171
	Sig.	.000

Principal Components Factors Influencing the Choices of Housing Financing Models

According to Pallant (2011), the next step after showing the appropriateness and suitability of the research data is component (factor) extraction. This is a process to ascertain the number of components to retain, based on their influence on the choice of the model, since not all factors are kept (Tabachnick & Fidell, 2012). The "Kaiser's criterion using eigenvalues" was adopted to extract the components and varimax rotation was used to extract the variables that load on each identifiable variable. However, the significant factors, according to Kaiser's criterion, are those factors with eigenvalues above 1. In Table 4, five components with initial eigenvalues greater than 1 were extracted from the components to achieve factors influencing the choice of the model. The eigenvalues of the five variables are 7.461, 1.342, 1.290, 1.152 and 1.017; the result shows that the first component is capable of explaining 39.267% of the variance while the second component explained 7.06%, third explained 6.79% fourth explained 6.06 % and fifth explained 5.35% of the component. However, the five components combined to explain 64.54% of the total variance and considered to be highly significantly responsible factors affecting the choice of the models. While those below 1 were considered to be less significant factors.

Table 3 Communalities

Variables	Initial	Extraction
Appropriate Collateral	1.000	0.941
Stringent Condition	1.000	0.880
Repayment Criteria	1.000	0.672
Interest Rate	1.000	0.610
Accessing NHF	1.000	0.766
Type of Loan	1.000	0.683
Type of Project Financed	1.000	0.614
Site and Location of Project	1.000	0.642
In Adequate Funding	1.000	0.923
In effective Housing Finance	1.000	0.546
Financial Instrument	1.000	0.713
Govt. Programme Policies	1.000	0.686
Policy Instrument	1.000	0.397
Poor Research and Dev.	1.000	0.694
Lack of Effective Plan	1.000	0.423
Approval of Building Plan	1.000	0.538
Bureaucracies in Land Allocation	1.000	0.381
Difficulty in Obtain C of O	1.000	0.696
Weak Institutional Framework	1.000	0.459

Extraction Method: Principal Component Analysis.

Table 4 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.461	39.267	39.267	7.461	39.267	39.267	7.412	39.009	39.009
2	1.342	7.064	46.331	1.342	7.064	46.331	1.362	7.169	46.178
3	1.290	6.788	53.119	1.290	6.788	53.119	1.236	6.505	52.683
4	1.152	6.063	59.182	1.152	6.063	59.182	1.139	5.997	58.680
5	1.017	5.352	64.535	1.017	5.352	64.535	1.112	5.854	64.535
6	.894	4.706	69.241						
7	.823	4.330	73.570						
8	.791	4.165	77.736						
9	.782	4.118	81.854						
10	.659	3.467	85.321						
11	.617	3.248	88.569						
12	.546	2.873	91.442						
13	.456	2.402	93.844						
14	.317	1.669	95.513						
15	.314	1.653	97.166						
16	.281	1.477	98.643						
17	.162	.853	99.496						
18	.074	.392	99.888						
19	.021	.112	100.000						

Extraction Method: Principal Component Analysis.

To further confirm the number of components to retain, Catell's scree test was performed on the variable and the results is shown in Figure 1. The (scree plot) shows that two components are retained. These components are the point, which is above the elbow on the scree plot shown in Figure 1. These components, however, contribute the most to the variance in the data set, and this agrees with the results displayed in Table 3

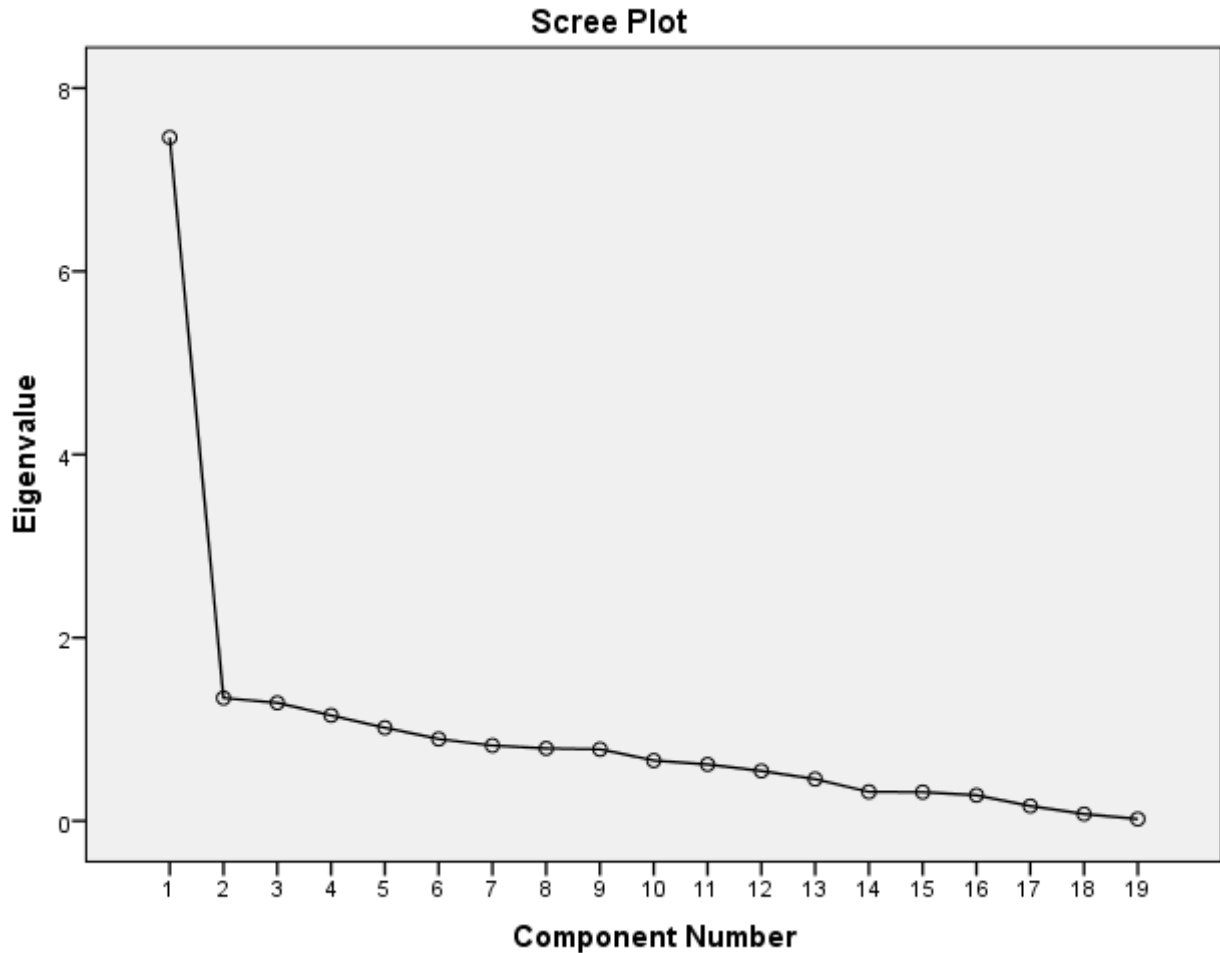


Figure 1: Catell's scree plot for factor influence the choice of housing financing model

CONCLUSION

The study has evaluated the various factors that affect the choice of housing financing models in Niger State. A total of Nineteen (19) factors were identified and classified into five major groups, stringent condition, inadequate funding, research and development, Government programme and policies and project to be financed. From the analysis it was concluded that appropriate collateral, stringent condition, repayment criteria, interest rate and access to National Housing Fund are the most important factors considered by the respondents that hinder the easy accessibility to housing financing. The identified factors have not been advantage to the building sector and its participants and proper measures should be taken to put stop to this factor. The study has therefore provided additional data base of factors affecting the choice of financing models to Developers, stakeholders' professionals and financial institutions that partake in housing provisions in making quality decisions as regards investment in housing development and to reduce the conditions upon which finances are obtained.

Recommendation

From the finding the following recommendation were made in order to implement the selection of best housing financing model to enhance delivery of sustainable housing projects.

1. Government, developers, housing providers, construction professional's and stakeholders in the building industries should make use of the result obtain from the analysis in the decision making and the selection of the best financing models that are effective and suitable for successful delivery of sustainable housing project.
2. The financial institutions should reduce the conditions attached to the procedures for obtaining housing loans by the prospective homeowners.

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INFLUENCE OF PROJECT RISK MANAGEMENT IN HIGH-RISE BUILDING CONSTRUCTION ON PRODUCTIVITY OF WORKERS IN ABUJA, NIGERIA

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ABSTRACT

Although building construction projects are some of the most dynamic, complex and risky human endeavours, the traditional building construction process is fragmented, complicated, uncertain and risk-prone. Risk in high-rise projects, which can affect the productivity, performance, quality, and budget of such projects, may be impossible to eliminate, but it can be minimized, transferred or retained. The aim of this study was to evaluate the influence of project risk management in high-rise building construction on productivity of workers in Abuja, Nigeria through the ranking of key risk factors and relating artisan productivity to risk perception. The study adopted a quantitative research design through survey with close-ended, self-administered questionnaires. Data was gathered from a purposive sample of 37 artisans built up through a snowballing approach and was analysed using Mean Item Score and Kendall's tau-b Correlation. The study identified six key risk items, which included 'Poor competence and productivity of labour'; 'Poor coordination with subcontractor'; and 'Payment delays'. It thus concluded that labour productivity was not significantly related to risk in high-rise projects. It was recommended that risk management in high-rise projects should focus on the Technical, Logistical, Financial and Socio-Political risk factors. Suggested mitigation measures for these key risks include on-site testing of labour before recruitment; use of Project Managers to carry main and sub-contractors along; and use of payment bonds by clients. Further studies could focus on the influence of work height on labour productivity risk in high-rise building construction projects.

Keywords: building, high-rise, labour, productivity, risk.

INTRODUCTION

Buildings are one of the most valuable assets of any nation that provide people with shelter and facilities for work and leisure (Lam *et al.*, 2010). Consequently, the construction industry plays a key role in the economy of any nation, more so in a developing country like Nigeria. According to the Frontier Market Intelligence report (2012) building construction in Nigeria accounted for 1.33% GDP in 2012 which is below the global average benchmark of 9% of GDP, and is indicative of the huge room for growth in the construction of buildings. Building construction projects are complex, dynamic and risky endeavours (Kangari, 1995; Mills, 2001), which traditionally span four sequential stages: conceptual design, construction, operation and maintenance (John *et al.*, 2005). Clients' briefs are prepared during the conceptual stage; this initial design of the building and services is expanded by construction professionals (e.g. architects, engineers and quantity surveyors, etc.) who produce the design information required for the next stages. Contractors make use of this design information during the construction stage, in order to actually erect the building. On completion, the building will be operated and maintained, by either an estate department or a facilities management team.

However, the traditional building construction process as described is fragmented, complicated, uncertain and risk-prone (Arayici *et al.*, 2012; John *et al.*, 2005). Risk and the costs associated

with it are abstract concepts that construction contractors rarely think about; this is despite the fact that it is one of the largest expense items (Cavignac, 2009). The structured, systematic and scientific management of risk helps the key project participants - client, contractor or developer, consultant, and supplier - to meet their commitments and minimize negative impacts on construction project performance in relation to cost, time and quality objectives (Banaitiene *et al.*, 2011). This is the essence of risk management, the absence of which has several negative consequences for participants in a building project due to lack of preventive action against the risks and uncertainty that any project presents (Serpell *et al.*, 2014).

A large number of building construction projects in developing countries suffer setbacks in completion of projects at the stipulated time, cost and quality, a situation that quite often turns profitable projects into losing ventures (Sweis *et al.*, 2008). Oyewobi *et al.* (2011) pointed out that cost and time overruns have become associated with lack of good quality end products. To address this challenge, risk management has to become an important part of decision-making process in construction industry (Abujnah and Eaton, 2010). Risk affects the productivity, performance, quality and budget of high-rise building construction projects; it can however be minimized, transferred or retained (Smith *et al.*, 2006). This paper evaluated the influence of project risk management in high-rise building construction on productivity of workers in Abuja, Nigeria. The two objectives of the paper were to rank the key risk factors, and determine the influence of risk factors on labour productivity in high-rise building construction projects.

LITERATURE REVIEW

Construction Risk

Risk, a complex phenomenon having many dimensions (Loosemore *et al.*, 2006), which comes from the French word *risqué* (Abujnah and Eaton, 2010) first appeared in 18th century insurance transactions (Flanagan and Norman, 2000). The word 'risk' best describes a situation in which the outcome of decisions is predicted based on the probability of recurrence of past recorded similar experiences (Oztas and Okmen, 2004). According to Smith *et al.* (2006), risk exists when a decision is expressed in terms of a range of possible outcomes, to which known probabilities can be attached. According to Odeyinka *et al.* (2006), risk is a variable in the construction process whose occurrence renders uncertain the final cost, duration and/or quality of a project. From these definitions of risk, two common elements can be identified: uncertainty and loss. Hence, to discuss the presence of risk, there must be at least two possible outcomes; at least one of the possible outcomes must be undesirable. For example, if it is known that a loss will definitely occur; there cannot be any risk (Oztas and Okmen, 2004).

Risk management is one of the ten project management areas (i.e., integration, scope, time, cost, quality, human resource, communications, risk, procurement and stakeholders) propagated by the Project Management Institute (PMBOK, 2013). British Standard 31100 (2011) defined risk management as the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence. Risk management strategies employed by clients and project owners include (i) risk ownership (which party owns the risk; risk exposure and transfer) and (ii) risk financing (how to budget for risk through allowances or contingency) (Smith *et al.*, 2006). Serpell *et al.* (2015) posits that a major role of project managers is dealing with risks continuously during a project.

There are many benefits of risk management in construction. A properly implemented risk management process will enhance the successful completion of building construction projects and thereby make the project more profitable. Key advantages of risk management process as

described by Toader *et al.* (2010) and Poh (2005) include (i) it is efficient: project managers are aware about the risks which influence the activity of the project and manage them so that they do not occur; (ii) application of risk analysis in the tendering stage enables a realistic project pricing; (iii) efficient risk management increases the chances of success of the project, despite the uncertainties in the project environment, and (iv) in the presence of risk information, more comprehensive and accurate decisions about risks can be made. Other benefits are (v) availability of risk knowledge will help avoid mistakes made in past projects when planning for risk in future projects; (vi) good track record and proven risk management systems of construction firms will enhance their chances to secure future projects from the same project owner; (vii) an effective risk management process can improve communication among project participants.

Construction Risk Factors

The risk factors and associated risk items employed in this study were extrapolated mainly from a study carried out by Altoryman (2014), which had been sourced from an extensive review of literature from across the globe. The complete list of risk factors and items are given below.

Management-related RF: Decision making process M01; Communication and coordination between parties (clients, consultants and contractors) M02; Unclear responsibility M03; Availability of capable representatives M04; Postponement of work (held orders) M05; Issuance of instructions M06; Availability of project management team members (experience) M07; Information dissemination M08 Q09 - Site mobilisation and delay in site handover M09; Contractor's experience M10; Availability of competent subcontractors / suppliers M11; Rework due to errors during construction M12; Availability of disputes and claims – comprehensive dispute resolution M13; Conflicts in subcontractor's schedule in execution of project M14; Delays in subcontractor's work M15; Unsatisfactory work of contractor M16; Delay in approving major changes in the scope of the work M17; Long wait for approval of tests and inspection M18; Quality assurance / control M19; Excessive use of contractors / subcontractors M20; Unreasonable risk allocation M21; Frequent change of subcontractors because of their inefficient work M22; Revising / approving design documents, shop drawings and sample materials M23.

Design -related RF: Design team experience D01; Complexity of project design D02; Confusing requirements D03; Design modifications D04; Data collection and survey before design D05; Complete documents and drawings of projects D06; Producing design modification documents D07; Clarity of details in drawings D08; Excessive change order D09.

Finance-related RF: Payment for completed work F01; Financing project by contractor /client F02; Cash flow plan analysis F03; Cost estimation accuracy F04

Material-related RF: Quality of materials (below standard) MAT01; Availability of construction materials in market MAT02; Change in material types and specifications during construction MAT03; Material delivery MAT04; Manufacturing of special building materials MAT05; Material supplier problems MAT06; Material waste handling MAT07; Compliance of material to specification. MAT08

L&E-related RF: Labour performance / productivity L&E01; Equipment availability L&E02; Productivity and efficiency of equipment L&E03; Labour and management relations L&E04; Necessity of skills L&E05; Labour strikes and disputes L&E06

External-related RF: Site's topography is changed after design EXT01; Civil disturbances EXT02; Problems with neighbours EXT03; Government permits EXT04; Changes in regulations EXT05.

Construction Risk Management Process

Risk management is the effort to optimize decisions in order to reduce uncertainty about future events when the information is incomplete or unclear (Jafari *et al.*, 2011). The risk management process is made up of a number of critical cyclical steps. Early studies on risk management had outlined different approaches to risk management. For example, Chapman (1997) outlined a generic project risk management process consisting of nine phases: (i) Define the key aspects of the project; (ii) Focus on a strategic approach to risk management; (iii) Identify where risks might arise; (iv) Structure the information about risk assumptions and relationships; (v) Assign ownership of risks and responses; (vi) Estimate the extent of uncertainty; (vii) Evaluate the relative magnitude of the various risks; (viii) Plan responses, and (ix) Manage by monitoring and controlling execution.

Akintola and Macleod (1997) suggested a four-stage process that consists of (i) identification, (ii) analysis, (iii) assessment and (iv) control. The need for a systematic risk management is essential to manage construction projects risks has for long been recognized. Jafari *et al.* (2011) identified four well-known approaches to risk management as PMBOK (2008), Project Risk Analysis and Management (PRAM) (APM, 2004), Management of Risk (MOR) and the standard AS/NZS4360:2004 (Australia Standard / New Zealand Standards, 2007). All of these approaches are based on the key steps of planning, identification, qualitative and quantitative analysis, reaction to risk, and controlling.

High-Rise Building Projects

The increasing need for space and limited land especially in urban areas have necessitated the construction of many high-rise building projects in big cities. Basari (2017) reported that in the Special city of Jakarta, of the 189 multi-story buildings (including those under construction) 113 buildings are apartments, 31 hotels and 45 offices. There are many definitions about high-rise building projects; from the civil engineer's perspective, a building can be described as 'high-rise' when its height has significant impact on its design. Such impact might be from lateral forces like earthquakes or winds. This engineering perspective will classify buildings with more than 10 floors or buildings which having a height of more than 32 meters as high-rise buildings (Mabhoot *et al.*, 2013). Construction of high-rise building projects takes place in complex and dynamic environments that are fraught with uncertainty and high levels of risk. There are several characteristics associated with such projects such as deadlines, special objects, financial constraints, economic requirements, organizational conditions, special laws, and systematic complexity (Basari, 2017). These features mean that risk always exists in construction projects and often leads to delay schedules or cost overruns.

Construction Labour Productivity

Labour is one of the main resources employed in the construction process, so labour productivity has a key influence on the time and cost of construction activities (Hoła and Nowobilski, 2019). Kathiravan *et al.* (2014) defined productivity, for the purpose of their research, as the amount of work done by a workman in either a day or an hour. In construction management literature, the term "productivity" is defined in different ways. However, it is most common in construction to take productivity as referring to labour productivity (Halligan *et al.*, 1994). Labour productivity has been most often defined as a relationship between human hours and work accomplished (Moselhi and Khan, 2012). Some researchers have however gone further to include other variables in the equation apart from output and time. Hwang and Soh (2013) as well as Yi and Chan (2014) defined labour productivity as the relationship between the output produced and the inputs used during the production process period. Moselhi and Khan (2012) as well as Nguyen

and Nguyen (2013) defined labour productivity as a ratio of output to input while producing a product. Economically, this ratio is usually expressed as a percentage, e.g., 100% productivity means that the person is working as per the standard employed in evaluating the worker. A higher score means that the worker is working more efficiently, that is, above the level of efficiency specified in the evaluation standard. This paper follows Kathiravan *et al.* (2014) definition of productivity as being equal to Total quantity of work done/ Number of workers involved.

Since labour is one of the most unpredictable inputs in construction, some of the greatest risks in a construction contract arise from the use of labour. Labour must thus be controlled and its performance continuously improved upon. It goes without saying that the construction company with the most efficient labour operations has a greater chance to make more money and deliver construction projects in a faster manner. There are several factors that can affect the productivity of construction labour on a jobsite. These factors include weather conditions, workers' skill level, overcrowding of work crews, type of construction methods used, and material delivery/storage/handling procedures.

METHODOLOGY

This study adopted a quantitative research design approach through survey with close-ended, well structured, self-administered questionnaires that were designed in two main sections, using Likert-style response options. Data was gathered through a purposive sample of 37 artisans, partially through a snowballing approach, and partially through the researcher's personal knowledge of the study area. The study was limited to construction artisans performing bricklaying, carpentry, iron-bending and plastering trades on high-rise building projects. It is believed that they have adequate experience about working on high-rise building projects, and about the ways in which risk factors affect their productivity on such projects. Such artisans can thus answer the questions of this study.

The questionnaire data was analysed using descriptive statistical method (Mean Item Score and Standard Deviation), as well as inferential methods (Kendall's tau-b correlation). A total of 60 risk items (10 risk items each from six risk factors) were identified from review of construction management literature. A 4-item semantic Likert scale was then used to obtain rankings of the risk factors from artisans. Mean Item Scores (MIS) were computed and used to rank the risk factors in order to identify the risks that respondents considered to have a higher influence on their productivity. To be considered a key risk factor, risks must have an MIS higher than 3.50.

Kendall's tau-b correlation was carried out by using the average of semantic scores computed for each respondent in each of the six risk categories considered in this paper. This enabled the level of association between artisans' perception of risk factors and the daily productivity of such artisans to be assessed. The assessment was carried out in three phases; first, the linearity of the association was observed. Then, the strength of the association was examined through the computation of coefficient of determination (R^2) values. Thereafter, the level of significance of the association was determined through the 2-tailed 'Sig' values obtained from the correlation analysis; 'Sig' values lower than 0.05 were taken to be statistically significant. All of the results of these analyses were presented in tables.

RESULTS AND DISCUSSION

Demographic analysis of the data

Bricklayers made up 35% of the sample, followed by carpenters (27%), iron-benders (24%) and least of all plasterers, who made up 14% of all respondents. This result is presented in pie chart form as Fig. 1.

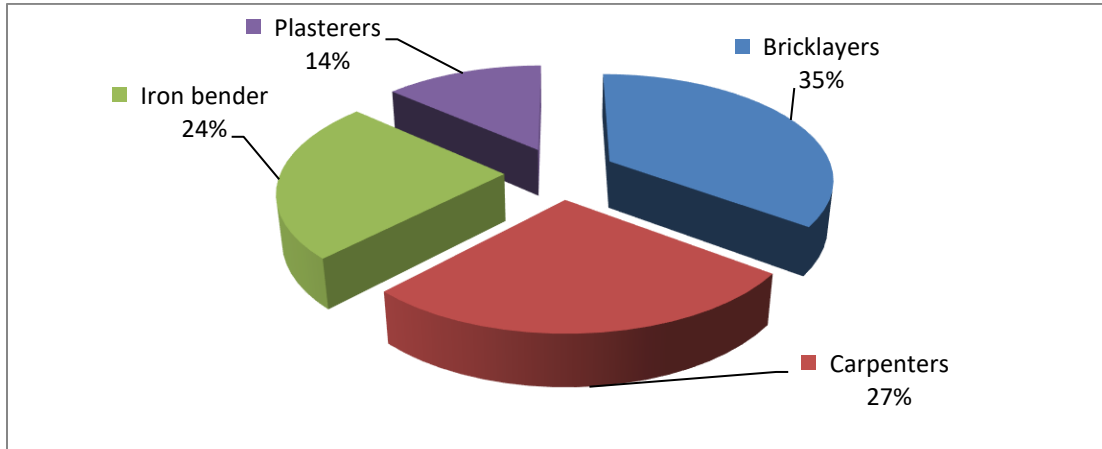


Fig. 1: Trades practiced by respondents

With respect to hourly and daily quantities of work done, bricklayers laid around 28 blocks per hour or 222 blocks per work-day; carpenters were able to complete carpentry works covering an average of 2.75 square meters per hour or 28 square meters per work-day. The work values presented in Table 1 are average estimates, and do not reflect the rate of working over the entire work-day. Detailed analysis of rates of work would have to take into account rest periods, slack periods, waiting for material periods and inspection periods. The monetary value of the work done by the artisans was relatively similar for all of the four trades. The least cost of work was 437.50 Naira per hour for bricklayers while the highest was 562.50 Naira for iron-benders. In the Nigerian construction industry, minimum thresholds for wages of artisans are fixed centrally by the National Joint Industrial Council (NJIC). Although some level of variation exists across the different construction firms, considerable similarity in wages should be expected.

Table 1: Descriptive statistics of work quantity and cost

Trade	Quantity /hour	Quantity /day	Cost /hour	Units measured in
Bricklayers	27.69	221.54	437.50	Blocks; Naira
Carpenters	2.75	28.00	500.00	Sq.m; Naira
Iron bender	2.39	22.22	562.50	Kg; Naira
Plasterers	7.56	28.00	500.00	Sq.m; Naira

Source: Fieldwork (2020)

Key risk factors in high-rise building construction projects

Technical risk factors

Only one risk factor from the ‘Technical risks’ category qualified to be referred to as a key risk, as is evident from the results in Table 2. This was ‘Poor competence and productivity of labour’, which had an MIS of 3.84. Seven other risk factors qualified to be described as ‘high technical risk’ only, since they had MIS values ranging from 2.65 to 3.43. Two factors ‘Delay in

availability of drawings’ and ‘Risk of defective design’ constituted ‘low technical risks’ to the productivity of artisans on high-rise building projects; these had MIS values of 2.30 and 2.24 respectively.

Table 2: Ranking of Technical risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
TR8	Poor competence and productivity of labour	3.84	0.37	0.96	1	Very High Risk
TR10	Less control and coordination in team	3.43	0.50	0.86	2	High Risk
TR5	Labour Shortage	3.38	0.49	0.84	3	High Risk
TR7	Lack of qualified Craftsmen	3.38	0.49	0.84	3	High Risk
TR3	Accidents/safety during construction	3.35	0.48	0.84	5	High Risk
TR6	Risk of insufficient technology	3.30	0.46	0.82	6	High Risk
TR9	Inaccurate estimation of quantities of work	3.19	0.81	0.80	7	High Risk
TR4	Inaccurate execution plan/schedule	2.65	1.06	0.66	8	High Risk
TR2	Delay in availability of drawings	2.30	0.91	0.57	9	Low Risk
TR1	Risk of defective design	2.24	0.95	0.56	10	Low Risk

Source: Fieldwork (2020)

Logistical risk factors

Only one risk factor from the ‘Logistical risks’ category qualified to be referred to as a key risk, as is evident from the results in Table 3. This was ‘Poor coordination with subcontractor’, which had an MIS of 3.65.

Table 3: Ranking of Logistical risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
LR8	Poor coordination with subcontractor	3.65	0.48	0.91	1	Very High Risk
LR9	Risk of defective material from supplier	3.49	0.87	0.87	2	High Risk
LR4	Theft/robbery of material at site	3.22	0.71	0.80	3	High Risk
LR6	Poor performance of subcontractor	3.19	0.40	0.80	4	High Risk
LR1	Shortage/delay of material supply	3.16	0.37	0.79	5	High Risk
LR7	Slow delivery	3.11	1.05	0.78	6	High Risk
LR5	Labour, materials and equipment availability	3.08	0.28	0.77	7	High Risk
LR10	Shortage of plant and equipment	2.73	0.61	0.68	8	High Risk
LR3	Third party delays	2.68	1.11	0.67	9	High Risk
LR2	Risk of labour disputes and strikes	2.35	1.25	0.59	10	Low Risk

Source: Fieldwork (2020)

Eight other risk factors could only be described as ‘high risk’ only; these had MIS values ranging from 2.68 to 3.49. Only one other factor was found to constitute a ‘low logistical risk’ to the productivity of artisans on high-rise building projects. This was ‘Risk of labour disputes and strikes’, which had an MIS value of 2.35.

Environmental risk factors

No risk factor from the ‘Environmental risks’ category qualified to be referred to as a key risk, as is evident from the results in Table 4. Only one factor was found to constitute a ‘high environmental risk’ to the productivity of artisans on high-rise building projects. This was ‘Terrorism/war threats’, which had an MIS value of 2.78. Eight other risk factors qualified to be described as ‘low risk’ only; these had MIS values ranging from 1.68 to 2.24.

Table 4: Ranking of Environmental risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
ER5	Terrorism/war threats	2.78	0.82	0.70	1	High Risk
ER1	Risk of natural disasters	2.24	1.16	0.56	2	Low Risk
ER7	Risk to Flora and Fauna	2.19	1.15	0.55	3	Low Risk
ER2	Risk of unforeseen site conditions	2.03	1.24	0.51	4	Low Risk
ER9	Risk of Air Pollution	2.03	1.04	0.51	5	Low Risk
ER8	Risk of Water Pollution	1.97	1.21	0.49	6	Low Risk
ER10	Risk from Noise and Vibration	1.97	0.96	0.49	7	Low Risk
ER6	Risk of Land Degradation	1.92	0.98	0.48	8	Low Risk
ER3	Risk of differing site conditions	1.86	1.00	0.47	9	Low Risk
ER4	Adverse weather conditions	1.68	1.08	0.42	10	Low Risk

Source: Fieldwork (2020)

Management-related risk factors

No risk factor from the ‘Management-related risks’ category qualified to be referred to as a key risk, as is evident from the results in Table 5. Seven factors were found to constitute ‘high management-related risk’ to the productivity of artisans on high-rise building projects. These seven factors had MIS values of between 2.46 and 3.08. Three other risk factors that had MIS values ranging from 1.81 to 2.19 were ‘low management-related risks’ only.

Table 5: Ranking of Management-related risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
MR6	Management of project resources (material, equipment, employee, financial, and method)	3.08	0.86	0.77	1	High Risk
MR8	Strategic risks	2.89	0.94	0.72	2	High Risk
MR9	Operational risk	2.88	1.12	0.66	3	High Risk
MR10	Incomplete daily report and low level of project document management	2.86	1.16	0.72	4	High Risk
MR2	Risk of Changes in scope of work	2.73	0.80	0.68	5	High Risk
MR4	Accuracy in determination of the organization structure	2.68	1.11	0.67	6	High Risk
MR3	Risk of Construction Management	2.46	1.19	0.61	7	High Risk
MR7	Governance risk	2.19	1.22	0.55	8	Low Risk
MR5	Complexity of license and regulation in implementation of project activities	2.19	1.00	0.55	9	Low Risk
MR1	Delays in obtaining permits	1.81	0.94	0.45	10	Low Risk

Source: Fieldwork (2020)

Financial risk factors

Only two risk factors from the ‘Financial risks’ category qualified to be referred to as key risks, as is evident from the results in Table 6. These were ‘Payment delays’ and ‘Bankruptcy of project partner’, which had MIS values of 4.00 and 3.54 respectively. Four other risk factors qualified to be described as ‘high financial risk’ since their MIS values ranged from 2.70 to 3.49. Two other factors (‘Fluctuation of interest rate’ and ‘Rise in fuel prices’), which had MIS values of 2.35 and 1.81 respectively constituted a ‘low financial risk’. The last two factors qualified to be described as ‘very low financial risks’; these were ‘Insurance risk’ and ‘Liquidity Risk’, which had MIS values of 1.41 and 1.19 respectively.

Table 6: Ranking of Financial risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
FR2	Payment delays	4.00	0.00	1.00	1	Very High Risk
FR5	Bankruptcy of project partner	3.54	0.51	0.89	2	Very High Risk
FR3	Level of overheads	3.49	0.87	0.87	3	High Risk
FR1	Risk of funding problems for project	3.46	0.51	0.86	4	High Risk
FR10	Fraud risk	3.30	0.85	0.82	5	High Risk
FR4	Exchange rate fluctuation and inflation	2.70	1.20	0.68	6	High Risk
FR6	Fluctuation of interest rate	2.35	0.95	0.59	7	Low Risk
FR7	Rise in fuel prices	1.81	0.97	0.45	8	Low Risk
FR8	Insurance risk	1.41	0.93	0.35	9	Very Low Risk
FR9	Liquidity Risk	1.19	0.52	0.30	10	Very Low Risk

Source: Fieldwork (2020)

Socio-Political risk factors

Only two risk factors from the ‘Socio-Political risks’ category qualified to be referred to as key risks, as is evident from the results in Table 7. These were ‘Social Safety’ and ‘Unaccepted work by Owner’, which had MIS values of 3.51 and 3.59 respectively. Seven other risk factors were described as ‘high socio-political risk’ since their MIS values ranged from 2.57 to 3.11. One other factor was found to constitute a ‘low socio-political risk’ to the productivity of artisans on high-rise building projects. This was ‘Inadequacy of insurance’, which had an MIS value of 2.35.

Table 7: Ranking of Socio-Political risk factors in high-rise building projects

Risk code	Risk description	Mean Score	SD	RII	Rank	Remark
SPR9	Social Safety	3.59	0.50	0.90	1	Very High Risk
SPR8	Unaccepted work by Owner	3.51	0.51	0.88	2	Very High Risk
SPR2	Corruption including bribery at sites	3.11	0.31	0.78	3	High Risk
SPR1	Political instability	3.05	0.62	0.76	4	High Risk
SPR6	Low level of employee’s discipline	2.89	0.94	0.72	5	High Risk
SPR7	Submission of construction claim	2.84	1.26	0.71	6	High Risk
SPR10	Religious and Ethnic Tension	2.68	0.94	0.67	7	High Risk
SPR5	Inappropriate risk allocation in contract	2.57	1.30	0.64	8	High Risk
SPR4	Delays due to disputes with contractor	2.57	0.83	0.64	9	High Risk
SPR3	Inadequacy of insurance	2.35	0.95	0.59	10	Low Risk

Source: Fieldwork (2020)

Risk factors and labour productivity on high-rise projects

Negative linearity was observed in four out of six risk categories (Logistical, Environmental, Management-related and Socio-Political); this implied that higher levels of daily productivity are associated with higher risk factor influence. Associations between risk categories and labour productivity were observed to be extremely weak; in most cases less than 1% of the variance in labour productivity was explained by the influence of risks. It was therefore not surprising that none of the associations between the six risk categories and artisans’ productivity was found to be of statistical significance (see Table 8).

Table 8: Correlation result of Productivity and risk factors in high-rise projects

Parameter examined (Influence of risk perception on the daily productivity of artisans in high-rise building construction projects)	N	Kendall's tau-b	Linearity	R ² (%)	Sig. (2-tailed)	Remark
Technical Risks	37	0.037	Positive	0.14	0.785	NS
Logistical Risks	37	-0.048	Negative	0.23	0.728	NS
Environmental Risks	37	-0.070	Negative	0.49	0.591	NS
Management Related Risks	37	-0.116	Negative	1.35	0.376	NS
Financial Risks	37	0.022	Positive	0.05	0.866	NS
Socio- Political Risks	37	-0.017	Negative	0.03	0.900	NS

Source: Fieldwork (2020)

The importance of payment delay risk has been brought out by the results presented in this subsection. This was the only risk factor that had respondents in complete agreement about the importance of the factor, which was why the factor had an MIS value of 4.00. The finding of the study that the perception of risk factors by artisans in high-rise building projects does not significantly impact the productivity of such artisans helps to focus research effort elsewhere, on other variables that may influence artisans' productivity, and which have not been included in this study. In their own study, Kathiravan *et al.* (2014) found that demanding increased productivity from construction labour might create special risks that would adversely affect the project. This is in line with this study's result regarding technical and financial risks; positive linearity in the result implies that increasing productivity would be accompanied by an increase in the influence of these categories of risks.

CONCLUSION

This paper evaluated the influence of risk factors on the productivity of workers in high-rise building construction projects in Abuja, Nigeria. Six key risk items from the Technical, Logistical, Financial and Socio-Political risks factors were identified. These were (i) 'Poor competence and productivity of labour', (ii) 'Poor coordination with subcontractor', (iii) 'Payment delays', (iv) 'Bankruptcy of project partner', (v) 'Social Safety' and (vi) 'Unaccepted work by Owner'. It was also found that the productivity of artisans was not significantly influenced by how the artisans perceived risk factors. From the foregoing, this study has concluded that labour productivity on high-rise building construction projects is not significantly affected by perceptions of project management risk.

The main recommendations of this paper are that risk management in high-rise building construction projects should be focused on the identified six key risk items belonging to the Technical, Logistical, Financial and Socio-Political risks factors as listed in the preceding paragraph. These key risk items could be mitigated by (i) Carrying out on-site testing of labour before recruitment; making effort to retain satisfactory artisans even between projects; (ii) using Project manager to provide leadership for main and sub-contractors; (iii) exploring the use of payment bonds by Clients (upon work being certified acceptable, contractors can be paid by a third party such as a bank on behalf of the client, as a result of a bond taken by the client guaranteeing timely payment to the contractor); (iv) exploring the use of work completion bonds by Contractors; (v) implementing corporate social responsibility (CSR) initiatives for large high-rise building projects, in order to endear the project to the immediate host community; and (vi) avoiding unaccepted work by adhering to the specifications laid down in the contract documents,

ensuring timely work inspections, and having all Supervising Officer's instructions promptly confirmed.

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ASSESSMENT OF THE MOST POPULAR SOCIAL MEDIA SITES AMONG QUANTITY SURVEYING STUDENTS IN SOUTHWEST NIGERIA

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ABSTRACT

Social media have become an important part of students' life to do multifarious functions: to search for information on the internet, information shearing, to download photos/videos on the internet, to get latest news/current affairs, to learn latest innovations, and to understand class lectures, assignment and projects etc. Social media is known to both affect academic performance positively and negatively. This study aims to investigate the most popular social media sites among quantity surveying students in South West Nigeria. The study chose four institutions including Federal University of Technology, Akure (FUTA), Obafemi Awolowo University (OAU) Ile-Ife, Federal Polytechnic, Ede, and Rufus Giwa Polytechnic, (ROGIPO) Owo all in southwest Nigeria. A total number of 243 students were chosen from two Departments of Architecture and Quantity Surveying for the study across the institutions using stratified random sampling. The study finds that the most important reasons for the use of social media are to chat and communicate with friends, education and news and information. Additionally, study finds that the most frequently visited social media sites are WhatsApp, YouTube and Facebook. The study recommends that that students should endeavour to understand the merits and demerits of social media and how they affect their academic performance; the academic system should integrate the social media sites into their teaching system to enhance the academic excellence; student should focus on sites with strong academic content to help them to be at par with other students internationally; and lastly students should use the social media sites in a way that improves their academics performance.

Keywords: academic performance, internet, quantity surveying students, social media and WhatsApp.

INTRODUCTION

The Internet is a collection of millions of computers around the world that are connected to each other. It is so much in use and is generally accepted by all because of its benefits and aid towards communication, information, performance and increase in technology. Due to all these, it has millions of users and lovers. With the many benefits it has, it also has its effects which are mostly on the youths especially students as it tends to divert their attention in some ways. The users and users of the internet also increase daily as technology advances. People have different uses for the internet, such as communicating with distant people, family and friends, browsing for information online, chatting and playing games. It is used in organizations, in school, at work, at home and anywhere (Warren *et al.*, 1998). The internet is used worldwide in different countries, hereby making it possible to communicate despite the distance. Scientific knowledge could be gained via the internet which makes the students versed in various aspects. They get information faster and easier which also helps the academic performance and makes them better as they advance in knowledge and technology. There are various advantages on the use of the internet by students as well as disadvantages. It has greater disadvantages on students that are so much addicted to it. They spend resources and highly valued time on it, though for the use of a

service there is a cost attached, when it is used in excess, the cost attached is in excess. These networking sites are used by most people to interact with old and new friends, physical or internet friends (Asemah & Edegoh, 2012).

Some of the areas which students mostly get involved in for the use of internet are: to use search engines like Google, Yahoo, Opera mini to source of information on the internet, to share information with family and friends on the internet, to download and watch videos related to what is taught in class, to download photos and pictures from the internet to learn more about what was taught in class, to learn randomly about things generally, to get latest news and information online, to read other materials related to what was taught in class, to research on the internet for homework and projects, to learn recent innovations from the internet which gives an edge as a student. Some of the areas which students rarely got involved in the use of internet and which are highly important are: To enter library websites on the internet; to use database program on the internet; to search for educational games and activities on the internet; to get information about the topics taught and learnt in class; to gain from websites relating to education and knowledgeable innovations; to find and download e-books; and to follow educational journals on the internet. Others includes: to learn more about English language and speaking; to find interactive program samples from the internet; to benefit from the forums related to education; to check out articles and publications that are on the internet; and to participate in classes and exam applications by e-learning portals on the internet (Dogruer, Eyyam & Menevis, 2011).

The use of the internet and social media at large has positively affected the academic performance of students, although there are negative effects abound (Englander, Terregrossa & Wang, 2010). The time spent by youths generally on social media is also an issue to be considered, in the 24hours which is in a day, some are always online throughout, some spend 20hours online and some randomly. These time factor affects the students as it encroaches on their study time and makes their reading or studying output very low. These days' students are so addicted to the social media that they are almost 24 hours online (Kuss & Griffiths, 2011). Even in classrooms and lectures theatres, it has been observed that some students are always busy whatsApping, Facebooking, or tweeting while lectures are on. Times that ought to be channelled towards learning, academic research and innovating have been taken by the passion for meeting new friends online and most times busy discussing trivial issues, the reading culture of students therefore diminishes cause the time to be spent reading has been spent on social media. Hence, most students' academic performance suffer setback as a result of distraction from the social media (Olubiyi, 2012). The study investigates the most frequently visited social media sites among quantity surveying students in southwest Nigeria. The study is structured into six sections which include introduction, literature review, methodology, result, discussion and finally, conclusion and recommendations.

LITERATURE REVIEW

Shrestha (2013) defines social media as a form of exchange of information amongst people. Alison also sees the social media to be an online tool which enhances communication and sharing of information. Students learn, get entertained and also get innovative ideas from the internet; sites like linkedIn provide students with the avenue of getting job opportunities and many companies use the social media site to advertise their products (Asad, Anam & Kanwal, 2016). Students spent approximately thirty minutes a day socializing, mostly during the evening hours between 9pm to 12am. Students spent an average of forty-seven minutes a day on Facebook.

More than 50 percent of college students go on a social networking sites several times a day (Sheldon, 2008). Quan-Haase and Young (2010), find that 82 percent of college students reported logging into Facebook several times a day. Younger students are more liable to use Facebook more frequently than older students to keep in touch with friends from high school or from their hometown (Pempek *et al.*, 2009). Social networking sites use to interact with people, family and friends far and near include facebook, whatsapp, twitter, instagram, yahoo and skype (Aseman & Edegoh, 2012). The social media has widely and beneficially used by students for academic purposes such as improving learning experience and make students grow in some aspects. Social media is also known to have some negative effect on student academic performance (Johnston, 2013; Selwyn, 2009; Tapscott & Williams, 2010; Junco, Cotton, Jacobsen & Forste, 2011 etc.).

The social media/network sites are websites that permits individuals to have and update profiles, display user connections, and search within the list of connections. They facilitate building of social network among people who share similar interest, activities and background on real life situations to share information amongst themselves. They are good medium to stay connected online (Kietzmann, Silverstre, McCarthy & Leyland, 2012). Nielsen (2012) noted that students tend to spend more hours on social media sites than other sites. Social media can be classified into six classes as follows: collaborative project (Wikipedia), blogs and microblogs (twitter), content communities (YouTube), social networking site (WhatsApp, Facebook & 2go etc.), virtual game world (world of war craft), virtual second world (second life). Important sites such as blogs (e.g. Huffington Post), networking platforms (such as Facebook, LinkedIn, Twitter, etc.), video sharing (e.g. YouTube), image or picture sharing (e.g. Instagram, Flickr) audio sharing (Podcast), mobile sites (2go etc.), are all inclusive in technology. They give student access to large amount of material or information on diverse subjects to improve their explanation and knowledge (Kaplan & Haenlein, 2010). The use of the social media has increased round the globe recently. Social media are penetrating the educational system. The online social networks are highly being used by both college students and also by instructors for different reasons (Mazer, Murphy & Simonds, 2007, 2009).

The Sites Frequently Visited by Students on Social Media

Aseman and Edegoh (2012) hold that social media sites which are commonly used by students include Facebook messenger, Instagram, twitter, WhatsApp messenger, YouTube, skype and LinkedIn. They are used to communicate with friends and relatives both far and near. Students through the use of smart phones, iPad, laptops and computers frequently visit sites like Facebook which is used almost all day to chat with people both far and near, view pictures and happenings which are really captivating. Students make use of the WhatsApp too majorly for chatting also and to communicate faster with people, the YouTube is used by students to download different videos and also to watch videos online, for things which are for academic benefits and also those which are not of academic benefit. Twitter is also used by students frequently for getting information and chatting. The Instagram is also visited by students through which videos can be watched, passing of information and communications are done. LinkedIn is used mostly for serious communications and networking as it connects people of like mind and careers together which is of great benefit (Cortijo, Arteaga & Javed, 2013).

Facebook as a Case study: Cave painting was the first known communication technique. Communication which was done through cave paintings was a very important part of the early human society (Morriss-Kay, 2009). Also, while the importance of communication goes on, the world-wide penetration of computers and the Internet has resulted online mediums where people

can communicate. The first social networking site which was founded in 1995 is Classmates.com (Meltzer & Philips, 2009). Nowadays, social networking sites give users a form of online identity. The world's largest social network site which is Facebook, is recorded to have more than 1.31 billion mobile active users and 1.49 billion monthly active users (Facebook, 2015). Furthermore, recent studies show that 90% of 18-29-year olds in USA use the social networks and a very high percentage (between 85 and 99%) of students use Facebook (Brenner, 2013; Matney & Borland, 2009). The use of Facebook and multitasking made the difference and impact of Facebook known on student's GPA within different levels of undergraduate students in the USA (Junco, 2015). In Summary what began out as being a hobby for several computer literate people has turned out to be a social norm and existence-style for individuals around the globe (Nicole Ellison, 2007). Students have noted these internet sites to be able to contact their peers, share information, reinvent themselves, and showcase their social lives. Internet sites are now being an activity that's done mainly on the web with various websites (Vaughn Coyle, 2008). Mazman & Usluel, (2010) and Cortijo, Arteage and Javed (2013) have identified major ways through which social media can promote student learning experience through: conversation, cooperation, active participation, information sharing, critical thinking and all other social benefits.

RESEARCH METHODOLOGY

Research methodology is a process of finding out the result of the research problem; it entails the procedure to be used to collect the data needed for this study. Different criteria are required to give solution to the research problem. Research comprises defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organizing and evaluating data, making deductions and reading conclusions and deciding if they fit formulating (Clifford, 2011). The basic idea of research is to get actual facts related to a particular problem and bring a means of solving the problem. Information like research design, target population, sampling frame, sampling size, sampling technique, data collection instruments are contained in this section.

Research design is a strategy for planning a research and making it efficient as possible with little expenditure of time, effort and money (Kohari, 2004). It is a detailed plan of how the goals of the research would be achieved successfully. This study on the effects of the use of social media among the students of Quantity Surveying and Architecture was conducted through survey design method as it is most suitable for the present study. The study population includes Quantity Surveying and Architecture Departments of the Federal University of Technology, Akure (FUTA), Obafemi Awolowo University, (OAU) Ile-Ife, Rufus Giwa Polytechnic, Owo, (RUGIPO) and the Federal Polytechnic, Ede Polytechnic.

The sample frame is the list of elements from which sampling occurs. It represents the total number of elements which the research would be conducted from (Cresswell, 1994). The sample frame for this study was limited to the 200L, 300L and 500L students as well as NDII, HNDI and HND II students.

Table 11 sample frame

SCHOOL	POPULATION
FUTA	504
OAU	348
RUGIPO	280
FEDERAL POLY EDE	267
Total Population	1399

Sample Size: If the average student spends 35 percent of their time on social media and a large sample is required for a study to give a 90percent confidence that is within an accuracy of ± 5 percent. Then the sample size for this study may be calculated as follows;

$$n = \frac{z^2 pq}{e^2}$$

Where;

n = Sample size

e = Level of precision

z= Confidence interval

Z = 90% confidence = 1.645, p = 35%, q = 65%, e = $\pm 5\%$;

$$n = \frac{1.645^2 * (0.65) * (0.35)}{0.05^2}$$

and n = 246

This formula was used to get the randomly selected questionnaires which was distributed amongst the participating students

Table 12 Sample size

Institution	Number of Respondent per institution
FUTA	63
OAU	63
RUGIPO	60
FEDERAL POLY EDE	60
Total sample size	246

Sampling Techniques: The study adopts a variant of multistage sampling technique. The first stage involves selecting the institutions i.e. the cluster (two universities and two polytechnics) then the class or level of study of the students i.e. the strata (NDI, HND1&II and 200L, 300L & 500L) and finally drawing the sample (the participating students) through stratified random sampling.

Data Collection Instruments: The data collection instrument is structured into three sections which includes (a) preliminary or personal information (b) the important reasons for visiting social media and (c) most frequently visited social media sites.

Data Collection Procedure: The process of data collection for this study was through the social media platforms Facebook, WhatsApp and email were employed intensively. The various class reps or leaders of the students were contacted and properly briefed on how to help to administer

questionnaires to his class members who were selected by random for the study. The class reps were most friendly and helpful as they promptly returned the answered questionnaires through the social media.

Methods of Data Presentation and Analysis: The method of presentation and analysis of data was done by statistics; the questionnaires were examined and information gotten for each of the items of the questionnaires through descriptive narratives. These were achieved by the use of frequencies and also with tables so as to make it more clarified and interpreted. The analysis tool also included Factor analysis and Regression

Descriptive Statistics: The analytical technique is used to assess the data set on social media used by the participating students are standard descriptive statistics. The descriptive statistics includes mean, median, mode and standard deviation. This allows for the data to be described in a way that eases better understanding and to drawing reasonable conclusions.

Frequency and Percentage Distributions: This is used to summarize data collected from respondents on the use of social media. Similarly, the percentage is used to summarise the frequencies as a proportion of the whole which is normally 100percent. Both the frequency and percentage distributions of the dataset are presented in a tabular format. The frequency and percentage distributions of the dataset allow for meaningful deductions from the dataset.

RESULT

This section deals with the report of the outcome of the analysis based on the methodology adopted by the study. A total of 243 questionnaires were administered for the purpose of this study. The first section of the questionnaire was to get the personal information of the respondents which includes the gender, the study course level, the department, and the faculty, the name of the university / polytechnic and the cumulative grade point average (CGPA). The table 3 shows frequency and percentage distribution of the respondents' gender and department. Table 3 shows that the gender includes 156 male and 87 female respondents. Information on the departments indicates that 134 respondents were quantity surveying students and 109 respondents were architecture students.

Table 13 Gender and Department of Respondents

		Frequency	Percent			Frequency	Percent
Gender	Male	156	64.2	Department	QSV	134	55.1
	Female	87	35.8		ARC	109	44.9
	Total	243	100			243	100.0

Table 4 indicates the descriptive statistics of the level of importance for visiting the social media. The reason for visiting the social media to chat and communicate with friends has the highest mean which is 5.71, followed by Education which has a mean of 5.60 and News and Information with a mean of 5.21, The use of the social media by students for sports has the lowest mean. This signifies that students use the social media mostly to chat and communicate with friends, to socialize, followed by using the social media for academics (Education) for assignment, knowledge etc. The table indicates that the rate of students' usage of the social media for sports update and videos is the least with a mean of 3.84.

Table 14 Level of Importance of Reasons for Visiting Sites

	Mean	Std. Deviation	Rank
To chat and communicate with friends	5.71	1.631	1
Education	5.60	1.567	2
News and Information	5.21	1.798	3
Entertainment (Music, Video)	4.81	1.892	4
Business	4.06	2.074	5
Religion	3.86	1.919	6
Sports	3.84	2.325	7

Table 5 indicates the descriptive statistics of the most frequently visited social media sites by students. The study finds that the use of WhatsApp by students has the highest mean of 6.35 followed by the use of YouTube by students which has a mean of 5.03 the least visited site was discovered to be skype which has the lowest mean of 1.82. The result shows that students are so fond of using WhatsApp which relates to the previous descriptive statistics of reasons for using the social media reported in table 4 which is ‘to chat and communicate with friends. Additionally, the study discovered that after the frequent visit of students to WhatsApp, the students frequently visit the YouTube for different reasons including to download academic materials, videos and tutorials which relates to the descriptive statistics of reasons for using the social media which is the second most important i.e. ‘Education’ (see Table 4). The use of skype is for video chat and voice calls between computers, tablets and mobile devices (which are not listed in table 4), this signifies that students rarely use the skype site compared to other social media sites available.

Table 15 Most frequently visited sites

	Mean	Std. Deviation	Rank
WhatsApp	6.35	1.338	1
YouTube	5.03	1.893	2
Facebook	4.38	2.221	3
Instagram	4.32	2.062	4
Twitter	3.31	2.293	5
LinkedIn	2.34	1.931	6
Skype	1.82	1.513	7

DISCUSSION OF RESULT

The discussion section is an opportunity to evaluate the findings of the study. This is done by making a comparison between the result of the data analysis and the extant literature to discern any agreement or otherwise. This makes the understanding of the result better and laid the background for the conclusion of the study. Results from the study shows students preference for sites like WhatsApp, Facebook, to communicate with family and friends and to know the recent happenings generally which correlates with Aseman and Edegoh (2012) that the social

media sites which are commonly used by students include Facebook messenger, Instagram, twitter, WhatsApp messenger, YouTube, skype, LinkedIn, and they employ them to communicating with families and friends both far and near. Students through the use of smart phones, iPad, laptops and desktops frequently visit social media sites like WhatsApp, Facebook and twitter which is used almost all day to communicate with people both far and near, view pictures/videos and events which are really captivating at monetary cost.

CONCLUSIONS AND RECOMMENDATIONS

The usage of social media has become a fad among youth and young people around the world this is more o among students of tertiary institutions who need social media sites for a wide variety of benefits. The study was to assess the most frequently visited social media amongst students. The study finds that quite a large number of students make use of the social media in many useful ways such as to chat and communicate with friends, education, news and information and entertainment (Music & Video) among others. The study concludes that quantity surveying students more frequently visit WhatsApp ($\bar{M}=6.35$) 'to chat and communicate with friends'; YouTube($\bar{M}=5.03$) to download academic materials, videos and tutorials; and lastly skype($\bar{M}=1.82$) for video chat and voice calls. Finally, the study recommends that quantity surveying students must avail themselves with benefits of social media to improve their academic excellence and to be at par with other students internationally as the world becomes increasingly globalised.

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APPENDIXES

Department of Quantity Surveying
Federal University of Technology
P.M.B 704, Akure, Ondo State.
22nd July 2019

Dear Respondent

REQUEST FOR COMPLETION OF QUESTIONNAIRE

This questionnaire is designed to obtain information on the research topic: " **Assessment of the effect of the use of Social media on students' academic performance**". In partial fulfilment for the award of B.TECH in Quantity Surveying. The information supplied shall be treated confidentially and used for academic purpose only.

Thank you for your anticipated co-operation and understanding

Yours Faithfully,

Ayodabo, B. O

Email address: blessingodunayo@gmail.com

Tel: 07036095455

SECTION A PERSONAL INFORMATION

1. Gender (a) Male [] (b)Female []
2. Please indicate your level (a) 200[] (b) 300[] (c) 500[] (d) ND 11[] (e) HND 1[] (f) HND 11[]
3. Department _____ 4. Faculty/School _____ 5. University/Polytechnic _____
6. Please indicate the range of your CGPA (a) 1.5-2.5[] (b) 2.6-3.0[] (c) 3.1-3.49[] (d) 3.5-3.99[] (e) 4.0-5.0[]

SECTION B FREQUENTLY VISITED SITES

TABLE 1: Please fill in the level of importance of the following for visiting the social media 1(Low) 7(High)

S/N	Reasons	1	2	3	4	5	6	7
1	To chat and communicate with family and friends							
2	Religion							
3	Education							

4	News and Information							
5	Sports							
6	Entertainment (Music, Video)							
7	Business							
8	Others (please specify) _____							

TABLE 2: Please rate your most frequently visited site on social media 1(Low) 7(High)

S/N	Social Media sites	1	2	3	4	5	6	7
1	Whatsapp							
2	Facebook							
3	Twitter							
4	LinkedIn							
5	Instagram							
6	Skype							
7	Youtube							

ASSESSMENT OF ENTRY MODES AMONG NIGERIAN QUANTITY SURVEYING FIRMS IN INTERNATIONAL CONSTRUCTION CONSULTING BUSINESS

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ABSTRACT

The modern business environment is a continuous innovation that encompasses technology advancement, increased competitiveness, globalization and the emergence of multinational corporations (MNCs). This provides many market opportunities to business firms and therefore influenced them to go international and thereby improving the performance of the industry. This paper assesses the plausible entry modes available for the Nigerian Quantity Surveying Firms (NQSFs) in the international construction consulting business. The study adopts a comparative case study design using the only four NQSFs with international practice. The study collects primary data through the administration of 40 questionnaires and document scrutiny. However, only twenty-two (22) returned questionnaires were found appropriate for analysis. The data collected were analysed using standard descriptive statistics including mean, median, mode and Standard Deviation. The study finds that the NQSFs have very sound knowledge of the most modes of entry into the international construction market and that Joint Venture (JV) is the most frequently used entry mode among NQSFs in international consulting business. The study recommends for the formulation and implementation of policies to support capacity development of NQSFs to internationalise similar to Singapore and Malaysia. The study recommends further studies on how to increase NQSFs participation in international construction consulting practices.

Keywords: entry modes, globalization, international construction consulting, joint venture and Nigerian quantity surveying firms (NQSFs).

INTRODUCTION

The modern investment climate is dynamic and changes may be very spontaneous that only the very strong firms are able to survive and compete favourable. The dynamic environment of technology innovation, product improvement, globalised competition and ever changing domestic and international regulation ensure that only the very serious firms are able compete in the domestic market and able to remain internationally competitive to be global player. This provides many market opportunities to business firms and therefore influenced them to go international. Since the 1980s, companies have shifted their orientation from domestic to global and are using global marketing techniques to reach international markets. International business is characterized by any form of transaction taking place across national borders for the purpose of satisfying the needs and demands of individuals and firms (Gajendran, Brewer & Marimuthu, 2013). Most companies need to enter foreign markets to stay competitive. There are several other reasons for going international: stagnating home market, faster growth in foreign market, following domestic competitors, countering foreign competitors' entry on their home market, etc. Whatever the reason for international business, the basic purpose of doing business in the international market is the potential profits to be made (Baura & Chowdhury, 2014). A number of studies address the reasons why firms go abroad. Thomson, Strickland & Gamble (2005)

mentioned four main reasons that motivates company to expand their business into foreign markets: to gain access to a large number of new customers that further help company to generate more revenues; lowering cost and improving the competitive position of company in the market; capitalizing on its organizational capabilities as well as core competencies; and dispersing business across the wider market so that economic slowdown may not put the company at risk.

Entry into foreign markets most likely means being exposed to completely new business environment. The usual business conditions might differ from domestic market and may even constitute higher level of socio-cultural differences and trade barrier that may prove to be complex to handle. If the firm lacks important resources and organizational capabilities in unfamiliar foreign market, then it may become difficult to sustain in the market for long periods. However, being aware of the potential of a target market is prerequisite for making a decision regarding entry into foreign markets. Entry mode is an institutional arrangement that makes possible the entry of a company's products, technology, human skills, management or other resources into a foreign country (Chen & Messner, 2011). An entry mode defines how a firm enters a foreign market, by abstracting the pattern of institutional settings to support the entry process. Similarly, Courturier and Sola (2010) assert that firms must develop internationally in order to survive and sustain in the foreign market. Nevertheless, it is crucial for these firms choosing a suitable target market in order to expand their business network. There are a number of entry modes available to firms such as licensing, Mergers & Acquisitions (M&As), Joint Ventures (JV), Strategic Alliances and Turnkey etc. However, the firm, when going abroad, must also investigate whether the target foreign market has the necessary potential to grow or not. The choice of an inappropriate entry mode may have severe repercussion on that foreign investment and the entire business given that wrongful choice can hardly be undone without negative effect. It is against the backdrop of the foregoing that the study assesses the different types of entry modes popular among Nigerian Quantity Surveying Firms (NQSFs) in international consulting business.

LITERATURE REVIEW

Foreign Market Entry Modes for Quantity Surveying Firms: Studies have classified market entry mode based on level of control, resource commitment, and risk involvement. Albaum & Duerr (2008) bring up the fact that firms consider different option of entry modes when expanding into new foreign market. The various entry modes differ not only for the level of control, but as well as the level of commitment, risk and involvement. The various types of entry modes include Licensing, Joint Ventures (JV), Turnkey, Wholly Owned Subsidiary (Greenfield, Merger & Acquisitions (M & As)) and Strategic Alliances.

Licensing: Licensing is an attractive entry mode for firms considering international expansion (Mottner & Johnson, 2000). Root (1994) defines licensing as a way of transferring intangible assets that are not a subject for import restrictions. Johnson & Tellis (2008) describe licensing mode as a formal permission or right offered to a firm or agent located in a host nation to use a home firm's proprietary technology or other knowledge resources in return for payment. A licensor (home firm) gives license to a licensee (foreign firm) that enables them to use, for example, manufacturing, processing, trademark, or name for selling purposes. Licensing is a mode that may include licensing, franchising, or technology transfer, which involves a contract between parties in different countries on a licensee's use of limited rights or resources, e.g., patents, trademarks, trade names, technology and managerial skills etc. from a licensor. This

allows the licensee to provide construction services in the host country similar to the services the licensor has already been providing in its home country. A fast-growing type of licensing is the franchising most used by American fast consumer moving goods (FCMG) particularly in food retailing. Small and medium-sized enterprises (SMEs) consider licensing as one of the most favorable type of entry modes. A licensor in the home country makes limited rights or resources available to the licensee in the host country. The rights or resources may include patents, trademarks, managerial skills, technology, and others that can make it possible for the licensee to manufacture and sell in the host country a similar product to the one the licensor has already been producing and selling in the home country without requiring the licensor to open a new operation overseas. The licensor earnings usually take forms of one-time payments, technical fees and royalty payments usually calculated as a percentage of sales. As in this mode of entry the transference of knowledge between the licensor and the licensee is strongly present, the decision of making an international license agreement depend on the respect the host government show for intellectual property and on the ability of the licensor to choose the right partners and avoid them to compete in each other market. Licensing is a relatively flexible work agreement that can be customized to fit the needs and interests of both licensor and licensee.

Some of the major advantages and disadvantages of licenses are discusses as follows. Some of the advantages of Licensing include: increase income for technical knowhow and services abroad; reach new markets not accessible by exports from existing facilities; fast expansion with low risk and little capital investment; pave the way for future investments in the market; retain established markets closed by trade restrictions; political risk is minimized as the licensee is usually 100 percent locally owned; is highly attractive for firms that are new in international business. The disadvantages of licensing: Lower income compared to other entry modes; loss of control of the licensee manufacture and marketing operations and practices leading to loss of quality; risk of having the trademark and reputation ruined by an incompetent licensee; and the foreign partner is a potential rival or competitor (Schirmer, 1996).

Joint Venture (JV): The Joint Venture (JV) is also known as consortium, contractual joint venture, or a contractual alliance is a very common entry mode in international business. Joint Venture implies that the shared ownership of two partners of which one located in the home nation and the other located in the host nation (Johnson & Tellis, 2008). JV is very common in international business expansion. As a matter of fact, International Joint Ventures (IJVs) is increasingly being used by multinational corporations (MNCs) (Dhanaraj & Beamish, 2004 cited in Lu & Beamish, 2006; Hitt, Ireland & Lee, 2000; Osborn & Hagedoorn, 1997 etc.). For the strategic importance in modern global business environment, both MNCs and SMEs depend on JV for expansion and foreign market entry (Li, 2007). The equity share of the international company can vary from 10percent to 90percent, but generally it is between 25percent to 75percent (Levi, 2006). The main feature of JV is that ownership and control are shared (Albaum & Duerr, 2008). A JV project helps a firm to be strategically and organizationally flexible in the target market and the foreign entrant can save money by using a host country partner's infrastructure and liability limitation (Chen & Messner, 2009). Compared to other partner options, in a joint venture, a local partner has more knowledge about various aspects such as: about needs and tastes of the local consumers, local competitors. The benefits of JV are access to financial resources, pooled research efforts, product development and wider distribution channels (Wilson, 2005). IJVs are formed between firms belonging to different countries. As a result, they can exchange knowledge about different markets which make JV as a popular entry choice for foreign firms. In addition, IJVs is effective for foreign firm to share the risks that exist in the foreign market with the local partner. Disagreement over the strategies to be adopted, lack

of mutual control over management, lack of clear decision-making policy, lack of adequate mechanisms to resolve the dispute, high risk of losing control over technology to a venture partner, and diluting the profits are the drawbacks of a JV. Types of JVs include JV projects and JV firms.

Joint Venture Project: A JV on a project basis, or sometimes called a consortium, contractual JV, or contractual alliance, is very common in international business. It is a vehicle in which profits and other responsibilities are assigned to each partner according to a contract. These do not necessarily accord with each partner's percentage of the total investment. The partners also have the option of forming a limited liability entity or partnership with legal person status, similar to that of a JV firm, but this entity only exists for this specific project. There are two types of JV projects: the integrated and non-integrated (Sridharan, 1994). In an integrated JV project, staff members from the different partners are seconded to the JV and a single project team is created. The partners take joint responsibility for the profit or loss made on the project. In a non-integrated JV project, partners are responsible for planning and executing their own portion of the work as well as the profit and loss made from their respective portion. A JV project can ensure a firm is strategically and organizationally flexible in the foreign market, and other advantages include cost saving by using an overseas partners' infrastructure and liability limitation. They are sometimes mandated by local laws or owners despite the dismantling of some market barriers against establishing permanent local presence. However, it can be difficult to find the right partner who is technologically progressive and compatible with an entrant's business purpose, as well as politically savvy locally. Schirmer (1996) however, contends that in comparison with a JV company, sophisticated clients are tending away from a JV project because of liability issues, the lack of permanency, struggles among the JV partners, and a perceived need for clients to resolve differences within the JV so that it can fulfil its mission.

Joint Venture Company: A JV firm occurs when two or more legally separate bodies form a jointly owned entity in which they invest and engage in various decision-making activities (Geringer, 1991). A JV firm is termed international JV Company when at least one of the parties (or parents) is based outside the country where the venture is taking place (Geringer & Hebert, 1989). A JV company can take one of two legal forms of either a corporation or a partnership. Architecture, Engineering and Construction organizations have extensively used international JV as a vehicle to enter new construction markets around the world (Mohamed, 2003). To set up a JV company, each partner contributes cash, facilities, equipment, materials, intellectual property rights, labour, or land-use rights. A JV company can be further classified as a majority JV, equal JV, or minority JV according to the equity percentage of the entrant. However, control is not always in proportion to ownership. Schirmer (1996) believed that contractual blocking mechanisms in the legal agreements can enable effective control with minority ownership. Complementary capabilities and resources are the normal basis to form a JV company. A JV company can be formed between contractors; between a contractor and a client; and between small and medium or large size firms to form synergy to pursue overseas projects.

Advantages of JV: The risk involved in the investment is shared with the local partner; likewise, since the two firms are able to share resources and know-how, the firm is able to access its partner's local knowledge; the firm is able to have significant input and control over the operation and management of the JV.

Disadvantages of JV: The firm may have challenges identifying the right partner and agreeing terms with the partner, and some time even when they agree they may still end up disagreeing down the road; The firm does not have full control and this may significantly hinder its ability

to integrate and coordinate its activities across national boundaries; and the firm may lose competitive advantage as a result of imitation.

Turnkey Projects: A turnkey project refers to a situation when clients pay contractors to design and construct new facilities and train personnel. A turnkey project is a way for a foreign company to export its process and technology to other countries by building a plant in that country. Industrial companies that specialize in complex production technologies normally use turnkey projects as an entry strategy.

Advantages of Turnkey: One of the major advantages of turnkey projects is the possibility for a company to establish a plant and earn profits in a foreign country especially in which foreign direct investment opportunities are limited and lack of expertise in a specific area exists; potential higher profits; chance of a permanent presence on the foreign market(s) after the completion of the investment; ability to earn returns from technologies in countries where FDI is restricted.

Disadvantages of Turnkey: potential disadvantages of a turnkey project for a company include risk of revealing companies secrets to rivals, and takeover of their plant by the host country; entering a market with a turnkey project CAN prove that a company has no long-term interest in the country which can become a disadvantage if the country proves to be the main market for the output of the exported process; requires high costs; a form difficult to implement; and high financial risks.

Wholly Owned Subsidiary (WOS): As a more integrated entry mode, a WOS allows a company with a transitional strategy to use profits generated in one market to improve its competitive position in another market (Hill, 2011). In this type of entry mode, a company can establish operations in a foreign country without direct involvement of the company from that country (Ling, Ibbs & Cuervo 2005). According to Hill & Jones (1998) a WOS can be set up either by acquisition or by establishing a completely new entity (Greenfield investment) risk and uncertainty.

Strategic alliances: Strategic alliances enable a firm to compete in the global market by building new sources of competitive advantages. It helps a firm in gaining access to desired strategic capabilities by linking to a partner with complementary resources, or by pooling its internal resources with a partner processing similar capabilities (Nohira & Garcia-Pont, 1991; Porter & Fuller, 1986 cited in Chen & Chen, 2002 etc.). A Strategic Alliance (SA) is a long-term inter-corporate association without an affiliated organization based on trust and a mutual respect for each participant's business needs, used to further the common interests of the members that can include customers, governments, suppliers, engineers, financial institutions, and other contractors. According to the positions of the partners in the supply chain, a strategic alliance can be either horizontal when partners are on the same level (e.g., between contractors or vertical when partners are on different levels, between an owner and a contractor). An entrant can form a strategic alliance with local firms, firms from another country, or firms from its own country. Within a strategic alliance, partners agree to share resources, technology, profits, and jobs, and supplement each other's' needs for a long period of time. Unlike a joint venture company, a strategic alliance does not involve an incorporated subsidiary, affiliate, or partnership, and normally staff remains attached to the parent organizations. Instead, it is for a long-term cooperation or a group of projects, which is different from a joint venture project that is for a specific project. In general, a strategic alliance can help entrants to reduce investment risks, share technology, improve efficiency, enhance global mobility, and strengthen global competitiveness. An alliance with a local partner can aid in obtaining the construction permit and getting

acquainted with local construction codes and market situations such as labor availability and competitor information (Badger & Mulligan, 1995; Tse, Pan, & Au, 1997).

Advantages of strategic alliances: Firms that involved in strategic alliances stand to gain a lot of benefits that include the following (Hill, 2000).

1. Cost sharing and saving: The firms that would not have been able to finance certain projects will be able to do so, when resources are pool together. Also, the savings from the alliance will be used effectively to pursue other strategic objectives.
2. Complementary skills and other resources advantages: Firms that are endowed with complementary skills and other resources form alliance to take advantage of their complementarities to tap opportunities. Through this they are able to achieve goals/objectives with minimum cost.
3. It facilitates entry into a new market: Firms can form alliances to enable them penetrate a new market. This is especially, when either of the collaborating partners are already used to the new market. This helps to break the barriers of new entrants into the new market.
4. Minimizes the risk of competition: Strategic alliances by firm are a potent tool for coping with high degree of rivalry in an industry. Through an alliance, they are able to control price and supply to the market for mutual benefits.
5. Risk Reduction and diversification: The risk of the business is collectively shared by the partners, unlike a situation where one firm bears the risk and uncertainty of a business; the collaborating firms in an alliance bear the risk that may arise from the business.
6. Economics of Scale: Through strategic alliances, firms in the collaboration will be able to raise enough capital to benefit from bulk purchases which attracts discounts and other benefits that lower cost and selling prices of the firm's goods/services. This reduction is a competitive tool for winning rivals in competitive market.

Disadvantages of strategic alliances- despite the fact that strategic alliances have been embraced by a number of firms as easy way out of the global economic challenges and other environmental constraints that hinders a firm effectiveness; it is however confronted with a number of challenges between or among firms in the union which include the following (Hill, 2001).

Management problem: The value of the collaborating firms differs, so also are the managers different in their preferences and culture. These differences in value and preferences structure can be a source of conflicts among managers from the collaborating firms.

Low- cost route to new technology and new market: Strategic alliances among firms allow some firm to have cheap access to new technology that would not have been easy to come by through research and development (R&D) or imitation. However, this benefit will be achieved at the expense of the original owner of the technology. Also, at the expense of the partner(s) that is already familiar with the market. A firm in the union may suffer the risk of receiving less than what it contributes to the alliance.

METHODOLOGY

The methodology encompasses all set of directions, processes and procedures that govern the research study. The methodology includes the research design, sampling, method of data collection and method of data analysis (Collis & Hussy, 2009).

Research Design: The study employs a comparative case study design to investigate the various entry modes available to the Nigerian Quantity Surveying Firms (NQSFs) with international

practices experience. Multiply case study is used to explore a subject of interest using more than one setting (cases) to generate in-depth knowledge and understanding. In a multiple case study, the research must involve more than one data collection methods and may include both quantitative and qualitative data (Collis & Hussey, 2009). Thus, a comparative cross-case study analysis of all the four (4) firms/cases was carried out to understand and explore similarities and differences among them in term of entry modes to foreign countries.

Population, Sampling and Sampling size: The study identified only four Nigerian Quantity Surveying Firms (NQSFs) with experience in international practice. All NQSFs with foreign practices experience are based in Lagos (3) and Abuja (1). All members of the population were sampled. Additionally, all the quantity surveyors employed by these NQSFs were also participants in the sampling for quantity surveyors. The study suffers from a limitation of small sample size given that less than 30 quantity surveyors are known to have international experience with the NQSFs. Eventually, only 22 questionnaires were returned ready for analysis.

Methods of data collection: The primary approaches to data collection for this study are through the use of structured questionnaires and document examination or scrutiny. Similarly, the comparative case study approach for this study encompasses both the quantitative and qualitative data collection methods. **Questionnaire Survey:** A structured questionnaire administered to the selected firms in Lagos and Abuja which assessed the most used entry mode for the NQSFs. Responses was elicited on a 7-point Likert type scale formats anchored on “extremely important” (7), “highly important” (6), “moderately important” (5), “important” (4), “fairly important” (3), “slightly important” (2) and “not important” (1). **Document Scrutiny:** A second data collection approach involves the use of document examination or scrutiny. This is achieved through the examination and extraction of data from past oversea or foreign projects documents that the NQSFs were involved (Beri, 2000; Collis & Hussey, 2009).

Method of Analysis: The analysis of the collected data was carried out using descriptive statistical tools such as frequency and percentage as well as the measure of central tendency (mean, median & mode) and measure of spread (standard deviation). **Frequency distribution and Percentage:** frequency is the total number of observations of an item while the frequency distribution is an array or a summary of all the frequencies of individual items within a particular variable. Percentage is the number of times an item appears as a proportion of the whole. **Measures of central tendency and spread:** the measure of central tendency provide a unique may to summarise a data set with a single statistic. The mean for example is the average of a data set which is calculated by dividing the sum of the values in data set by the number of values in the data set. The measure of spread enables us to understand how the data set spread around the centre. Range, variance and standard deviation are popular ways to measure the spread of a data set (Borden & Abbot, 2002; Chisnall, 2001; Morenikeji, 2006).

RESULT and DISCUSSION

Most Frequently Used Entry Modes by NQSFs (Through Survey): The five (5) possible entry modes of for NQSFs identified from relevant literatures were assessed. Table 1 shows the responses of respondents that joint venture (JV) is the entry mode of choice with 100percent usage i.e. no any modes was chosen by the respondents.

Table 16 most frequently used entry modes

Entry modes	Frequency	Percent	Valid Percent	Cumulative Percent
Joint Ventures	22	100.0	100.0	100.0
Licensing	0	0	0	0
Strategic Alliance	0	0	0	0
Wholly Owned	0	0	0	0
Subsidiary (WOS)				
Turnkey	0	0	0	0

Most Frequently Used Entry Mode by NQSFs(Document Scrutiny): The observations and extractions from document scrutiny of NQSFs with international experience in Lagos and Abuja to determine the most frequently used entry mode for international practice indicates that Joint Venture (JV) is the most frequently used(see table 2). In this study, JV emerged as the most frequently used entry mode by NQSFs into the international market. As an important means of international expansion, international joint ventures (IJVs) have been implemented with increasing frequency (Osborn & Hagedoorn, 1997; Hitt *et al.*, 2000; Dhanaraj & Beamish, 2004 cited in Lu & Beamish, 2006).

Table 17 most frequently used mode (document scrutiny)

Cases	Country	Building/Civil Engineering Project	Private/Public	Entry Mode
Case 1	Rwanda	Building project	Private	Joint Ventures
	Gambia	Building project	Private	Joint Ventures
	Niger republic	Building project	Private	Joint Ventures
Case 2	United Kingdom (UK)	Building project	Private	Joint Ventures
Case 3	United Kingdom (UK)	Building project	Private	Joint Ventures
	Ghana	Building project	Private	Joint Ventures
	United states (US)	Building project	Private	Joint Ventures
	Kazakhstan	Building project	Private	Joint Ventures
Case 4.	Ghana	Building project	Public	Joint Ventures

Benefits, Cost and Risks of Entry Modes: The study assesses the various entry modes according to benefits, cost and risks. The various entry modes were ranked based on the mean and standard deviation. Table 3 shows the responses of respondents that joint ventures under benefits ranking has the highest mean score of 7.00 and standard deviation of 0.00 which indicates that it has the highest benefits over licensing, it also shows that joint venture has the highest mean of 3.00 and standard deviation of .690 in term of cost over licensing and also shows that licensing has the highest mean of 6.55 in term of risks which implies that it has a higher risk than others. In this study, joint venture was shown to be the most preferred entry mode. Under the examination of different entry mode according to cost, benefits and risks joint venture has a low cost, highest benefits and low risks. Albaum & Duerr (2008) bring up the fact that companies are considering different types of entry modes when expanding in the international market, as a mode of entry, a JV is very common in international market.

Table 18 Entry Modes according to Benefits, Costs & Risks

Entry modes	Benefits		Costs		Risks	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Joint Venture	7.00	.000	3.00	.690	2.32	.477
Licensing	4.64	1.177	1.55	.510	6.55	.510
Strategic alliance	-	-	-	-	-	-
Wholly Owned Subsidiary (WOS)	-	-	-	-	-	-
Turnkey	-	-	-	-	-	-

CONCLUSION AND RECOMMENDATIONS

The study investigates the most frequently used entry modes in international practice of NQSFs with international practice experience. The study reveals through the survey of quantity surveyors working for NQSFs with international practice that JV is the most frequently used entry mode. Similarly, document scrutiny of projects handled by NQSFs with international practice also indicates that JV is the most frequently used entry mode. Additionally, the study also reveals that JV is most preferred entry mode due to its superior benefits and cost efficiency. The study therefore concludes that JV is the preferred entry mode of choice for any potential NQSFs contemplating foreign operations. The study recommends for the formulation and implementation of policies to support capacity development of NQSFs to deepen international practices within Africa and beyond. The benefits to the NQSFs and the Nigerian economy are immense in terms of job creation, diversification of exports, foreign exchange earnings and improvement in global best practices and international competitiveness. The study also recommends for further studies on the how NQSFs can improve international consulting practices in Africa and beyond and becoming one of Nigeria's global players.

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AN APPRAISAL OF PROJECT MANAGERS' ROLE IN BIM-BASED PROJECTS

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ABSTRACT

Over the last decade, there have been many solutions developed to resolve the problem of poor performance in the construction industry, yet the problem persists. To address this proactively, BIM is employed as one of the most recent approach currently in use. Research reported that Construction Practitioners (CPs) lack of understanding of the roles of project manager is one of the factors leading to ineffectiveness in teamwork within the construction industry. Hence, adding another layer of role i.e. BIM-Based role within the existing Project Manager roles, which is now an inevitable requirement for successful Project Management can only further increase the complexity of role clarity and conflict amongst team members. Therefore, this current research assessed the project managers' role perceptions in a BIM-Based project. The BIM-Based roles and responsibilities used in the study were identified from literature and used in the survey to collect data from respondents and afterwards analysed using descriptive statistics. Findings had established that CPs were of the perception that all the identified roles can be influenced by BIM implementation and as well can influence BIM implementation even though the degree of influence differs. The research recommends that CPs requires some form of education on how PM roles can indeed be influenced by BIM implementation and/or influence the implementation of BIM for improved performance.

Key words: Building Information Modelling (BIM), Construction Practitioners (CPs), Project Manager/Project Management (PM), Project Success.

INTRODUCTION

The construction industry has suffered from a decline in productivity for some time. The industry is one of the largest industries in the world economy, but its productivity has fallen as compared with other sectors for decades. McKinsey (2017) report concludes that a key way to improve the poor productivity in the construction industry is by using digital technology.

Building Information Modelling (BIM) is one of the most recent approach that can bring about the most desired change and improvement in productivity (NBIMS, 2007; Eastman, Teicholz, Sacks & Liston, 2008; Gu & London, 2010; Azhar, 2011; Jung & Joo, 2011). BIM was developed as a means of tackling the issues contributing to inadequate levels of productivity in the Architectural, Engineering and Construction (AEC) industry (Eastman *et al.*, 2008; Azhar, 2011; Andy, Francis & Abid, 2011; Lee, Park & Won, 2012; Abubakar, Ibrahim & Bala, 2014; Ding, Zhou & Akinci, 2014).

It has been well established that effective project management contributes to project success (Carvalho, Patah and de Souza Bido, 2015; Joslin and Müller, 2015). This requires the roles and responsibilities of the project manager to be clearly defined. In today's construction context, when the use of BIM is likely to become mainstream, this aspect still holds true because rather than BIM diminishing the role of the project manager, it actually enhances and sharpens it.

More recently, research found out that project managers have been left out of the mainstream action on BIM, partly due to lack of engagement on their part and partly because the front-end use of BIM in design has been in the limelight. This situation needs to change because effective project management is critical to ensuring successful BIM implementation and successful project delivery (RICS, 2015; RICS, 2017)

Previous studies have established that the role and function of the project manager in BIM implementation across different types of projects, including BIM-driven changes to existing project management roles, responsibilities and practices have not been fully documented. However, this study tends to address it.

LITERATURE REVIEW

BIM-Based Project Delivery and its Challenges

BIM based project delivery can be known as the project which is based on BIM applications and spans over the entire life cycle of a facility such as; project programming, design, preconstruction and post-construction phases. According to Autodesk (2016), the traditional 2D CAD-based design approaches focused on increasing the productivity of the construction document phase, a BIM-based design workflow changes the process in a more fundamental way by enabling the sharing and incremental enhancement of design information through all project phases. The productivity and economic benefits of BIM to the AEC industry are widely acknowledged and increasingly well understood. Further, the technology to implement BIM is readily available and rapidly maturing. Yet BIM adoption in most of the developing countries has been much slower than anticipated (Azhar, Hein & Sketo, 2008; Masood, Kharal, & Nasir, 2014).

BIM-Based Roles and Responsibilities

Essentially, the key role that every PM play on projects is to bring together a team of experts and integrate their knowledge into a design that is buildable which pays attention on cost, quality, reliability, sustainability, and policy setting and needs, and creates value. to project sponsors, project team members, and end users. The role of the PM is key as the “Project Integrator”, being responsible for integration throughout the project (various project stages) and at all levels of organisations, processes, and information. The success of a project depends on how effective the PM can be in integrating these steps. With BIM as the leading provider of effective integration, it is important for PM to understand how to use it and apply it for their projects.

BIM implementation in construction projects is expanding its scope to include project management alongside the convention of managing design and construction related information. Hence, Table 1 presents the BIM-Based roles and responsibilities of the project manager.

Table 1: BIM-Based Roles and Responsibilities of the Project Manager

BIM-Based Roles and Responsibilities

Definition and identification of client organisation structure

Identification of key stakeholders and managing their inputs

Advising on statutory requirements and their management

Assisting with strategic decision-making

Identifying needs and developing the project brief and project execution plan

Establishing roles and responsibilities of project teams e.g. client, professional, contractor etc

- Leading and managing project teams
- Identifying and managing project risks
- Coordinating legal and other regulatory consents
- Advising the selection/appointment of the project team
- Advising on alternative procurement strategies
- Advising on risk management strategy
- Administering consultant appointments and construction contracts
- Establishing communication and management protocols
- Managing the feasibility and strategy stages
- Establishing the project budget and project program
- Managing the integration and flow of design information
- Managing the preparation of design and construction programs/schedules and critical path networks
- Conducting tender evaluation and contractor selection
- Establishing time, cost, quality and function control benchmarks
- Managing and administering contracts e.g. relationship, construction etc
- Controlling, monitoring and reporting on project progress in terms of cost, quality, function and project program
- Assisting in the handover process at completion

Source: RICS, (2017).

BIM in Project Management

BIM's potential in construction projects is consistent with PMBOK information, since the nature and role of each element is similar. Therefore, BIM can be considered as an effective and powerful tool in project management in the construction industry as it can be able to increase efficiency within construction team members thereby bringing an end to the ever-existing poor performance.

Integration management is the first area of PMBOK, which has the same function as the BIM. BIM integrates the documents, plans and efforts of all parties involved on a project. BIM is also an object-based environment that can categorize different elements of a building and break it down into different groups, like what occurs in project scope management. Another characteristic of BIM is its capability in managing time and cost or what is allegedly called 4D and 5D. This is similar to project cost and time management areas in PMBOK standard. Although the constructability does not illustrate all risks associated with a construction project, it is a powerful tool in building a project and mitigates the construction risks. Clash detection in BIM acts as a quality process which visually recognizes, modifies and analyses the soft and hard clashes. Collaboration and team building in BIM is what human resource management considers as a project management area. Communication is a main feature of BIM which facilitate the professional relationship between all parties including project managers, designers and engineers on a construction project by creating effective and direct communication channels. Finally, procurement management would be possible by quantity take-offs which are produced by BIM. In addition, changes in any item can be easily reflected in cost and time and work needed for its procurement. In spite of the extensive framework of project management, BIM can be presented as a main and effective concept corresponding to project management knowledge areas (NBS, 2015; PMBoK, 2017).

In research conducted by Rokooei (2015), it was found that since interrelationship is the main area of the BIM feature, user characteristics affect the effectiveness of BIM. BIM users include all parties and professionals involved; hence, attitudes of team's members should be considered as an effective factor, specifically, project managers as the core of communication channels. Experience level of project managers has a direct relationship with the success of BIM on a construction project. Thus, considering the BIM knowledge as an excessive capability for construction project managers should be withdrawn; instead, having appropriate experience and knowledge in BIM should be set as a criterion for admission of a construction project manager.

Project managers have a very important role to play, to help clients achieve their objective, for on-time delivery, within budget, at optimal quality, with zero accidents, with optimised operational or lifecycle cost, and reduced environmental impact, and technology and processes like BIM can really help balance all these things, and allow better engagement of all the stakeholders (Montague, 2015; RICS, 2017).

RESEARCH METHODS

A quantitative research approach was adopted for this study due to the nature of the research. The study also explored literature within PM and BIM, PM BIM-Based roles and responsibilities and a streamlined review on BIM in PM. In addition, construction industry practitioners were the targeted population for this study. Therefore, the list of the professionals actively involved in the construction industry includes but not limited to, Architects, Builders, Estate surveyors and valuers, Land surveyors, Quantity surveyors, Town planners, Civil, Electrical, Mechanical and Structural Engineers (Rivera & Kashiwagi, 2016). To achieve the purpose of this study, four of these professionals were selected; they include the architect, builder, engineer (structural and mechanical/electrical engineer) and quantity surveyor. According to Architects Registration Council of Nigeria (ARCON) report 2017, there are about 3,651 registered architects in the country. Council of Registered Builders of Nigeria (CORBON) in their 2018 report has 2,259 registered members. Also, Council for the Regulation of Engineering in Nigeria (COREN) there are 42,835 registered engineers in the country. The Quantity Surveyors Registration Board of Nigeria as at 2018 has 3,271 registered members. The construction professionals were drawn from consulting firms, construction organisations, financial institutions, academics and government ministries, parastatals and agencies at federal, state and local governments. The sample size for this research was deduced to 176 CPs by using Yamane (1986)'s formula. Purposive sampling was adopted in selecting the relevant CPs, taking into considerations the likelihood that not all the practitioners will be experienced enough to provide reliable answers to the questions raised in the questionnaire. In addition, the study collected data from field by administering a closed-ended questionnaire to practitioners. The key stakeholders were selected because they were considered to be in a position to provide relevant information for the study in line with the views of Oppong (2013) who opined that selecting subjects to take part in a research should be based on their ability to provide information considered relevant to the research problem. The questionnaire presents a list of PM BIM-Based roles and responsibilities in a construction project and respondents were requested to indicate the extent of their belief with the PM roles that can be influenced by BIM implementation and those roles that can influence BIM implementation. In the survey, a total of 250 questionnaires were purposely distributed to the CPs, 124 were returned which amounted to 49.6% response rate. However, going by Moser and Kalton (1971)'s assertion, if a response rate of above 40% is retrieved from a survey, the results could be considered significant and accepted as valid, thus the study sample was

considered adequate. Data collected from CPs who were purposely selected and also have worked on different construction projects were statistical analysed using descriptive statistics.

RESULTS AND DISCUSSIONS

Results

Table 2: Respondent's Information

	No	%		No	%
Main Professional Background			Working Experience		
Architect	35	28.2	1-5 years	14	11.3
Builder	22	17.7	6-10 years	43	34.7
Engineer	29	23.4	11-15 years	35	28.2
Quantity Surveyor	38	30.6	16-20 years	16	12.9
Total	124	100	Greater than 20 years	16	12.9
			Total	124	100
Nature of Projects Handled			Undertake Project Management Services		
Building	73	58.9	Yes	54	43.5
Civil Engineering	17	13.7	No	70	56.5
Heavy Engineering	1	0.8	Total	124	100
Multiple	33	26.6			
Total	124	100			

Source: Field Survey, (2018).

Findings from the field survey undertaken to appraise Project managers' role perceptions in a BIM-Based project revealed the general information of respondents through descriptive statistics. Also, results of the main subject matter addressing the objectives were presented in this chapter.

Respondent's General Information

The table above presents four main professional background, five categories of working experience, four classification of project types handled and two distinctions of whether or not they undertake project management services.

PM BIM-Based Roles and Responsibilities

Respondents were asked to indicate their level of believe on how each responsibility '*can be influenced by BIM implementation*' and/or '*can influence the implementation of BIM*' in construction projects based on five-point Likert scale. Table 3 and Table 4 shows the breakdown of the responses gathered. The responses of "Not at all Influential" and "Slightly Influential" scales were combined as one category of "Not Influential" while the responses of "Very Influential" and "Extremely Influential" scales were combined as one category of "Influential". Converting the responses in this way will make it easier to analyse if the proportion of influential is statistically different from the proportion of not influential.

Using a 5-point likert scale, respondents were requested to indicate their extent of believe with each of the roles that can be influenced by BIM implementation and roles that can influence BIM implementation respectively. Standard deviation was adopted in this work as the means of judgement where a scale exists. For this study, since it's not a normal distribution one standard deviation was adopted. The results of the analysis presented in Table 3 and Table 4 shows the mean score, standard deviation and ranking of respondent's responses.

Table 3: Mean Response and Ranking of PM Roles that can be influenced by BIM implementation

Roles that can be influenced by BIM implementation	Mean	Std. Deviation	Ranking
Managing the integration and flow of design information	3.91	1.03	1
Establishing time, cost, quality and function control benchmarks	3.88	1.11	2
Establishing the project budget and project program	3.83	1.01	3
Controlling, monitoring and reporting on project progress in terms of cost, quality, function and project program	3.82	1.05	4
Leading and managing project teams	3.76	1.12	5
Identifying needs and developing the project brief and project execution plan	3.71	0.98	6
Managing the feasibility and strategy stages	3.71	1.08	6
Assisting with strategic decision-making	3.70	1.04	8
Establishing roles and responsibilities of project teams e.g. client, professional, contractor etc	3.63	1.08	9
Managing the preparation of design and construction programs/schedules and critical path networks	3.60	1.13	10
Establishing communication and management protocols	3.55	1.08	11
Advising the selection/appointment of the project team	3.50	1.20	12
Identifying and managing project risks	3.46	1.08	13
Conducting tender evaluation and contractor selection	3.46	1.22	13
Administering consultant appointments and construction contracts	3.43	1.35	15
Advising on risk management strategy	3.42	1.12	16
Assisting in the handover process at completion	3.39	1.38	17
Advising on statutory requirements and their management	3.34	1.19	18
Advising on alternative procurement strategies	3.34	1.19	18
Managing and administering contracts e.g. relationship, construction etc	3.32	1.16	20
Identification of key stakeholders and managing their inputs	3.15	1.26	21
Coordinating legal and other regulatory consents	3.15	1.29	21
Defintion and identification of client organisation structure	3.10	1.30	23

Source: Field Survey, (2018).

Table 3 showed the highest mean score of 3.91 and 3.88 which when approximated to 4.0 will translate to “Very Influential”, is indicating that *managing the integration and flow of design information* and *establishing time, cost, quality and function control benchmarks* are roles that can be influenced by BIM implementation. However, correcting their mean with one standard deviation i.e $\pm 1\sigma$, about 68% of the respondents chose between scale 3 to 5 which is “*Somewhat Influential*” and “*Extremely Influential*”. Also, on the table are ranking of the PM roles that can be influenced by BIM implementation. The result showed that *managing the integration and flow of design information* ranked first with a mean score of 3.91 can significantly be influenced by BIM implementation. The next major PM role identified and ranked as the second was *establishing time, cost, quality and function control benchmarks* with a mean score of 3.88 can be highly influenced by BIM implementation. However, *coordinating legal and other regulatory consents* and *Definition and identification of client organisation structure* with a mean score of 3.15 and 3.10 were ranked 21st and 23rd respective PM roles that can be influenced by BIM implementation.

Table 4: Mean Response and Ranking of PM Roles that can influence BIM implementation

Roles that can influence BIM implementation	Mean	Std. Deviation	Ranking
Assisting with strategic decision-making	3.86	1.08	1
Defintion and identification of client organisation structure	3.84	1.23	2
Establishing communication and management protocols	3.84	1.04	2
Establishing time, cost, quality and function control benchmarks	3.83	1.01	4
Advising on statutory requirements and their management	3.77	0.94	5
Establishing the project budget and project program	3.76	1.13	6
Identification of key stakeholders and managing their inputs	3.73	1.20	7
Identifying and managing project risks	3.73	1.17	7
Managing the feasibility and strategy stages	3.72	1.06	9
Leading and managing project teams	3.71	1.24	10
Managing the integration and flow of design information	3.71	1.16	10
Establishing roles and responsibilities of project teams e.g. client, professional, contractor etc	3.64	1.17	12
Identifying needs and developing the project brief and project execution plan	3.60	1.10	13
Advising the selection/appointment of the project team	3.58	1.26	14
Administering consultant appointments and construction contracts	3.57	1.18	15
Conducting tender evaluation and contractor selection	3.57	1.12	15
Advising on alternative procurement strategies	3.54	1.15	17
Advising on risk management strategy	3.54	1.11	17
Managing and administering contracts e.g. relationship, construction etc	3.50	1.14	19
Controlling, monitoring and reporting on project progress in terms of cost, quality, function and project program	3.46	1.14	20
Managing the preparation of design and construction programs/schedules and critical path networks	3.45	1.27	21
Assisting in the handover process at completion	3.33	1.25	22
Coordinating legal and other regulatory consents	3.31	1.05	23

Source: Field Survey, (2018).

From Table 4, it can be seen that respondents believed that all the identified roles can influence BIM implementation. However, the level of influence differs as indicated by the mean score. *Assisting with strategic decision-making*, *Defintion and identification of client organisation structure* and *Establishing communication and management protocols* are roles with the highest mean score of 3.86, 3.84 and 3.84 respectively which when approximated to 4.0 translate to “Very Influential”. More so, correcting their mean with one standard deviation i.e $\pm 1\sigma$, about 68% of the respondents chose between scale 3 to 5 which is “*Somewhat Influential*” and “*Extremely Influential*”. Table 4 above also showed the ranking of respondent’s responses on the PM roles that can influence BIM implementation. The result showed that *Assisting with strategic decision-making* ranked first with a mean score of 3.86 can essentially influence BIM implementation. The next major PM roles that can influence BIM implementation as identified and ranked the second were *Defintion and identification of client organisation structure* and *Establishing communication and*

management protocols with both having the same mean score of 3.84. However, *assisting in the handover process at completion* and *Coordinating legal and other regulatory consents* with a mean score of 3.33 and 3.31 were ranked as the 22nd and 23rd of the least PM roles that can influence BIM implementation.

DISCUSSIONS

In line with the findings of Meng & Boyd (2017) and Battistella, Nonino & Palombi (2017) that lack of understanding of roles and responsibilities amongst team members would only lead to conflict and inefficiency, adding another layer of role within construction project i.e. BIM-based PM role and responsibilities can only further exacerbate the already confusing roles situation in the Nigeria construction industry as this finding further confirms which is also in support (Adeyinka *et al.*, 2014).

The result of BIM-Based roles and responsibilities from Table 3 and Table 4 shows that some of the roles and responsibilities can be influenced by BIM implementation as well as can influence the implementation of BIM in construction projects. This is in line with RICS, 2017 report where *Managing the integration and flow of design information; Establishing time, cost, quality and function control benchmarks; Controlling, monitoring and reporting on project progress in terms of cost, quality, function and project program; Conducting tender evaluation and contractor selection; Managing the preparation of design and construction programs/schedules and critical path networks; Establishing the project budget and project program; Managing the feasibility and strategy stages; Establishing communication and management protocols* can both influence and can be influenced by BIM implementation. Whereas, the result of the survey indicated that *Definition and identification of client organisation structure; Identification of key stakeholders and managing their inputs; Advising on statutory requirements and their management; Coordinating legal and other regulatory consents; Advising the selection/appointment of the project team; Advising on alternative procurement strategies; Advising on risk management strategy; and Assisting in the handover process at completion* can both influence and can be influenced by BIM implementation. This is contrary to the RICS, 2017 report which shows that this roles and responsibilities can only influence BIM implementation.

Also, the result from table 3 and 4 shows that on the average, respondents generally believed that the identified roles can be influenced by BIM implementation as well can influence BIM implementation even though the degree of influence differs as highlighted by mean of each group. From the results, it can be concluded that all the roles and responsibilities can indeed be influenced by BIM implementation and can influence the implementation of BIM for improved project performance even though is not supporting the report of RICS (2017).

The implication of this study is that the research added to the PM existing body of knowledge by harmonising PM and BIM. The findings of this study demonstrated that CPs were of the perception that the PM roles can be influenced by BIM implementation as well as can influence BIM implementation. This add to the insight of PM and BIM in construction project. Inferences is also drawn from the finding that BIM would have a great influence on the PM aspects and processes.

CONCLUSION

Based on the study's findings, CPs were of the perception that the identified roles can be influenced by BIM implementation as well as can influence BIM implementation. However, it can be concluded that the findings revealing that some roles and responsibilities can be influenced by BIM implementation is contradicting literature. Finally, the study concludes that CPs within the NCI perceived that BIM can influence all the project management aspects and processes. The research recommends that CPs would need to acquire some level of education on how BIM can influence the roles of PM for improved efficiency amongst construction team members.

The study is limited to Nigeria as it only appraised the perceptions of construction practitioners in Nigeria. Hence, it did not provide any research implications of practitioners in any other industry. Quantitative approach was employed in the study by means of measuring construction practitioners' perceptions on the role of project management in BIM-enabled construction projects and did not encompass a qualitative approach to provide deep insights about the practitioners' perceptions. Structured questionnaires were used to collect data from respondents. Hence, this study did not provide insights about the perceptions of practitioners towards their responses due to lack of open-ended questions.

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CONSTRUCTION PROJECT DELIVERY IN A DEREGULATED ECONOMY

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ABSTRACT

Construction projects located in Nigeria suffer from many problems and complex issues and this ultimately impact on the country's economic development. Consequently, the aim of this paper is to assess the Role of Quantity Surveyor in Construction Project Delivery in a Deregulated Economy. The specific objectives of the study are to examine the effect of deregulated of materials specification as stated in bill of quantities (BOQ) on building construction project delivery in Nigeria. The methodology adopted was focused group discussion (FGDs) method. The study explores both primary and secondary sources of data collection. Primary data were collected mainly through in-depth interview and Focused Group Discussions (FGDs). The populations of the study involved 20 interviewed respondents and 5 FGDs participants. The interview was carried out on contractors and foremen on construction site while the FGDs were conducted in two sessions. Each session featured five (5) participants in an intensive deliberation on the subjects of study, with the researcher providing the lead. The method of analysis employed was qualitative descriptive. The qualitative element enables the researcher to utilize focus group discussion analysis with involved arguments points. The researcher constructed a conceptual model map, with its target Group Argument Discussion (GAD). The study revealed that if the government implements policies on regulating construction project, it will save the country from financially loss resulting from delay in project delivery and high rate of collapsed buildings. It was concluded that the current policy and regulation in the country is only on paper. Therefore, it was recommended that the Federal Government of Nigeria should see to the effective adherence to the regulation so as to improve efficiency of construction project delivery.

Keywords: Construction, Deregulation, Economy, Project Delivery.

INTRODUCTION

The importance of good structures (building, road etc.) in the society has necessitated the need for improvements in the standard of construction, this is possible through coordinated and committed participation of all stakeholders in the industry using the appropriate regulations as the key guide and document for quality management. However, there has been increase in cases of building collapse in Nigeria in recent times, which has brought to the fore the effectiveness of instituted construction regulations (Ruya, Chitumu and Jatau, 2017).

Policies and procedural frameworks are regulations guiding the building industry. These rules and regulations include Environmental Laws; Health and Safety; Environmental Impact Assessment; Approval Processes of Awarding of Contract and Payment; Construction and Other Ethical Practices (Usman, Kamau, and Mireri, 2014). These ethical standards are used in

enhancing construction project delivery in an economy. These are laid down rules and regulations guiding the various stake holders on project delivery within the construction industry.

Regulation of building construction in Nigeria is done through a statutory authority known as the Council of Registered Builders of Nigeria - CORBON, whose function is to establish and oversee the construction industry and coordinate its development. The Council of Registered Builders of Nigeria - CORBON is mandated to encourage the standardization and improvement of construction techniques and materials, provide, promote, review and co-ordinate training programs for skilled construction workers and construction site supervisors, accredit and register contractors and regulate their professional undertakings, accredit and certify skilled construction workers and construction site supervisors, develop and publish a code of conduct for the construction industry.

Policy/procedural frameworks are laws governing the construction industry to successful project delivery. In developed economies, building laws, regulations and codes are established for use in the building industry. For example, UK has professional and regulating bodies, research institutions as well as effective utilisation of their tertiary institutions to ensure the production of buildings and proper management at every stage (Jambol, 2012).

In a study by Ofori (2014), USA developed building legislation from a Uniform Building Code (UBC) to the Standard Building Code (SBC) and to International Building Code (IBC). The UK and American legislation promote good building practice just like other developed economy but in developing economy there are no standard rule and guideline governing construction industry. The few that have are poorly monitored/deregulated as Usman *et al.* (2014) points that in Nigeria, policies are there but lack of compliance is what's happening in practice. Jambol (2012) said that Nigeria have National Building Code (NBC) that provided policies and procedures for building construction processes. However, the same person (Jambol, 2012) lamented that the Nigerian Building Industry (NBI) is fragmented, underperforming, uncoordinated, undisciplined and operating as if there are no laws guiding its operations. These are serious threats to project delivery within the building industry.

In spite of the laws guiding the NBI, the Nigerian construction industry is still characterized with the problem of substandard materials and workmanship; and can be controlled by proper use of the appropriate regulations (Umeokafor, Umeadi & Jones, 2014). The Quantity Surveyors as key personnel that control materials specification and labour supplied need to put it hand in the right

place if construction project has to be delivered to standard. As materials have to be certified before they are used on site; and each level of the building processes, must be inspected and approved by them. Hence, this study is to assess the role of Quality Surveyor in construction project delivery in a deregulated economy. The objectives of the study were:

1. To examine the effect of deregulation of materials specification as stated in bill of quantities (BOQ) on building construction project delivery in Nigeria; 2. To examine the effectiveness of quantity surveyors' professional body (The Nigerian Institute of Quantity Surveyors, NIQS) in regulating construction projects in Nigeria; 3. To analyse the problems associated with construction standard and regulations in Nigeria. The study thus hypothesised that:

There is significant relationship between regulated and deregulated materials specification on building construction project delivery in an economy.

LITERATURE REVIEW

Construction regulations are statutory instruments that seek to ensure that the construction policies set out in the relevant legislation are carried out. Construction regulations approval is required for most construction work in any given country. In construction, regulation involves registration of contractors, projects, skilled construction workers, construction site supervisors, training institutions, and provisions relating to collection and payment of the construction levy.

Regulations are often not complied within quality control of materials and work on site (Baake, Kamecke & Wey, 2007). Ayuba, Olagunju and Akande (2011), categorized the problems in practice into two broad groups - unsound regulations and unused regulations. Unsound regulations arise because regulations are often not well-written. Unused regulations refer to problems that arise when specified products/services are not used. The causes of unsound regulations, according to Ayuba *et al.* (2011) are misuse or misquoting of standards, non-compliance with regulations, pseudo-specifications (more content than needed and not job specific) and conflict with drawings; unsound regulations are those that are unused by contractors and unused by contract administrators or construction enforcement officers.

Regulatory Framework and Construction Standard

Regulation is treated as synonymous with law. Regulations are rules or norms adopted by government and backed up by some threat or consequences, usually negative ones in the form of penalties. While a regulatory framework on the other hand, refers to a system of regulations and the means used to enforce them. These are usually established by industry regulatory bodies to regulate the specific activities (Edinburgh, 2003). According to the Nigerian Institute of Quantity Surveyors (NIQS), regulatory framework is the due process of regulation surrounding a single topic that entails all of the relevant legislative documents (acts, regulations, annexes) and describes the agency or body responsible for administering the framework.

The Building Regulation finds it necessary to identify the factors that promote and determine the future regulation process of the building and regulation process and associated standards and guidance in the next 20 years in relation to sustainable construction issues (Architect and Quantity Surveyors Act, 2010 quoted in Ruya, 2017). The factors are based on emerging scenarios relating to physical, social and economic changes that are taking place in the country and globally like international requirements, human needs and responsibilities and technological changes. Edinburgh (2003) indicated that some of the factors include climate changes, resource conservation, waste minimization, biodiversity and health and well-being of individuals and communities in and around building. The relationship between construction practices and regulations and a variety of economic growth, environmental quality and social prosperity factors is increasingly being recognized globally (Christensen, 2009).

The Current Regulatory Framework in developing countries like Nigeria results in conflicts due to inadequacy at the boundaries of the responsibilities of its composite agencies and inevitably policy and development aspirations. An ideal situation may be unachievable, but few would argue that no improvement is possible. The sustainable development agenda in particular has already brought many important issues and conflicts to the fore particular in respect of planning, land use and construction activities (Ruya, 2017). The effectiveness of the current regulatory frameworks in Nigeria are therefore of uppermost importance in building standard in the construction sector.

Some Specialized Regulatory Boards in Nigerian Construction Sector:

1. Quantity Surveyors Registration Board of Nigeria (QSRBN)

Is the regulatory body of the quantity surveying profession and practice in Nigeria? It was established by Decree No. 31 of December 5, 1986, now CAP 383 Laws of the Federation of Nigeria (LFN). Its goals include:

- To ensure that all quantity surveying graduates produced by higher institutions of learning in Nigeria meet internationally required standards.
- To eliminate quackery and ensure that all Quantity Surveyors employed in both the private and public sectors are registered with QSRBN.
- To ensure that firms carrying out quantity surveying services in the country are registered with the Board and adhere strictly to the best practices and code of conduct of the profession.

The body executes its mandate through training, registration and enhancement of ethical practice. According to the regulations, no person should practice under any name, title or style containing any of the words or phrases "quantity surveyor" or "quantity surveying" unless he is registered under the Law as a Quantity Surveyor.

2. The Society of Chartered Surveyors (2006)

Identifies that upholding ethical principles is a key reason why people rely on professional bodies. Competence and trust are central elements in generating confidence in the professions (The Society of Chartered Surveyors, 2006). Cartlidge (2011) argues that professions can only survive if the public retains confidence in them. Transparency and ethical behaviour are particularly important for quantity surveyors who are involved daily with financial transactions such as procurement, contractual arrangements, payments and valuations (Cartlidge, 2011).

3. Nema and Construction Standard

The National Environment Management Authority (NEMA) is a body established under the Environmental Management Act of the laws of Nigeria to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. NEMA has the primary responsibility of implementing environmental safeguards, although many actors have responsibilities including civil society, private consulting firms, development banks which

finance infrastructure and other government actors including local government and the court system. Currently, the system suffers from inadequate funding, corruption, a lack of engagement with important community stakeholders, gaps or duplications of regulations, and a misunderstanding by society at-large of the benefits of a sustainable and standard construction. These serious issues result in little oversight of development projects with potentially huge environmental impacts.

Impacts of Policy/Procedural Frameworks

Policy and procedural framework is a means of avoiding the ills inherent in the construction sector and which lead to project failure, incompleteness, and abandonment (Idoro, 2014). However, the success of any building project in public or private sectors depends on the level of compliance to policies/procedures and control, and strict monitoring of time, cost, material, quality and environmental constraints (Aniekwu, 2003).

Policy/procedural frameworks are supposed to be the guiding principles for building production within the built environment; unfortunately, government officials do not follow standards of town planning provisions, thereby allocating plots without following rules and procedures (Ede, 2010). This was in agreement with Ike (2012), that town planning departments were no longer performing their role as laid down by law. Contrary in Dubai, studies have shown that before any project starts, specialized property development consultants are engaged (Ike, 2012; Ede, 2010). These consultants study the soil and conduct investigation. The design carried out based on the reports of the soil investigations (Usman, Chen and Lodson, 2010) points that in Nigeria, policies are there but lack of compliance is what's happening in practice.

For instance, in Dubai, it takes eight months for a building plan to be approved (Ike, 2012). He added that contractors are not allowed to mobilize to site until after the approval processes. Besides, materials have to be certified by a consultant before they're used on site; and each level of the building processes, must be inspected and approved. With these, government and professional bodies track and monitor building production from the initial to completion phases.

In spite of the laws guiding the NBI, the problem of substandard materials and lack of compliance have continued to increase (Idoro, 2012). This is a serious bone of contention that influences cost, time and quality standards which affect project delivery. It is interesting to note that both civilian and military administrations have made the issue housing for all (new or improved) a

policy or programme that was workable but unfortunate the implementation was not impressing. Poor management and delays of projects have led to indigenous contractors suffer.

Project compliance can be used to mean the whole process of translating broad policy and procedures and specific programmes of action that can enhance project delivery. This forms the interaction between the setting of goals and the actions required to achieve them. However well formulated a policy, unless action is taken to implement it, it remains only as paper work. Adherence to policy and procedures is the full range of managerial activities associated with putting the chosen strategy into place, supervision of its pursuit, and achieving the targeted result (Idoro, 2012).

However, if there is no commitment from the organization's leaders to implement policies and procedures to achieving quality, any effort to actualize it can lead to cynicism and lessen the likelihood of its adoption and success in future. Proper compliance results from administrative decisions on how to do things and create fits between management policies and operations. Kabir, Bello, Kolo & Bustani, (2009) and Idoro (2012) opined that administrative and managerial elements are necessary to put a management policy into place and that full implementation can take several months to years depending on the amount of coordination involved.

Government Influence in enabling the Construction Industry

Government has great influence in simplification and standardization construction industry as they have fundamental power in:

- **Enabling a continuous flow of work**

Only the government can promote a sustained effort to ensuring a steadier and forecastable flow of work suitable for various categories of small and emerging businesses. It is possible to extract information on the amount and types of work suitable for various categories of small and emerging businesses, and to direct these opportunities through applicable procurement mechanisms and foster greater participation of indigenous capacities. This initiative will also encourage private sector investment in the construction industry.

- **Access to finance**

The difficulties in securing credit for construction projects on reasonable terms from Lending Institutions, especially for interim construction financing, is identified as a very important problem of the Nigerian construction industry. A prerequisite for improved access to finance, is

the regularization of this market to reduce the uncertainty which informs the investment decisions of financial institutions. Various programmes have been suggested to encourage the banks to establish specific loan-assistance programmes for emerging businesses but only the government can promote and sustain such programmes. Even access to a loan-guarantee fund can be established for encouraging emerging construction businesses. In addition, mechanisms can be worked out to enable SMEs to cede contract payments to financial institutions until their loans are repaid.

- **Payment and surety arrangements**

Sureties or performance guarantees for certain low-risk public-sector contractors could be waived by government. However, these facilities will only be accorded to enterprises with a demonstrable capacity to perform. Registration and accreditation procedures, as well as performance monitoring, will minimize and limit risk in such cases.

- **Skills formation and access to training**

Access by emerging contractors to requisite construction skills is tied to reorientation of the structure and funding of industry training, in co-operation with industry stakeholders. The government through her appropriate agencies should promote the principle of equitable and manageable payment towards training costs and the ability of contractors to access both artisan and entrepreneurial skills training through the auspices of a Sectoral education and training Authority. Generally, most small and emerging construction businesses are run by persons who may or may not have vocational training experience but are unlikely to have received any formal management training. Training schemes directed at enterprise owners and managers should be encouraged.

METHODOLOGY

The study explores both primary and secondary sources of data collection. Primary data were collected mainly through in-depth interview and Focused Group Discussions (FGDs). The interview was carried out on contractors and foremen on construction sites while the FGDs were conducted in two sessions. Each session featured five (5) participants in an intensive deliberation on the subjects of study, with the researcher providing the lead. The study conducted interviews with twenty people, eight contractors and twelve foremen.

Secondary data were, however, collected through data retrieval technique from relevant scholarly textbooks, journals, official publications, seminar and conference papers, newspapers and the Internet provided other sources of secondary data.

Target Population

Target population as described by Borg and Grall (2009) is a universal set of study of all members of real or hypothetical set of people, events or objects to which an investigator wishes to generalize the result. The target construction project population of this study was five government building construction projects in Enugu State while the study population was Consultants, Client, Contractors, Services Engineer/Project Manager, Architect, Civil/Structural, Mechanical etc.

Therefore, populations of the study involve 20 interviewed respondents and 5 FGDs participants were constituted through purposive sampling procedure. Apart from its ease of administration, purposive sampling helps to include identified key informants in the sample population.

Sample and Sampling Technique

Sample is a small group of elements or subjects drawn from the specified population of study. In other words, it is the actual number or part of a study population that is objectively and systematically selected for the study. Moreover, we sample because the entire population cannot be studied. To determine the sample size of the above estimated population of 20 and 5 participations, Taro Yamane formula or any other statistical method was not employed because of the small number of the population.

Method of data analysis

The study adopts qualitative analysis. The qualitative element enables the researcher to utilize focus group discussion analysis which involved discussion and arguments points.

RESULT AND DISCUSSION

To analysis the objectives of this study, the researcher formulated operational and conceptual models for the study as shown below.

Operationalization of Model Variables

The study will make use of two groups of variables in this study, the dependent variable and the independent variable.

Dependent variables for the study are

- **Construction project deregulated**

Independent variables are

- **Material specification in BOQ,**

- **Cost**

- **Time**

Conceptual Model for Focus Group Discussion

The model is a map for Group Argument Discussion (GAD). Thus, the conceptual model is showed below.

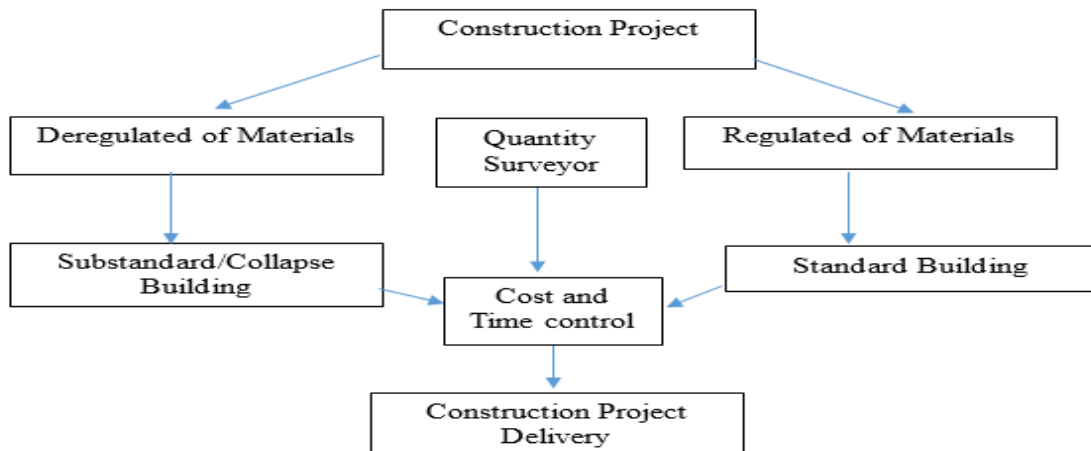


Figure 1: Researcher's Conceptual Model for GAD, 2019.

From figure 1 above, the right-hand side shows a construction project with deregulated materials as stated in bill of quantities (BOQ) while the left-hand side shows a construction project with regulated materials as stated in the contract document. The central shows the Quantity Surveyor standing to control cost and time. At the end, the graph pointed that if one decided to move either right or left it will end in cost.

Therefore, the researcher found out that if a client decided to carry out his construction project without involving the Quantity Surveyor (QS) whose major duty is acting as the accounting auditor and purchasing officers in a construction site to regulate his building construction project will end up wasting cost and time.

The focused group was of the opinion that if the government put their house in order by implementing the policies on regulating construction project as it will save the country from high rate collapse building and financially loss resulting from delay of project delivery (Ayuba, Olagunju, and Akande, 2011).

The focused group had this to say on the issue of Regulatory Boards in Nigerian. They stated that professional bodies like Quantity Surveyors Registration Board of Nigeria (QSRBN), National Environment Management Authority (NEMA), etc are not carrying out their task effectively and efficiently.

Accordingly, the focused group discussants conclude that immunity clause in the Nigerian constitution is an irritant as it covers or protects Nigerian leaders (political) and government officials who commit financial crime especially that made for construction project.

CONCLUSION

Policy and procedural are successful use in developed economy but its use in Nigeria has a break borne. It led to many questions: Is policy framework being applied only by a section of industry in Nigeria or by entire? Is policy framework seen by industry players as an effective tool that will ensure quality and durability in the building industry? Is there resistance to the application of policy/procedural framework by the industry? These posed a serious challenge in the delivery of projects on quality, cost and time overruns; however, these challenges can be mitigated by compliance and adherence to professional ethics within the building industry in developing countries.

The measuring tool for construction project delivery are cost, time and quality standards this is because clients usually demand for a better value on investments. As such, they want projects to be completed on time, within cost and with the right quality. The above cannot be achieved if construction project is not regulated in an economy as the focus group discussion (FGD) participation stated that most of the projects in the country were completed at a higher cost and time overrun. Therefore, the researcher concluded that the current policy and regulation in the country is only on paper.

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A REVIEW OF PROCUREMENT STRATEGIES TO ENHANCE SUSTAINABLE HOUSING PROJECT DELIVERY IN ABUJA

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ABSTRACT

Procurement strategies for project delivery are considered to be key to performance improvement in the construction industry. Clients, through their bargaining power, can provide incentives and rewards to encourage good performance. The need for sustainable construction, research and development in sustainability and procurement is emerging, as the bridge between design and construction, the building procurement system therefore is critical to deliver sustainability in practice. It is crucial for the successful implementation of sustainability within conventional construction processes. This paper reviews the concept of sustainability in construction and explores the internal relationship between sustainability and building procurement system. Analysis of findings from the literature revealed that, the key project parameters are; project cost, time and quality and involved construction stakeholder satisfaction. It also revealed that traditional and design and build with their variants contract procurement strategies are cost effective, time efficient and improve quality and stakeholder satisfaction. It was concluded that the perceived contract procurement approaches are effective and satisfy all the key project parameters. It is recommended that, critical understanding of clients' needs and expectations for particular construction project objectives requires a careful selection of an appropriate contract procurement strategy; thus, the adoption of a contract procurement system that best addresses project objectives must be implemented. By adopting an appropriate contract procurement method, clients can expect to achieve best value-for-money outcomes, as risks could be most effectively minimised and the occurrence of contractual disputes and cost and time overruns, would also be eliminated.

Keywords: Building procurement systems, construction, Housing delivery, stakeholders, sustainability.

INTRODUCTION

Currently, there are two common presumptions accepted by most clients and suppliers in the construction industry, globally. First, a project may be regarded as successful if the building is delivered in the right time, at the appropriate price and quality standards, and provides the client with a high level of satisfaction (Love *et al.*, 1998). Second, selecting an appropriate procurement system is key in achieving such client satisfaction and project success (Tookey *et al.*, 2001). Masterman (1992) opine that, an inappropriate procurement system may lead to cost and time overruns, claims and disputes on projects.

Contract procurement strategies have been described as organised methods or processes and procedures for clients to obtain or acquire construction products (Rashid, 2006). Apart from the traditional approach, there are now other "fast-tracking" (as the name being called) or innovative procurement systems used by the construction industry worldwide. The different procurement strategies differ from each other in terms of allocation of responsibilities, activities sequencing, process and procedure and organizational approach towards affordable housing delivery. These differences invariably have impacts on the delivery of a sustainable housing. However, the darts of uncompleted and abandoned projects occurrences requires effective contract procurement strategy to deliver projects, as buttressed by (Woodward, 2001).

In an effort to improve contract procurement performance, many new procurement systems emerged during the 1980's and 1990's, that provide better selections and flexibility. Seeley (1986) and it is crucial that clients make the right choice of project procurement method in a progressively complex condition with an extensive array of objectives and procurement systems. The construction industry is a service rendering industry in which design and production are carried out by more than one entity outside the project site. In most other industries, designs, schemes, modelling, production, fabrication, quality assurance and marketing deeds are mostly embarked on within the same organisation and site although, by diverse experts or units (Sanvido *et al.*, 1992). Under this delivery method, construction projects follow a traditional approach in which the client engages an Architect, and other construction professionals, to be in charge of the design and specification of his project. Under a dispersed bid contract, the client appoints an independent general contractor to construct the project.

Moreover, Ashworth (2006) opines that for organizations with massive, continuing volumes of project, design and build services may be delivered by public sector design expertise, rather than consulting designers, as the designers frequently serve as project managers and construction managers as the project moves through its life cycle. It is therefore vital to integrate design and construction being treated as separate entities under the traditional procurement method. Noteworthy, the different contract procurement systems contribute to the successful delivery of sustainable housings in terms of allocation of risks (environmental, economic, social – sustainability concerns), activities sequence (management integration), process and procedure and organisational approach in project delivery. Hence, an effective procurement system has to be established in order to satisfy clients and stakeholders' needs, taking cognizance of price certainty (cost – affordability), time schedule (delivering housing to scheduled time towards meeting clients' housing demands), complexity of design and many other factors.

The construction industry has a quite high rate of abandoned projects while so many completed ones have time and cost overruns (Aibinu and Odeyinka, 2006). The impacts of these in term of the delivery of a sustainable housing are quite enormous. However, several thousands of projects have been constructed and many more are still in the pipeline but the problem still seems far from being over (Kumaraswamy and Dissanayaka, 1998). Noteworthy, the contract procurement strategies adopted for construction has relationship with the delivery of a sustainable housing. In recent years, a number of alternative procurement methods have emerged so as to counter the shortfalls of the traditional system. Therefore, the researcher's interest is drawn on non-traditional methods in particular, being the alternative procurement methods gaining a lot of popularity in the construction industry. The distinctive nature of construction projects is that each project is unique; hence, there is a need for integration and coordination of all the activities involved in the construction process, before and during construction (Kumaraswamy & Dissanayaka, 1998). The significance of this study is the examination of various contract procurement strategies adopted in the construction industry for housing construction projects and to examine the impact of each of these strategies on the delivery of a sustainable housing while taking into consideration, the cost, time and quality, so as to ascertain the effective option suited, for the delivery of a housing particular project type, with a view to establish the effective strategies to procure sustainable housing delivery.

LITERATURE SEARCH

Contract Procurement Strategies for Housing Projects

The environmental, social and economic value of housings cannot be underestimated, particularly, housings that has been specially designed to improve the livability of the immediate environment is essential to building communities, improving social wellbeing and sustaining high standards of living into the future (Sutton, 2000). A well planned and managed investment in housing projects plays a vital role in supporting economic, environmental and social growth and providing capacity to meet the increasing demand for services that accompanies strong housing development (Casey *et al.*, 2014). Stressing further, an appropriate procurement strategy that establishes careful consideration and analysis of all available options will enable clients to identify the delivery model and procurement method most suitable for the project in question. By adopting an appropriate procurement method, clients can expect to achieve best value-for-money outcomes as risks will be most effectively managed and the occurrence of contractual disputes, cost and time overruns is possible to be minimized.

Hughes *et al.* (2006) posit that within the construction sector, procurement has become a complex issue, because it refers not only to what is bought, but also to a diverse array of methods for acquiring a vast range of construction products. Before developing a general view of the difference in contract procurement methods, it is advantageous to identify the main features of existing procurement approaches. Contract procurement practices in construction, are quite diverse and complex in the sense that it is quite challenging to outline the various arrangements available (Akram *et al.*, 2012). A contract is a key component of a procurement system and it is a crucial element necessary between two parties teaming up for a project. Davis *et al.*, (2008) defined a contract as “an agreement between two parties, whereby one party commits itself to deliver goods or services to a second party within a certain delivery time and for an agreed price”. Procurement is derived from the word procure, which literally means “to obtain by care or effort”. Contract procurement strategies have been described as organized methods or processes and procedures to obtain or acquire construction products (Rashid *et al.*, 2006). Contract procurement strategies identify the best way of achieving the objectives of a construction project and value for money, taking cognisance of the risks and constraints, leading to decisions about the funding mechanism and asset ownership for the project. The aim of a contract procurement strategy is to achieve the optimum balance of risk, control and funding for a particular project (Thomson and Jackson, 2007). Masterman (2003), describes contract procurement as the organizational structure needed to design and build construction projects for specific clients. An appropriate contract procurement strategy, which is typically developed during the ‘evaluation’ or ‘definition’ phases of a project, is a key determinant of successful project delivery as it is more than just a high-level plan, it details practically, the recommended delivery model to be deployed in delivering a project and it also provides clear justification for use on a value-for-money basis (Casey & Bamford, 2014).

Project delivery, as described by the Austroads Guide to Project Delivery is “the process by which the aim or goal of a project is realised or achieved” (Casey and Bamford, 2014). Successful project delivery must be supported by an appropriate contract procurement strategy to ensure the essential works and/or services are not delayed or otherwise poorly executed. Programming the development of a contract procurement strategy is thus extremely important from a project management viewpoint. To achieve optimum timing, the procurement strategy

development process should commence as early as possible in the project lifecycle, as an element of the project's 'evaluation' and 'definition' phases (Casey and Bamford, 2014).

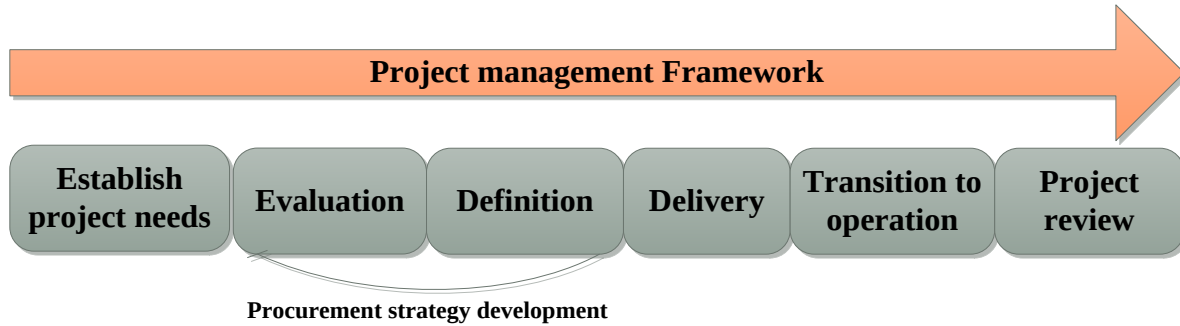


Figure 1: Procurement strategy development.

Adapted from Casey and Bamford (2014).

Furthermore, from a project management viewpoint, implementation of the recommended procurement strategy mostly begins in the project 'definition' stage, and continues through the 'delivery' stage and potentially also the 'transition to operation' phase, depending on the chosen delivery model (Casey & Bamford, 2014). Implementation of a contract procurement strategy should therefore be programmed to occur during these phases, as shown in Figure 2.

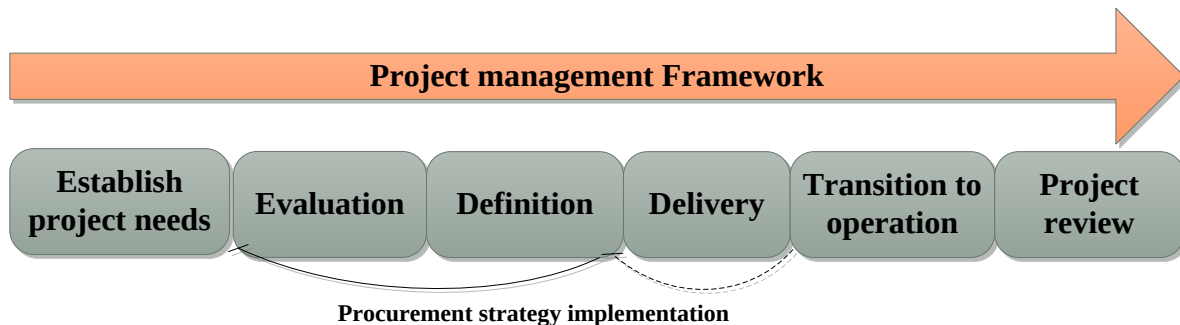


Figure 2: Procurement strategy implementation

Source: Casey and Bamford (2014).

Contract Procurement methods Effectiveness on Housing Projects.

Before developing a general view of how contract procurement approaches differ, it is vital to articulate the main features, the effectiveness and the distinguishing characteristics of different contract procurement approaches. According to Ashworth (2006), the following are the contract procurement strategies adopted in delivering housing projects in the construction sector:

- Traditional procurement method
- Design and Build procurement method
- Management contracting procurement method

- Construction management procurement method
- Project management procurement method
- Direct labour procurement method
- Labour only procurement method
- Public-Private-Partnership (BOT, DBOT, DBFO, ROT, BOOT, LROT, *et cetera*) procurement method.

Influence of Contract Procurement Strategies on the Delivery of Sustainable Housing

The influence of contract procurement strategies on the delivery of a sustainable housing is hereby analysed based on the key project parameters – cost (affordability), time and quality.

Traditional Procurement Method

Cost

Rashid *et al.* (2006), posit that traditional method of contract procurement provides cost certainty to clients at the early stage of the project; also, traditional procurement method gives clients stable price in the sense that the design and complete working drawings of the project have been fully developed and detailed out prior to tendering. Rashid *et al.* (2006), stressed further that the traditional procurement method eliminates design and construction vagueness that could make contractors inflate construction sum pointlessly.

Time

Traditional procurement method has the slowest delivery approach due to the linear or sequential process of activities (Olabode, 2012). However, Rashid *et al.* (2006), claims that the traditional procurement strategy is preferable to the other alternative strategies in the sense that it provides accountability and better design and construction control by the client, that is, there is ample time for the client and the project team to examine and evaluate the design before construction.

Quality

Ogunsanmi *et al.* (2003) is of the opinion that the traditional procurement method provides a high standard of quality, as it creates an opportunity for the client to syndicate the best design and management expertise between professional consultants and the contractor.

Design and Build Procurement Method

Cost

Masterman (2002) notes that although the construction cost is fixed at the tender stage and subject to design changes, the cost incurred in construction while adopting design and build procurement method is often higher compared to the cost incurred using the traditional procurement method. Rashid *et al.* (2006) posit that lack of design and specification details during tender has made the contractors inflate the construction sum to cover for all uncertainties

that could arise during the execution of the project unless there are variations instructed by the client.

Time

According to Griffith and Watson (2004), design and build procurement method is mostly called “build-it-fast” project delivery system as the design and construction phases are integrated. Design and build method allow design and construction process to run in parallel, thus, reducing the overall construction period considerably (Rashid, *et al.*, 2006).

Quality

The integration of design and construction allows the contractor to utilize his knowledge and experience to develop a more efficient design and construction control programme, as a result, it allows the contractor to be innovative in improving the construction process and techniques, hence, provides a good quality standard (Turner, 1997).

MANAGEMENT CONTRACTING PROCUREMENT METHOD

Cost

Ramus *et al.* (2006) stressed it that the cost incurred in executing construction projects with the adoption of management contracting method tends to be lower than using other procurement approaches as this is due to the fact that the cost of the project is actually the sum of prices quoted by the work contractors.

Time

Management contracting procurement method allows early commencement of construction work at the same time improves constructability in the sense that the management contractor has d knowledge, experience and competency to effectively manage the design and construction of the project (Masterman, 2000). According to Turner (1997), management contracting procurement method allows for effective and efficient coordination of construction works, construction resources – materials, manpower and machinery, thus, considerably reducing construction period compared to other procurement methods.

Quality

The management contractor is more concerned with the standard and quality of work carried out by various work contractors as the proficiency of the management contractor in selecting durable materials ensures efficient quality on the project and as such, provides better project quality (Ramus *et al.*, 2006).

Construction / Project Management Procurement Method

Cost

Ramus *et al.* (2006) opines that there is typically no fixed cost at the commencement of the project except a cost plan prepared by the Quantity Surveyor and during project execution phase, the cost plan could increase or decrease in the anticipated trajectory, thus, close cost monitoring must be ensured so as to prevent cost overrun.

Time

The whole construction work is divided into a number of smaller work packages, tendered for and constructed in accordance with the project programme, hence, construction work can

commence as early as design information is available takes off as early as design information is available, taking cognisance of project duration (Masterman, 2003).

Quality

Construction / project management procurement method allows design change fairly late into the programme and as such, enhances better work quality, provided the design change does not affect that which had already been built (Ramus *et al.*, 2006).

Direct Labour / Labour only Procurement Method

Cost

Olabode, (2013) claims that direct labour and labour only procurement method is a cost saving strategy, as the client purchases all the necessary construction materials from inception to completion and pays all labour employed and there is usually no contractual obligation.

Time

Tendering and negotiation process is not necessary as the procedure for carrying out construction works is majorly simplified, thus, reduces construction period substantially (Adenuga, 2013).

Quality

Iyagba *et al.* (1995) and Kadiri and Ogunsanmi (2003) posit that labour employed directly by clients eases client's communication problem, thereby promotes effective working relationship and environment, thus, controls quality.

PUBLIC-PRIVATE PARTNERSHIP

Cost

The close collaboration of the design and construction team results in more excogitative and less expensive designs, hence, the total costs of services rendered by construction professionals such as supervision and reviews and contract management activities, can be abridged (Sydney, *et al.*, 2014); Edwards & Hardcastle, 2000). Private partners utilize economies of scale, excogitative technologies, procurements and compensation that are more pliant, thus, reduce overhead, facilities maintenance or operating costs (Sydney *et al.*, 2014; Li *et al.*, 2005).

Time

PPP model offers both the public client and private contractor freedom to choose excogitative methods in the provision of assets and services and this leads to time saving because it accelerates project development by avoiding unnecessary delay in project delivery (Hall, 1998).

Quality

PPP model provides better quality standards on projects through improved operational efficiency and excogitation (Sydney *et al.*, 2001; Li *et al.*, 2005).

Benefits and Shortfalls of Contract Procurement Methods on Housing Project Resources (Materials, Manpower and Machinery).

Traditional Procurement Strategy

BENEFITS

The following are the benefits of traditional procurement strategy according to (Olabode 2012; Ogunsanmi *et al.*, 2003; Ramus *et al.*, 2006);

- the employer controls the design team.
- the contractor is not asked to embark on significant design management risk; he is simply requested to build, hence, there is little or no premium as the price is competitively tried and tested.
- there is a single point of responsibility and the client has a direct relationship with the contractor as it facilitates a high level of material, manpower and machinery functionality and improves the quality in the overall design.
- traditional procurement method is a tried and test method of procurement that the construction market is very familiar with, thus, provides price certainty regarding materials and machinery acquisition.
- variations (alterations or modifications) to the contract are relatively easy to arrange and manage and has no significant influence on construction materials, manpower and machinery.

SHORTFALLS

The following are the shortfalls of traditional procurement strategy according to (Davis, et al., 2008; Adenuga, 2013; Siyabonga, 2003; Akram, *et al.*, 2012);

- design consultants are often not selected from a competitive tender, thus, results in overly conservative design specifications and increased cost of materials and machinery.
- separation of design and construction often times lead to contractual disputes on defects in design (for which the client is responsible) and/or in materials and manpower (for which the contractor is responsible).
- design is finalised before construction contract is let, thus, could be difficult and time consuming for the client to make and implement later design changes on the project.
- overall project duration is usually longer than other procurement methods as the strategy is sequential and construction cannot commence prior to the completion of the design.

DESIGN AND BUILD PROCUREMENT STRATEGY

BENEFITS

The following are the benefits of design and build procurement strategy according to (Gordon 1994; Clamp, et al., 2009; Kumaraswamy & Dissanayaka, 1998; Turner, 1997).

- overlap of design and construction activities can cause a reduction in project time and improved constructability due to the contractor's input into the design.

- use of a guaranteed maximum price (GMP) with a savings option split can stimulate excogitation and reduce time (project duration) and project cost associated with construction materials, manpower and machinery.
- the financial commitment of the client is made from the outset, hence, price certainty is obtained before construction starts, as client's requirements are stated and changes in design are not introduced.
- single point of responsibility is provided, that is, client has to deal with one firm, thus, reduces the necessity to project duration, commit materials, manpower and machinery to contracting designers and contractors separately.
- close inter-communication between the contractor's design and construction team promotes cooperation in achieving smooth execution of the contract and prompt resolution of site problems.

SHORTFALLS

The following are the shortfalls of design and build procurement strategy according to Hughes *et al.* (2006); Ramus *et al.* (2006); Robinson (1987), Turner (1997) and Akram *et al.* (2012):

- difficulties can be experienced by client in preparing an adequate and appropriately comprehensive brief as client's changes to project scope and construction resources can be expensive.
- if the contractor's organisation is relatively small, it is unlikely he is an expert on design as he is on construction, and as such, the resulting building could be aesthetically less acceptable.
- the client has no means of knowing if he is getting value for money on the project and associated construction resources unless he employs his independent advisers, thus, increases project costs.

MANAGEMENT CONTRACTING PROCUREMENT STRATEGY

BENEFITS

The following are the benefits of management contracting procurement strategy identified by (Ashworth, 2006; Hughes, *et al.*, 2006; Davis *et al.*, 2008):

- the client deals with a single entity and that enhances improved coordination and collaboration between designers and constructors and effective utilisation of construction materials and machinery.
- there is high time-saving potential on the overall project duration, as design and construction activities are overlapped.
- works packages can be let competitively at current market prices.
- roles, risks and responsibilities of all parties are clear and quality can only be controlled by the design team.
- design changes are flexible as management contracting strategy allows great scope for client changes.

- the preliminaries (machinery) and management fee can be fixed, thus, allows a degree of price certainty.

SHORTFALLS

The following are the shortfalls of management contracting procurement strategy identified by (CWMF 2008; Hughes *et al.*, 2006; Davis *et al.*, 2008):

- management contracting procurement strategy is a low risk strategy for the management contractor as there is little responsibility for package contractor default, bankruptcy, et cetera.
- although guaranteed maximum price (GMP) can be achieved on construction resources, management contracting procurement is still prime cost in nature as it is an approach that most contractors usually prefer.
- there can be substantial cost increase as there is often times a tendency for the initial cost plan to be adjusted upwards.
- close collaboration and information control is required as client must provide a good quality brief to the design team as the design will not be complete until total construction resources (materials, manpower and machinery) have been committed to the project.

CONSTRUCTION / PROJECT MANAGEMENT PROCUREMENT STRATEGY

BENEFITS

The following are the benefits of construction / project management procurement strategy stated by (Ashworth, 2006; Walker, 2015; and Masterman, 2002):

- there is reduced confrontation between the design team and the construction team.
- detailed design runs in parallel with construction, thus, shortening project duration.
- privity of contract between the client and each of the trade contractors provide the client with a readier means of redress in events of delays arising.
- client has ownership of tendering and contractual arrangement.
- there is full opportunity to package the work to suit the capability of the trade contractors and to manage on-site interfaces including construction materials, manpower and machinery.
- client has the authority to identify and act upon poor trade contractor performance.
- construction / project manager focuses more on construction programme, sequencing and buildability.

SHORTFALLS

The following are the shortfalls of construction / project management procurement strategy stated by Rawlinson (1999); Walker (2015) and Masterman (2002):

- close cost monitoring and management are crucial as there is typically no fixed cost at the start of the project except a cost plan prepared by the Quantity Surveyor, hence, as the tenders come in during the course of construction, the project cost may move above or below an anticipated trajectory.

- client bears the highest risk associated with design including impacts of late or incomplete and uncoordinated design.
- the client's financial commitment is uncertain until the last of the works contract is signed.
- the client has more numbers of contractors to deal with instead of one main contractor only.

Direct Labour / Labour only Procurement Strategy

BENEFITS

The following are the benefits of direct labour / labour only procurement strategy highlighted by Opadiran (1987); Adenuga (2013); Hardie (2007) and Kadiri, *et al.* (2003):

- there is huge financial savings on construction materials and manpower and on the project as a whole.
- project rules, conditions and effective utilisation of construction resources are set by the client.
- work hours are clearly defined.
- quality control is closely tracked.
- the labour employed provides positive input, knowing the client's specific needs.

SHORTFALLS

The following are the shortfalls of direct labour / labour only procurement strategy highlighted by (Adenuga *et al.*, 2013),

- it is time consuming and extremely stressful.
- it serves as a minefield for the inexperienced.
- materials, manpower and machinery must be provided by the client.
- control of productivity by the client is difficult.

PUBLIC-PRIVATE PARTNERSHIP PROCUREMENT STRATEGY

BENEFITS

The following are the benefits of public-private procurement strategy highlighted by Hall & Watermeyer (2015); Li, *et al.* (2005),

- PPP procurement strategy improves buildability and maintainability.
- it accelerates project development, hence, saves time in delivering the project.
- PPP benefits local economic development through the transfers of technology to local enterprises.
- PPP facilitates creative and innovative approaches, thereby enhances government integrated solution capacity.
- PPP reduces public money tied up in capital investment by solving the problem of public sector budget restraint.

SHORTFALLS

The following are the shortfalls of public-private procurement strategy highlighted by (Li *et al.*, 2005).

- much management time is consumed in contract transaction, thus, reduces project accountability.
- it imposes an excessive restriction on participation as high participation costs are incurred.
- there could be confusion on government objectives and evaluation criteria may lead to high project costs.
- the private sector bears the highest risk.

METHODOLOGY

This paper adopts a desktop review of information to examine and establish the contract procurement strategies for housing project towards the enhancement of housing sustainability. The approach aided the exploration of the perceptions of construction professionals through published expression of previous researchers on procurement strategy that best addresses project objectives. Although, this paper is an extract from an ongoing Master of Technology research, which is aimed at examining the contract procurement strategies for project delivery implemented in the construction industry and uses the results in enhancing housing sustainability, the stakeholders' satisfaction in terms of cost, time and quality is put into consideration.

PRESENTATION OF FINDINGS

The study is designed to establish the most effective contract procurement strategy for project delivery towards enhancement of housing sustainability in Abuja. From the findings, the effectiveness of the contract procurement strategies used for housing project, factors influencing the selection of a contract procurement method for housing project delivery, the influence of the contract procurement strategies on project key parameters (cost, time and quality) and the benefits of the contract procurement methods used in housing project resources (materials, manpower and machinery) are presented.

CONCLUSION

One of the objectives designed to achieve the aim of the study is the examination of the contract procurement strategies used for housing projects. This objective was achieved through the review of literature, the analysis of findings from the literature revealed that, the key project parameters are; project cost, time and quality and involved construction stakeholder satisfaction.

It also revealed that traditional and design and build (with their variants) contract procurement strategies are cost effective, time efficient and improve quality and stakeholder satisfaction. It could therefore be concluded that the perceived contract procurement approaches are effective and satisfy all the key project parameters. Findings reveal that traditional and design and build contract procurement systems are primarily used in delivering construction projects in Abuja.

RECOMMENDATIONS

The supply of housing products that are durable, obtained at optimum cost and available within the shortest time possible is described as sustainable housing; hence, the enhancement of sustainable housing delivery requires the integration of a number of factors such as project management skills (on the part of construction professionals), effective integration of construction project resources (construction material, manpower and machinery), adequate and unambiguous project briefings from the client and client team, and effective communication and feedback capabilities between the design and construction teams. Failure to effectively integrate these factors will likely result in unsuccessful project delivery in terms of time and cost overruns, leaving involved construction stakeholders dissatisfied.

Contract procurement systems in Abuja are been regulated in all facets of government by the adoption of the basic processes, the standard usual procedures and strategies for procurement systems that are fair, equitable, transparent, competitive and cost-effective when executing construction projects within the construction industry. The critical understanding of clients' needs and expectations for particular construction project objectives requires a careful selection of an appropriate contract procurement strategy; thus, the adoption of a contract procurement system that best addresses project objectives must be implemented. By adopting an appropriate contract procurement method, clients can expect to achieve best value-for-money outcomes, as risks could be most effectively minimised and the occurrence of contractual disputes, and cost and time overruns, would also be eliminated.

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ASSESSMENT OF THE BARRIERS TO KNOWLEDGE MANAGEMENT PRACTICES AMONG CONSTRUCTION ORGANISATIONS IN ABUJA, NIGERIA

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ABSTRACT

Construction projects are information-laden and construction organisations require a great deal of work to ensure that information is properly recorded and archived for use in future projects. In spite of the efforts put into managing this knowledge information, construction projects suffer from time and cost overruns, rework, poor quality work, and battered reputation of project's stakeholders, all these resulted from distorted and loss of information; leading to reinventing the wheel in terms of poor performance and failures. Thus, this paper assessed the barriers to knowledge management (KM) practices in Nigerian construction organisations. This study was carried out using a survey design approach and well-structured questionnaire administered randomly to construction organisations. Data obtained was analysed using; Percentages, Relative Important Index (RII), Kruskal-Wallis H test and Mann-Whitney U test. The major barriers to knowledge management in the construction organisations identified by this study are: - lack of formal review and learning processes, poor communication network, lack of adequate technology, low level of training/intellectual capital, lack of IT support facilities, problem of converting knowledge, time constraint, and lack of coordination. A divergent view was observed among large, small and medium organisations, but a convergence of opinions observed between small and medium organisations. However, this study concluded that barriers to practicing of knowledge management among categories of construction organisations in Nigeria, was obvious and attributable to ineffective and inefficient practicing of KM system in the construction sector. It was recommended that adequate technology and communication network to support knowledge capturing, recording, and archiving is needed.

Keywords: Barriers, Construction industry, Construction organisation, Knowledge management, Nigeria.

INTRODUCTION

The construction industry is a powerful sector that provides job and stimulates growth, it contributes to the economic development of any nation and impact positively on other non-construction-related sector (Meshksar, 2012; Nnadi *et al.*, 2016; Onyeagam *et al.*, 2019). Due to the nature of the construction industry, construction organisations are faced with a lot of competition for their survival. The industry success and growth anchored on the ability to adopt to the dynamics of the construction market (Yusof and AbuBakar, 2012). The Nigerian construction industry is confronted with a lot of performance issues, such as poor-quality delivery, delivery time and cost increase as well as owner dissatisfaction (Hafez, 2001; Ademeso and Windapo, 2008). The performance of this industry in general are far below expectations. These problems are compounded by poor knowledge management practices and reluctant to take-up innovative activities (Alhaji *et al.*, 2013a; 2013b). Based on these the Nigerian construction firms are under tremendous pressure to improve their efficiency and performance in order to eliminate delays, time overrun, cost overrun, unnecessary variations, rework, loss of profit, and loss of business that characterised the sector. Thus, knowledge management has been

advocated to be a suitable strategy for promoting innovation and improvement in the construction processes (Alhaji *et al.*, 2013a).

Construction organisations are information generators and requires that every stakeholder exchange vital information across all phases of the projects (Yusof and AbuBakar, 2012). Ikediashi *et al.* (2012) posit that the successful execution of construction projects relies on the efficiency and effectiveness of workers employees and the project team members.

There is a considerable pressure on the construction organisations globally, Nigeria inclusive therefore to enhance and improved the efficiency of construction processes and to reduce or the delays, and unnecessary variations leading to time and cost overruns in construction projects (Yusof and Abubakar, 2012). The employees of construction organisations in Nigeria, acquired wealth of knowledge through training and experience, and these are hardly conveyed or transferred to the younger ones (or new entrants) before their retirement and /or exit from the system. These knowledge and experiences are most at times vanished because they are not recorded, captured, stored and shared among the employees for re-used in future and subsequent projects (Guribie *et al.*, 2018; Alhaji *et al.*, 2013a, 2013b). Thus, the performances of these organisations are affected and their future threatened (Yusof and Abubakar, 2012). Subsequent construction projects are facing the same problems or mistakes or errors the previous projects witnessed, because they are reinventing the wheel (Oke *et al.*, 2013; Tan, 2015; Leal *et al.*, 2017). Furthermore, construction organisations are facing great challenge in handling, storing, organising and disseminating effectively all the information needed to design and build a major facility, and this is affecting construction industry performance. Therefore, there is a need for the efficient and effective knowledge management in construction organisations (Becerik, 2004; Leal *et al.*, 2017).

Previous studies on Knowledge management emphasised only multinational companies mostly in developed countries. The research work on KM barriers centred on the three groups of organisations in Nigeria is lacking. Construction organisations are different in sizes as well as the specific features such as small and medium enterprises (SMEs) and large organisation that could affect knowledge management. It is against this backdrop that this study set to assess barriers to knowledge management practices in the Nigerian construction organisations (large, medium and small-scale organisations).

KNOWLEDGE SHARING PRACTICES IN CONSTRUCTION FIRMS

According to Ohioyenoye and Eboreime (2014), knowledge management is a veritable tool for the improvement of services, process, for growth and productivity. In the construction industry, projects are being tagged to be complex, diverse and non-standard in nature; it therefore requires employees to adapt knowledge, experiences and lessons gained from previous projects to quickly confront new conditions, work contents and challenges emanating from competitive environment in which they exist (Clough *et al.*, 2000; Hanisch *et al.*, 2009; Bakker *et al.*, 2011). Most of the problems generated, solutions proffered, experience gained and know-how in the previous projects are in the minds of the Engineers, Quantity surveyors and other experts as they emanate during the construction phase of a project (Alhaji *et al.*, 2013b; Ohioyenoye and Eboreime, 2014), thus, these are intangible and invisible to the eyes. The knowledge and experience that are intangible and invisible are resident in the mind of the professionals and is called tacit knowledge

Knowledge sharing has impact on the effective construction management; it helps to prevent transfer and repetition of previous projects' mistake and errors to new projects. Tserng and Lin (2004) advanced that records of both successful and unsuccessful projects executed by general contractors should be kept to identify best and worst company. The role of effective management of knowledge is evident in improving innovation, reducing project time, improving quality and customer satisfaction (Kamara *et al.*, 2002; Love *et al.*, 2003; Alhaji *et al.*, 2013b). Alhaji *et al.* (2013b) found that project knowledge management practices in the construction industry are the explicit type. It was reported that tacit knowledge is not yet fully practiced in the civil engineering construction firms. This implies that knowledge and experiences are wasted at the construction site without assigning anybody to be in charge of this knowledge.

Ozorhon *et al.* (2005) confirmed that records of the knowledge and experiences of engineers and experts from the past projects is the best way to improve the organisation efficiency in term of the project delivery. Alhaji *et al.* (2013b) suggested that if the knowledge and experiences are recorded, captured, stored, shared among the employees in the construction firms, it improves the construction organisational performance in term of project delivery. Although, it was found that the record of new ideas, knowledge and experiences of engineers and other experts in the repositories for future use are not practiced in the civil engineering construction firms, only the contract document and other paper works are stored in the database, excluding the tacit knowledge of the engineers and experts that are involved in the construction projects. Carrillo *et al.* (2004) in a study conducted in the United Kingdom discovered that in the construction firms, that knowledge and experiences of engineers and experts (tacit knowledge) play an important role in the success of the construction process. Alhaji *et al.* (2013b) posit that the engineers and experts after the completion of projects they are discarded and leave with their domain knowledge without nothing to benefit the organisation if not capture store in the repositories for re-use. Sheehan *et al.* (2005) found that more than 80% of the useful knowledge generated in construction projects are tacit and cannot be written down. Thus, according to Alhaji *et al.* (2013a; 2013b), a lot of knowledge exist and characterised the civil engineering construction firms, employees retire or leaves or are sacked, leaving the organisation with their tacit knowledge. This tacit knowledge is a potential source of competitive advantage that is required by these construction firms.

The mode of practice of knowledge sharing and management in construction organisation reported by Alhaji *et al.* (2013b) are fact to face, site meeting, mentoring and tutoring, projects briefing and interviewing sessions, and internal training courses. According to Oke *et al.* (2013), the practice of knowledge sharing and management available to of construction firms include colleagues experience is the highest source of knowledge, text books, interaction with outside party, and the use of phones followed.

Barriers to Knowledge Management in the Construction Organisations

KM is vital to successful project performance but its implementation is not without hitches. Organisational culture is one of the most crucial factors contributing to the success of a KM project, and 'perhaps the most difficult constraint that knowledge managers must deal with (Davenport *et al.*, 1998; Whelton *et al.*, 2002). Thus, organisational culture is a key barrier that has not yet been addressed in most organisations (Whelton *et al.*, 2002). According to Marshall and Sapsed (2000), knowledge management is both a technical problem involving the use of IT

and a sociocultural one involving motivating people 'to make them willing to yield up this knowledge for organisational use.

Whelton *et al.* (2002) suggested that there is the need to proactively tackle organisational culture, and associated barriers such as people's fears, attitudes or resistance to knowledge sharing. There are other barriers to the adoption of knowledge management include initiative overload, bureaucracy associated with KM, poor IT infrastructure, lack of top management support, conflicting priorities between KM and other business functions and the difficulties associated with communicating the benefits of knowledge management (Whelton *et al.*, 2002).

However, in projects, KM can improve communications within teams, and provide more informed knowledge. Siemieniuch and Sinclair (1999) asserted that the failure to capture and transfer project knowledge leads to the increase risk of reinventing the wheel, wasted activity, and impaired project performance. Robinson *et al.* (2005) argue that KM has always been a challenge to the construction industry, which is predominantly a project-based industry. Information overload, lack of time to share knowledge, not using technology to share knowledge effectively and difficulty in capturing tacit knowledge are few challenges in implementing KM (Carrillo *et al.*, 2000). The main barriers to implementing effective knowledge management include not having sufficient time, organisational culture, lack of standard work processes and insufficient fund (Carrillo and Chinowsky, 2006; Kazi *et al.*, 1999). Kasim and Saeed (2018) identified lack of coordination, poor utilisation of communication network, absence of firms' structural approach, and cultural elements as major barriers to knowledge management in the construction industry. Oke *et al.* (2013) affirmed that the top major barriers to knowledge management in construction include; funding, lack of time and understanding of KM, lack of proper technical expertise, lack of adequate and up to date data, lack of successful km model in the construction industry, lack of effective communication among construction professionals among others. The summary of the barriers identified from literature is shown in Table 1.

Table 1: Barriers to Knowledge Management

S/N	Barriers	Sources
1	Lack of coordination	Kasim and Saeed (2018)
2	Poor communication networks	Kasim and Saeed (2018)
3	Absence of firms' structural approach	Kasim and Saeed (2018)
4	cultural elements	Carrillo <i>et al.</i> (2006), Oke <i>et al.</i> (2013), Kasim and Saeed (2018)
5	Lack of 'voice' of the user group(s)	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
6	Inadequate stakeholder involvement and participation	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
7	Poor group dynamics	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
8	Misunderstanding of client organization and culture	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
9	Lack of client education of process	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
10	Lack of formal review and learning processes	(Whelton and Ballard, 2002), Whelton <i>et al.</i> (2002)
11	Lack of Time (Time constraint)	Carrillo and Chinowsky (2006), Leal <i>et al.</i> (2017), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
12	Trying to solve large problems	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)

13	problem of Converting Knowledge	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
14	Large number of SMEs	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
15	Multi-Disciplinary Teams	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
16	Uniqueness of construction Projects	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
17	Lack of Learning	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
18	Lengthy Time Period	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
19	lack of IT support facilities	Carrillo and Chinowsky (2006), Kazi <i>et al.</i> (1999); Oke <i>et al.</i> (2013)
20	Lack of top management support	Robinson <i>et al.</i> (2005), Oke <i>et al.</i> (2013), Whelton <i>et al.</i> (2002)
21	Mainly a male sector	Leal <i>et al.</i> (2017)
22	High turnover	Leal <i>et al.</i> (2017)
23	Low level of training/intellectual capital	Leal <i>et al.</i> (2017)
24	absence of incentives to promote sharing knowledge and insight among employees; Little time or attention is given to identifying lessons learned from past project failures and successes;	Cameron (2002); Polyaninova (2011)
25	Assumptions about new projects are not challenged	Cameron (2002); Polyaninova (2011)
26	Organization hires and promotes individuals based on technical expertise alone	Cameron (2002); Polyaninova (2011)
27	Management is reluctant to talk about projects that did not work well	Cameron (2002); Polyaninova (2011)
28		

Source: *Researcher's Compilation of Literature (2020)*

RESEARCH METHODOLOGY

This study adopted a survey research approach via a well-structured questionnaire, self-administered on construction professionals within organisations based in Abuja and selected using simple random sampling techniques in order to assess the barriers inhibiting their knowledge management practices. The premise for selecting Abuja is that, it is the administrative headquarters of Nigeria with a lot of construction projects being executed by Federal government and Private developers which attract a lot of professionals, investors and developers to the country's capital. According to Aje *et al.* (2015), a lot of companies, professionals and professional bodies are attracted and situated their head offices or branches in Abuja.

The opinions of the professional within the construction firms regarding the subject of this study were gathered who are construction professionals, experience on construction projects and operations of the firms. These construction professionals are the key agents for ensuring that knowledge is captured and shared in the organisations, and these organisations cut-across small, medium and large-scale organisations involved in building construction projects.

The number of these organisations is 131, this comprise of (28 small, 4 medium and 99 large organisations). In order to arrive at the sample size, 5 respondents were proposed to be sample from the small firms and 10 from the medium firms. One person each was proposed to be sample

from the large organisations. This is to avoid the number of SMEs sampled not to be overwhelmed by the large organisations. Thus, the total sample size is 279

Total of 279 questionnaires were administered to 131 organisations, and 158 were retrieved; 2 among them were discarded as a result of incomplete response. The remaining 156 which represent an effective response rate of 55.91% was deemed adequate for analysis. The decision to affirm this response rate to be adequate was based on the suggestions of Moser and Kalton (1999) and Akintoye (2000) regarding unbiased construction survey. It was suggested that a response rate of 20-30% and above is ideal. Thus, response rate of 55.91% was adjudged adequate, and following this decision the all the analyses done on the gathered data were carried out subsequently.

The questionnaire has two divisions in design; the first section sought to gather information about respondents' profile and organisational background, while the second section sought to gather information on the barriers by the construction practitioners within each group of organisations. The questionnaire used a 5-point Likert scale with 5 being strongly agree and 1 being strongly disagree. The Likert scale was adopted as it is easy to use and reduces uncertainty, confusion and misunderstanding (Manu, 2015). A pilot survey was carried out among five (5) randomly selected construction-based professionals within the study area; this is in order to eliminate ambiguity and improve clarity of questions asked. Based on their feedback the final draft of the questionnaire was prepared. The reliability and validity of the research instrument was determined using Cronbach Alpha Test for Reliability and validity. The gathered data on the barriers to KM have high level of reliability and internal consistency as the alpha value obtained is 0.881, which is well above the recommended value of 0.70. Oyedele *et al.* (2003) posits that an alpha value of 0.7 and above implies higher and better reliability and consistency of the research instruments. Also, the closer the Cronbach's α value is to 1, the higher and more reliable and consistent the data are (Aghimien *et al.*, 2018).

The data gathered was analysed using: Percentages, Relative Important Index (RII), Kruskal-Wallis H test and Mann-Whitney U test. The data gathered on the respondents' information was analysed using percentage; the barriers to KM was analysed using RII, Kruskal-Wallis H Test was further used to determine if there is any significant difference in the view of the organisations regarding each of barriers to KM and among the 3 categories of organisations. Furthermore, Mann-Whitney U test was used to compare the views of pairs of the organisations to determine if views will differ significantly, and to confirm the result of the Kruskal-Wallis test.

Hypothesis: there is no statistically significant difference in the views of the construction organizations

The decision rule for using Mann-whitney U test and Kruskal-Wallis test are;

- i. Accept hypothesis; if P-value ≥ 0.05 ; this implies a non-significant difference
- ii. Reject hypothesis; if p-value < 0.05 ; this implies a significant difference

RESULTS AND DISCUSSION

General information of the respondents

Table 2 is the result of the analysis of the respondents' general information. The analysis shows that 37.82% of the respondents work with the public organisation while 62.18% work with the private organisations. In terms of professionals' representation, the result revealed that Engineers

(35.90%), followed by Quantity surveyors (32.69%), Architects (12.18%), Builders (11.54%), and lastly other category constituted (7.69%). A look at the year of working experience of the respondents shows that 9.74% of them have their year of working experience to fall within the 1 to 5 range, while 36.36% and 28.57% falls between the range of 6 to 10 and 11 to 15 years respectively. Also 13.64% and 11.69% of the population falls between the ranges of 16 to 20 years and above 20 years respectively. However, the average years of working experience of the respondents is calculated as approximately 11.66 years.

In terms of academic qualifications, 19.87% of the respondents are holds HND, 17.31% hold PGD, 33.33% hold BSc/MTech (39.71%), while those with MSc. /MTech (27.56%), and PhD is 1.92%. In terms of professionals' membership 12.18% belong to MNIA, 11.54% are members of MNIQB, 35.90% are members of MNSE, 32.69% are members of MNIQS, and those who belong to other categories are 7.69%. Also, 35.90% are small construction organisations, 22.44% are medium sized and 41.67% are large construction organisations. Residential building projects with 62.82% formed a larger part of the project type upon which assessment was based, while the 37.18% are based on non-residential building/project type. Based on the result on the respondents' general information, it was concluded that the various sizes of construction organisation are well represented, as well as the professional. Also, the professionals are equipped academically, have the requisite professional experience to give reasonable and reliable information that aided answering the research questions.

Table 2: General Information of Respondents

Category	Classification	Freq.	Percent	Valid Percent	Cumm. Percent
Ownership of Organisation	Public organisation	59	37.82%	37.82%	37.82%
	Private organisation	97	62.18%	62.18%	100.00%
	TOTAL	156	100.00%	100.00%	
Respondents Profession/Responsibility	Architects	19	12.18%	12.18%	12.18%
	Builders	18	11.54%	11.54%	23.72%
	Engineers	56	35.90%	35.90%	59.62%
	Quantity Surveyors	51	32.69%	32.69%	92.31%
	Others	12	7.69%	7.69%	100.00%
	TOTAL	156	100.00%	100.00%	
Years of Experience	1 - 5years	15	9.74%	9.74%	9.74%
	6-10 years	56	36.36%	36.36%	46.10%
	11-15years	44	28.57%	28.57%	74.68%
	16-20 years	21	13.64%	13.64%	88.31%
	Above 20	18	11.69%	11.69%	100.00%
	TOTAL	156	100.00%	100.00%	
Highest Academic Qualification	HND	31	19.87%	19.87%	19.87%
	PGD	27	17.31%	17.31%	37.18%
	BSc/Btech	52	33.33%	33.33%	70.51%

Professional Membership	M.Sc/M.Tech	43	27.56%	27.56%	98.08%
	PhD	3	1.92%	1.92%	100.00%
	TOTAL	156	100.00%	100.00%	
	None member (others)	12	7.69%	7.69%	7.69%
	MNIA	19	12.18%	12.18%	19.87%
	MNIOB	18	11.54%	11.54%	31.41%
	MNSE	56	35.90%	35.90%	67.31%
	MNIQS	51	32.69%	32.69%	100.00%
	TOTAL	156	100.00%	100.00%	
Classification of Organisation	Small	56	35.90%	35.90%	35.90%
	Medium	35	22.44%	22.44%	58.33%
	Large	65	41.67%	41.67%	100.00%
	TOTAL	156	100.00%	100.00%	
Project Handle by Organisation for Basing Assessment	Residential building project	98	62.82%	62.82%	62.82%
	Others: Non-residential project	58	37.18%	37.18%	100.00%
	TOTAL	156	100.00%	100.00%	

Source: *Researcher's Analysis, 2020*

4.0.2 Barriers to Knowledge Management Practices in Construction Organisations

Table 3 shows the result of the analysis of the various construction organisations' perception on the barriers to knowledge management in the constructions industry sampled. From the Table, it shows that the top ten (10) barriers to KM are: Lack of formal review and learning processes (RII=0.973), poor communication network (RII=0.901), Lack of adequate technology (RII=0.863), Low level of training/intellectual capital (RII=0.835), Absence of firms structural approach (RII=0.831), lack of IT support facilities (RII=0.826), problem of Converting Knowledge (RII=0.821), Lack of client education of process (RII=0.813), Lack of Time (Time constraint) (RII=0.805), and Lack of coordination (RII=0.797). The least five (5) barriers to Knowledge management are; Lengthy Time Period (RII=0.681), Large number of SMEs (RII=0.656), Uniqueness of construction Projects (RII=0.629), Mainly a male sector (RII=0.579), Inadequate stakeholder involvement and participation (RII=0.559).

On the individual barriers these organisations views varied significantly on 50% the variables. These barriers have their P-value of less than 0.05. Also, 50% of the variables show non-significant difference; these barriers have P-value of > 0.05. This significant and non-significant result implies variability in the organisations through their professionals perceives these factors. This variation in views could be attributed to the relative understanding of knowledge management practices in the various organisational sizes. Also, Knowledge management objectives of the firms of the respondents could have also influenced their views; the practice could be different from firm to firm.

The study revealed that the major barriers to knowledge management in the construction organisations are lack of formal review and learning processes, poor communication network, lack of adequate technology, low level of training/intellectual capital, absence of firms structural approach, lack of IT support facilities, problem of converting knowledge, lack of client education of process, lack of time (time constraint), and lack of coordination. These findings are in line with the reports of (Robinson *et al.*, 2005; Oke *et al.*, 2013; Kasim and Saeed, 2018). The most critical barriers to KM according to Kasim and Saeed (2018) are; lack of coordination, poor utilisation of communication network, absence of firms' structural approach, and cultural elements. The top major barriers to knowledge management in construction according to Oke *et al.* (2013) are; Funding, Lack of time, and understanding of KM, Lack of proper technical expertise, Lack of adequate and up to date data, Lack of successful KM model in the construction industry, Lack of effective communication among construction professionals. A major challenge in this project-based industry has been knowledge management (Robinson *et al.*, 2005).

Table 3: The Barriers to Knowledge Management In Construction Organisations

S/N	Barriers	RII	Rank	Kruskal Wallis Test	
				P-value	Decision
1	Lack of coordination	0.797	10 th	0.175	Accept
2	Poor communication network	0.901	2 nd	0.000*	Reject
3	Absence of firm's structural approach	0.831	5 th	0.000*	Reject
4	cultural elements	0.785	12 th	0.101	Accept
5	Lack of 'voice' of the user group(s)	0.773	15 th	0.086	Accept
6	Inadequate stakeholder involvement and participation	0.559	28 th	0.000*	Reject
7	Poor group dynamics	0.724	21 st	0.000*	Reject
8	Misunderstanding of client organization and culture	0.787	11 th	0.087	Accept
9	Lack of client education of process	0.813	8 th	0.112	Accept
10	Lack of formal review and learning processes	0.973	1 st	0.033*	Reject
11	Lack of Time (Time constraint)	0.805	9 th	0.110	Accept
12	Trying to solve large problems	0.717	22 nd	0.288	Accept
13	problem of Converting Knowledge	0.821	7 th	0.345	Accept
14	Large number of SMEs	0.656	25 th	0.000*	Reject
15	Multi-Disciplinary Teams	0.776	13 th	0.000*	Reject
16	Uniqueness of construction Projects	0.629	26 th	0.150	Accept
17	Lack of Learning	0.732	19 th	0.156	Accept
18	Lengthy Time Period	0.681	24 th	0.012*	Reject
19	lack of IT support facilities	0.826	6 th	0.000*	Reject
20	Lack of top management support	0.772	16 th	0.106	Accept
21	Mainly a male sector	0.579	27 th	0.402	Accept
22	High turnover	0.729	20 th	0.035*	Reject
23	Low level of training/intellectual capital	0.835	4 th	0.001*	Reject
24	Lack of adequate technology	0.863	3 rd	0.034*	Reject
25	Diverse individual culture	0.709	23 rd	0.003*	Reject
26	Organisational culture	0.760	17 th	0.105	Accept
27	Lack of adequate training	0.740	18 th	0.111	Accept
28	Lack of standard work process	0.776	13 th	0.006*	Reject

Source: Researcher's analysis, 2020

*Pvalue<0.05

Degree of Variation on the Barriers to Knowledge Management Practices Among Small, Medium and Large Construction Organisations

A further analysis using Kruskal-Wallis test at 95% confidence level was carried out to ascertain if there is variation in the views of each of the organisation. The result of this analysis is shown on Table 4; the test showed that there is a significant difference in the ranking of the barriers to knowledge management adoption by these construction firms. There seem to be inconsistencies and divergences in view among the various three sizes of organisation regarding variables. The P-value for the variables is 0.008 which is less than 0.05 level of significant.

Since 50% of the barriers have a P-value < 0.05 and 50% > 0.05 (See Table 3), the result in table 4 will be misleading if a critical examination is not done further. In order to understand the result in table 4.3 turned out to show significant difference, the RII of the barriers with Pvalue < 0.05 were summed up and those with Pvalue > 0.05 were also summed up. The result showed that (P-value $> 0.05=10.510$; and those with P-value $< 0.05=10.838$). This shows that, variables with P-value < 0.05 weigh (0.328) more than those with P-value > 0.05 . Thus, the hypothesis which states that there is no statistically significant difference in the views of the construction organisations, is therefore, rejected. The reason for this could be as a result of the low or even non-existence of knowledge management innovation in SMEs. Furthermore, large firms are usually more technological incline than SMEs. Some of the indigenous ones engage expatriates and the multinationals among them have appreciable level of knowledge management practice as part of their internal policies than the small and medium organisations.

Table 4: Overall Comparison of Construction Firms' Perception of Barriers to KM

		Kruskal-Wallis			
	Construction firms'	Mean Rank	Chi Sq.	P-value	Decision
Barriers to KM	Small	87.22	7.767	0.008	Reject
	Medium	89.30			
	Large	65.17			

N = 56 for Small, N = 35 for Medium, N = 65 for Large, df = 2

Since the overall Kruskal-Wallis test showed a significant result for all combined groups of respondents; a series of Mann-Whitney U tests was conducted to compare perceptions between pairs of the organisations (See Table 5). Mann-Whitney U test was performed at $p \geq 0.05$ (95% level of significance). It was observed that the pair of the small and medium organisation showed a P-value > 0.05 ; this means that there is a convergence of opinion between the small and medium organisations regarding what constitutes a barrier to knowledge management. However, the pairs of the small and large, and medium and large organisations showed that P-value ≤ 0.05 , meaning that there is a statistically significant difference in the perception of large organisations and the SMEs regarding the barriers to knowledge management. This result shows that knowledge management is fairly being practiced in the large firms more than the small and medium organisations. The level of technology employed and network of communication available in the large firms could also have impact on the result obtained.

Table 5: Mann-Whitney U Statistics

Target Organisations	N	Z	Sig.	Decision
Small vs Medium	91	-0.274	0.784	Accept
Small vs Large	121	-2.717	0.007	Reject
Medium vs Large	100	-2.492	0.013	Reject

CONCLUSIONS

This research set out with the aim of assessing the barriers to knowledge management in construction organisations. Adopting a survey design approach, using questionnaire, and collection of data from construction organisation (small, medium and large), and study has been able to answer the main research question.

Based on the findings of the research, the study concluded that the major barriers to knowledge management in the construction organisations requiring immediate management attention are lack of formal review and learning processes, poor communication network, lack of adequate technology, low level of training/intellectual capital, absence of firms structural approach, lack of it support facilities, problem of converting knowledge, lack of client education of process, lack of time (time constraint), and lack of coordination.

A statistically significant difference was found among the subjective views of small, medium and large construction organisations. A convergence of opinion was observed between the small and medium organisations regarding what constitutes a barrier to knowledge management. A divergent view was observed between large organisations and SMEs. This implies that small and medium organisations viewed same indices as barriers to KM practices and hence to achieved efficiency and withstand competition, strategies must be put in place to mitigate those barriers, while the divergent views between large and (small and medium) organisations indicates that barriers to KM practices may not be an impediment to achieve efficiency and withstand competition.

Based on the conclusion, it is recommended that; provision of adequate technology to support knowledge capturing, recording, and archiving is paramount. This technology once provided with improved communication network, thus, ensuring effective and efficient communication among employees. Engaging of well trained and experience individuals who will competent to hoard knowledge in construction organisations. The study has added to the existing body of knowledge on KM among global construction industry. Also, it provides what could be regarded as the vital few barriers to KM which decision-makers in SMEs should focused in order to devise strategies for eliminating or avoiding them, while still not ignoring the trivial many. The limitation of this study lies in the number of samples and the location, and the findings may differ from what is obtainable from other part of the country or region.

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DEVELOPING A FRAMEWORK FOR PARTNERING WITH QUANTITY SURVEYING FIRMS IN NIGERIA

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ABSTRACT

Studies have revealed a number of benefits associated with construction partnering. However, despite these numerous benefits, some factors such as lack of technical knowledge on how best partnering project can be delivered, still hinders the use of partnering. This study aimed at developing a framework for partnering between quantity surveying firms. As such, this is with the primary purpose of increasing the adoption of the partnering approach by quantity-surveying firms in Nigeria. The study adopted a quantitative research approach. Data was collected from critical review of literature and questionnaires administered to 76 Quantity surveying firms in Nigeria, representing the sample size of the study. Data was analyzed using descriptive statistics, Mean score, standard deviation and Relative Importance Index. The study revealed that Trust is the most important driver/enabler for partnering with QS firms in Nigeria. Mutual trust was established as the most important success factor for partnering with QS firms. Furthermore, it was deduced that successful partnering was to be monitored and maintained by communication and exchange, so as to establish the ideal partnering. The framework was thus developed in four stages; with the first stage being the establishment of trust between the partnering parties and further maintaining the trust throughout the partnering arrangement. The second stage introduced the other important drivers and success factors to further strengthen the partnering relationship and achieve successful partnering. The third stage of the framework involved monitoring and maintaining the successful partnering by means of communication and exchange so as to achieve the ideal partnering culture. The final stage of the framework was ensuring the ideal partnering is introduced into subsequent partnering arrangements with QS firms. The study concluded that Parties to any partnering arrangement must set out a first objective of establishing Trust and further maintaining it throughout the entire process as Trust plays a dominant role in ensuring successful partnering with QS firms in Nigeria.

Keywords: Construction Industry, Framework, Partnering, and Quantity Surveying firms.

INTRODUCTION

The Construction Industry globally from its inception, is based on traditional procurement methods and contractual arrangements that put stakeholders on adversarial relationships because this traditional method encourages differences in values, orientations, and goals within the construction project team (Ola-awo, Roslan, Polycarp & Mukaila, 2018). Construction projects have been plagued by perennial constraints of cost and time overruns, poor quality, and lack of sustainability making it almost impossible for stakeholders to uphold the central goal of successful project delivery (Tanko *et al.*, 2017). The loss or suffering that stem from these problems is not only confined to the owner and the contractor, but also to the consultants, workers, the public and the country. To tackle these challenges, Latham (1994) proposed that the client should be at the core of the construction process and that the industry should move away from its adversarial structure, adopting a more integrated approach with greater partnering and teamwork. Ola-awo & Roslan (2016) pointed out that the traditional procurement system which is still being in use in most developing countries today is no longer suitable. Egan (1998) as cited in Ola-awo *et al.* (2018), suggested collaborative procurement methods such as joint venture, partnering and so on as the way out of these challenges. Equally, Helen *et al.* (2015) as

cited in Tanko *et al.* (2017) maintained that harmonious relationship and continuous coordination between stakeholders is paramount throughout the life cycle of projects to enhance the performance of projects.

In Nigeria, the drive to achieve greater value on every infrastructural project has prompted the Government and project owners to embrace project partnering (Awodele & Ogunsemi, 2007). Hence, the focus of this research being on partnering. Abdul-Nifa (2013) reported that the partnering strategy in the construction industry made its debut in the 1990s following the release of the Latham Report (1994) which was later complemented with the publication of Egan Report (1998). Partnering, as a concept emerged as a result of searches for more collaborative forms of inter-organizational arrangements in construction (Hartmann & Bresnen, 2011). It was introduced in 1988 and first used by the US corps of Army engineers and has since spread to other countries (Ola-awo *et al.*, 2018).

A handful of literature on project partnering globally exists, with much of the discussions being on the concept of partnering, definitions and approaches, partnering applications in the industry, success factors for partnering implementation and use, benefits and barriers to partnering among organizations (Eriksson, 2010; Cheng, Li & Love, 2000; Abdul-Nifa, 2013; Phillips-Alonge, 2018; Hartmann & Bresnen, 2011; Naoum, 2003; Egan, 1998; Latham, 1994; Jacobsson & Roth, 2014; Abdul Nifa & Ahmed, 2010; Hosseini, Wondimu, Klakegg, Andersen & Laedre, 2018). Also in Nigeria, literature on partnering has been on what the concept is all about- its benefits, success factors, how it can be applied in the industry and the barriers to its implementation (Awodele & Ogunsemi, 2007; Olatunji *et al.*, 2017; Kadiri *et al.*, 2015; Ola-awo *et al.*, 2018; Ola-awo & Roslan, 2016; Tanko *et al.*, 2017). In a highly fragmented industry like Nigeria's, collaboration and team work will be highly beneficial to project delivery (as pointed out in literature) and as such, partnering is highly encouraged. An analysis of success factors and benefits of partnering have been identified and certain requirements must be met if project partnering is to succeed in Nigerian Construction Industry; in specific, mutual trust, good and effective communications, commitment from all parties, a clear understanding of roles, consistency and a flexible attitude (Awodele & Ogunsemi, 2007). Implementation of partnering in Nigeria took off successfully as pointed out by Kadiri *et al.* (2015), but unfortunately, the outcome of the subsequent partnering projects has not been too encouraging in Nigeria. A study undertaken by Olatunji *et al.* (2017) considered partnering practice in Quantity surveying (QS) in Nigeria; where the benefits, barriers as well as applicability of partnering to projects was assessed. The research went further to state that amongst the barriers, an unclear and undefined partnering procedure/methodology is a significant one to partnering in QS firms and as such, recommended that a framework for partnering with quantity-surveying firms in Nigeria should be developed to serve as a guide to QS firms and other professionals for how to approach and implement partnering in their projects.

The aim of this study is to develop a framework for partnering with quantity surveying firms in Nigeria, and thus: to identify the drivers and critical success factors for partnering in Nigeria, identify the strategic approaches for partnering, assess the key drivers and critical success factors for partnering with QS firms in Nigeria, assess the strategic approach for partnering with quantity surveying firms in Nigeria and to develop a framework for partnering with quantity surveying firms in Nigeria and validate the developed framework.

LITERATURE REVIEW

Partnering as a concept emerged as a result of searches for more collaborative forms of inter-organizational arrangements in construction (Hartmann & Bresnen, 2011). Abdul-Nifa (2013) reported that the partnering strategy in the construction industry made its debut in the 1990s following the release of the Latham Report (1994) which was later complemented with the publication of Egan Report (1998). Partnering emerged in the construction industry in the late 1980s (CPR, 2010). The concept was given birth to from the forging together of the concepts of Total Quality Management (TQM) and Alternative Dispute Resolution (ADR), along with other techniques such as team building and collaborative problem solving (CPR, 2010). Early proponents and leaders in the partnering movement in the construction included the Construction Industry Institute at the University of Texas, the U.S. Army Corps of Engineers, and the Associated General Contractors of America (AGC) (CPR, 2010). Partnering was first used by the US Corps of Army Engineers and has since spread to other countries (Ola-awo *et al.*, 2018). The corps proposed a process whereby, post tender, the successful contractor and the employer would discuss the nature of the project they were building and their mutual expectations (Skeggs, 2000). Partnering was first applied in the UK in the North Sea oil and gas industries in the early 1990s. In the UK civil engineering and building industry, the concept emerged from the background of the initial successes of this new approach in the oil and gas industry and the US building industry (Skeggs, 2010).

In 1994, the UK government and the construction industry jointly commissioned Sir Michael Latham, to conduct an independent review of what was generally accepted to be an under-performing construction industry. Latham produced his “constructing the Team” report. The central message of this report was that the employer should be at the core of the construction process. The use of teamwork and co-operation was advocated to improve employer satisfaction. One specific method recommended was the use of project partnering (Latham, 1994). In the following year, Bennett and Jayes, of the influential Centre for Strategic Studies in Construction at the University of Reading, published *Trusting the Team: The Best Practice Guide to Partnering in Construction* (1995) based on research into Japanese construction and case studies of partnering in US construction (Skeggs, 2010). In addition to the UK, other countries where partnering has been implemented include Australia, Hong Kong, Holland, Malaysia, South Africa and a number of the Nordic Countries (Murtala, 2015). Furthermore, the partnering process has also been favorably received in many English-speaking countries such as Australia, Canada, England, Wales, and Scotland. Other countries such as Hong Kong, Denmark and Norway also use partnering. In these countries, partnering is credited with: better team performance, improved communications, savings in costs, reduced delivery time and increased user satisfaction (CPR, 2010).

Duncan (2009) defines partnering as cooperation and teamwork, openness and honesty, trust, equity and equality between the parties in the construction project. This concept of the relationship depends on the mutual trust established between two parties. Partnering is defined by Al-Amoudi (2011), as a strategic commitment between companies or firms in order to develop their performance in a mutual project. It is a strategic action that delivers marked improvements in construction performance.

Crowley and Karim (1995) as cited in Abdul-Nifa (2013) suggested that partnering is typically defined in one of two ways. Firstly, by its attributes such as trust, shared vision, and long-term

commitment; or Secondly by the process where partnering continues to be seen as a verb, such as developing a mission statement, agreeing on goals and conducting partnering workshops. This format of defining the term partnering in the construction industry can be seen up to the present moment. A key definition of partnering which is commonly cited by partnering literature is provided by the Construction Industry Institute (CII), which defines partnering as: “A long term commitment between two or more organisations for the purpose of achieving specific business objectives by maximising the effectiveness of each participant’s resources this requires changing traditional relationships to a shared culture without regard to organisational boundaries. The relationship is based on trust, dedication to common goals, and an understanding of each other’s individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services” (CII, 1991).

Benefits of Partnering

The majority of literature on partnering suggests that it can provide the basis for participants to reorient themselves towards a win-win approach to problem solving, meeting challenges, and moving towards shared goals where all project stakeholders benefit from the results. The benefits of partnering can be classified into two broad categories: Tangible and Intangible benefits (Faruk, 2014).

The Tangible Benefits linked to contract elements (e.g. time, budget, quality, conflict resolution and safety) and Intangible benefits linked to human interaction (e.g. trust, communication, respect, recognition and integrity)

Table 1: Benefits of Partnering

S/No	Benefits	Sources
1	Reduction in costs project execution	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
2	Reduction in time of project implementation	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
3	Establishment of good and less adversarial relationship	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
4	Risk sharing	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
5	Operational savings	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
6	Increased implementation speed	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
7	Construction projects cost savings	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi 2007)
8	Quality improvement (access skills, experience and technology)	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
9	Improved design	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
10	Increased understanding of parties	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
11	Increased customer satisfaction,	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)

12	Enhanced economic growth of a nation	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
13	Improved return on resources	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
14	Increased revenue generation to the national development	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
15	Improved administration	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
16	Financing option	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)
17	Reduced risk exposure	(Black <i>et al.</i> , 2000; Chan <i>et al.</i> , 2005; Awodele and Ogunsemi, 2007)

Barriers to Partnering

To ensure that the potentials of construction partnering are fully realized, it is important to identify and minimize if not eliminate the barriers of construction partnering. The study by Bresnen (2007) had noted that the challenges involved in developing a partnering relationship are numerous and difficult. According CIDB (2009) as cited in Murtala (2015), the major difficulties in implementing partnering are as follows;

- i. There is an inherent distrust within the construction industry. It is not an easy task to establish real trust between the client and main contractor relationship and it takes time.
- ii. There are behavioural problems. Some individuals in an organization may resist partnering because of their past experience and understanding of traditional approaches.
- iii. Contractors and sub-contractors do not understand partnering. All stakeholders need to be educated on what partnering is all about and the benefits it is likely to bring.
- iv. A lowest tender price mentality on part of clients is difficult to change. The mind-set that cheapest tenders produce cheapest construction cost have been undermined for a long time.
- v. Changing the culture is one of the biggest hurdles in adopting partnering. Moving away from traditional procurement approaches requires entire supply chains to change their existing policies and procedures.
- vi. Clients may have approached partnering with insufficient thought and not given serious attempts to make it work
- vii. Lack of capable and competent partnering champions who are truly empowered to ensure that partnering could be implemented efficiently.
- viii. Lack of well-structured courses and training programmes for supervisors and managers.
- ix. Pain/ gain sharing mechanisms are not always equitable and risk allocation remains a contentious issue.

Furthermore, according to Murtala (2015), in construction field, there are two main groups of barriers to partnering *Organizational* and *Individual barriers*. The *Organizational barriers* are: Status quo thinking, adversarial mind-set, internal conflict, fear of cooperation, suspicious, risk-taking, economic restraint, organization structure and lack of senior management support. The *Individual barriers* are: Ego, attitude, lack of empowerment, paradigm paralysis, disinterest, indecision, doubt, misconception, self-Interests, economies of time and money (Carr et al., 1999). Najimu (2012) as well as Lædre and Haugen (2006) as cited in Barde (2016) highlighted

some partnering challenges which include; partner selection communication gap, informal arrangement, trust, risk and reward sharing, commitment, conflict of interest and legal framework, communication gap, informal arrangement, trust, risk and reward sharing, commitment, conflict of interest and legal framework.

Critical Success Factors for Partnering

The concept of critical success factors (CSF) was developed by Rockart and the Sloan school of management with the phrase first used in the content of information system and project management. Rockart (1982) explain Critical Success Factors (CSFs) as: *“those few key areas of activity in which favourable results are absolutely necessary for a manager to reach his/her goals”*. Rawlinson (1999) states that critical success factors are those fundamental issues inherent in the project, which must be maintained in order for team working to take place in an efficient and effective manner. Among the success factors of partnering, trust and mutual understanding have been identified as the most important components (Hansen-Addy and Nunoo, 2014).

Table 2: Success Factors for Partnering

S/No	Success Factors for Partnering	Source
1	Establishment of efficient coordination	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
2	Support from Top Management	(Chan <i>et al.</i> , 2003, 2004; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).
3	Partnership formation at the design stage	(Cheng <i>et al.</i> , 2000; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014)
4	Dedicated team	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
5	Flexibility to change	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
6	Long-term commitment	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
7	Productive conflict resolution strategy	(Chan <i>et al.</i> , 2003, 2004; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).
8	Commitment to quality	(Chan <i>et al.</i> , 2003, 2004; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).
9	Commitment to win-win attitude	Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).
10	Mutual trust	(Akintoye and Fitzgerald, 2000; Chan, Chan, Fan, Lam, and Yeung, 2005; Hansen-Addy and Nunoo, 2014).
11	Effective communication	(Akintoye and Fitzgerald, 2000; Chan, Chan, Fan, Lam, and Yeung, 2005; Hansen-Addy and Nunoo, 2014).
12	Clear definition and understanding of Responsibilities	(Chen and Chen, 2007; Chan, Chan, Fan, Lam, and Yeung, 2005; Hansen-Addy and Nunoo, 2014).
13	Behaving in a manner consistent with objectives	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)

14	Technical expertise	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
15	Availability of resources	(Chan <i>et al.</i> , 2003, 2004; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).
16	Financial security	(Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Chan <i>et al.</i> , 2003, 2004; Murtala, 2015)
17	Total cost perspective	(Chan <i>et al.</i> , 2003, 2004; Chen and Chen, 2007; Awodele and Ogunsemi, 2007; Hansen-Addy and Nunoo, 2014).

RESEARCH METHODOLOGY

The research design adopted for this study is a descriptive research method aimed at collecting data for the purpose of describing and interpreting the existing conditions and developing a framework for partnering between quantity surveying firms, the anticipated findings is based on the objectives of this research, and the research employed a quantitative approach with the use of survey strategy in collecting the primary data.

The population size for this research which is the total number of Registered Quantity Surveying Firms in Nigeria is 318, as gotten from the 2017 handbook of the Quantity Surveyors Registration Board of Nigeria (QSRBN). For the purpose of this research, a purposive sampling was adopted. This is due to the nature of the study, as the research focuses on quantity surveying firms only. The study is geographical in nature, as the research is limited to Kaduna and Abuja. The rationale for the selection of Kaduna and Abuja as the area of study was due to the high concentration of quantity surveying firms and numerous construction activities in the study area. Therefore, data is to be collected from the owners/principal partners, as well as top/senior management as they are the ones to provide relevant information as regards how they would want their firms to be partnered with.

A sample size of 76 which is representative of the population was arrived at using Kish (1965) sampling formula shown below;

Taking the total number of quantity surveying firms in Nigeria to be 318,

$$n = n1 / (1 + (n1/N)) \text{ equation (1)}$$

Where;

n = Sample size

N = Total Population = 318

$$n1 = S2 / V2 \text{ equation (2)}$$

$$S2 = (P) (1-P)$$

Where; S = Maximum Standard Deviation in the population elements

P = Proportion of the population elements that belong to the defined category i.e. P = 0.5
(Considering 95% confidence level (C.L))

V = Standard error of the sampling distribution i.e. v = 0.05

Solving equation (2);

$$n1 = S^2 / V^2$$

$$S = 1 - 0.5 = 0.5$$

$$n1 = (0.5) (0.5) / (0.05) (0.05)$$

$$n1 = 0.25 / 0.0025 = 100$$

Substituting in equation 1;

$$n = 100 / (1 + (100/318))$$

$$n = 100 / 1.3145 = 76$$

Data Collection

Data was collected via responses from respondents which are to be obtained from the structured questionnaires. The questionnaire consists of 4 major sections, I- IV. Section I is sub-divided into 2 Parts; (a) which is Respondent's profile was used to obtain personal information about the respondent and his/her organization; while (b) was used to know if the respondent had been involved in any partnering arrangement and had knowledge on partnering.

Section II was designed to obtain the respondents "assessment on the degree of importance of each of the drivers/enablers that will facilitate partnering with QS firms in Nigeria". The drivers/enablers were identified from a review of literature. A *Likert* scale of 1-5 was used for the assessment where 1= Not important, 2= fairly important, 3= important, 4= very important, 5= extremely important.

Section III of the questionnaire was designed to obtain the respondents "assessment on the degree /of importance of each of the success factors for partnering with QS firms in Nigeria". The success factors were also identified from literature review. A *Likert* scale of 1-5 was used for the assessment where 1= Not important, 2= fairly important, 3= important, 4= very important, 5= extremely important.

Section IV questionnaire was designed to obtain the respondents "assessment on the degree of suitability of each of the strategic approaches for partnering with QS firms in Nigeria". These strategic approaches are based on the different partnering aspects which 57 were also identified from literature. A *Likert* scale of 1-5 was used for the assessment where 1= Not important, 2= fairly important, 3= important, 4= very important, 5= extremely important.

Data Analysis

The data obtained were analysed using descriptive statistical analysis (based on mean and standard deviation). Section I of the questionnaire obtained personal data related to the respondent and his/her organization.

Sections II, III and IV of the questionnaires were analyzed using mean and standard deviation and thereafter ranked based on the mean value. Furthermore, a reliability test was carried out to determine the internal consistency of the factors and to confirm whether the factors and their associated Likert scale measured what they were designed to measure.

Reliability test

Table 3: Reliability Statistics

Cronbach's Alpha	No of Items
0.912	45

Source: Field Survey, 2018

The Cronbach's alpha value 0.91 in Table 3 above is very high which shows that the instrument (questionnaire) used for this research is reliable.

Nevertheless, for ease and accuracy of the analysis, Statistical Package for Social Sciences (SPSS v25) computer package was used in conducting the analysis of data for this research work.

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

Descriptive Statistics tested the rankings of respondents to this research work in terms of mean and standard deviation with regards to level of importance of the Drivers/enablers for partnering with QS firms in Nigeria, as well as success factors and strategic approach to partnering.

Drivers/Enablers for partnering with QS firms in Nigeria. Section II of the questionnaire sought respondent's opinion with respect to the degree of importance of the drivers/enablers for partnering with Quantity Surveying firms in Nigeria. The drivers/enablers were identified from literature and the result of the responses obtained is presented in the Table 4.

Table 4: Respondents assessment of the level of importance of the drivers/enablers for partnering with QS firms in Nigeria based on mean, standard deviation and Rank values.

S/No	Drivers/Enablers for partnering with QS firms	Mean	Std. deviation	Rank
1	Collaboration and Cooperation	4.31	.849	3
2	Commitment	4.30	.745	4
3	Communication	4.35	.850	2
4	Culture	3.08	1.017	8
5	Trust	4.38	.852	1
6	Tools	3.81	.749	5
7	Policies	3.69	.838	6
8	Procurement	3.62	.983	7

From Table 4, it can be seen that for the 8 drivers/enablers identified, the mean values had a broad range, from the lowest value of M=3.08 (SD=1.017) for Culture to the highest value of M = 4.38 (SD = 0.852) for "Trust". This indicates that culture is considered as the least important driver/ enabler for partnering with QS firms while Trust is regarded as the most important factor

with the top most rank. Furthermore, based on Lu et al. (2008) in Olatunji et al. (2017), who benchmarked the mean scores of 4 on the 5-point Likert scale as Important, four drivers of the eight drivers/enablers for partnering with QS firms were highly important. These were “Trust” (M=4.38, SD=0.852), “Communication” (M=4.35, SD=0.850), “Collaboration & Cooperation” (M=4.31, SD=0.849) and “Commitment” (M=4.35, SD=0.745). From the research findings, Trust is the most important driver/enabler for partnering with QS firms.

Success Factors for Partnering with QS firms in Nigeria

Section III of the questionnaire sought respondent’s opinion with respect to the level of importance of the success factors for partnering with Quantity Surveying firms in Nigeria.

The Success factors were also identified from literature and the result of the responses obtained is presented in the Table 5

Table 5: Respondents assessment of the level of importance of the Success factors for partnering with QS firms in Nigeria based on mean, standard deviation and Rank values

S/No	Drivers/Enablers for partnering with QS firms	Mean	Std. Deviation	Rank
1	Establishment of efficient coordination	4.19	0.749	7
2	Support from Top Management	4.46	0.647	5
3	Partnership formation at the design stage	4.15	1.008	8
4	Dedicated team	4.46	0.706	4
5	Flexibility to change	3.77	0.951	17
6	Long-term commitment	3.96	0.824	12
7	Productive conflict resolution strategy	3.96	1.038	11
8	Commitment to quality	3.96	0.958	13
9	Commitment to win-win attitude	4.15	0.967	8
10	Mutual trust	4.58	0.578	1
11	Effective communication	4.54	0.582	2
12	Clear definition and understanding of Responsibilities	4.50	0.583	3

13	Behaving in a manner consistent with objectives	3.92	0.891	14
14	Technical expertise	4.27	0.827	6
15	Availability of resources	4.00	0.938	10
16	Financial security	3.92	0.935	16
17	Total cost perspective	3.92	0.845	14

From Table 5, it can be seen that from the 17 success factors identified, the mean values ranged from the lowest value of $M = 3.77$ ($SD = 0.951$) for “Flexibility to change” to the highest value of $M = 4.58$, $SD = 0.578$) for “Mutual Trust”. Still, based on the assertion made by Lu et al. (2008) in Olatunji et.al. (2017), who benchmarked the mean scores of 4 on the 5-point Likert scale as Important, 10 factors of the 17 success factors for partnering with QS firms were highly important. These were, “Mutual Trust” ($M=4.58$, $SD=0.578$), “Effective Communication” ($M=4.54$, $SD=0.582$), “Clear definition and understanding of responsibilities” ($M=4.50$, $SD=0.583$), “Dedicated Team” ($M=4.46$, $SD=0.706$), “Support from top management” ($M= 4.46$, $SD=0.647$), “Technical Expertise” ($M=4.27$, $SD=0.827$), “Establishment of Effective Coordination” ($M=4.19$, $SD= 0.749$), “Partnership formation at the design stage” ($M=4.15$, $SD=1.008$), “Commitment to win-win attitude” ($M=4.15$, $SD=0.967$) and “Availability of resources” ($M= 4.00$, $SD=0.938$). Based on the findings, “Mutual Trust” is considered to be the most important success factor for partnering with Quantity Surveying firms.

Strategic Approach for Partnering with QS firms in Nigeria

Section IV of the questionnaire sought respondent’s opinion with respect to the degree of suitability of the strategic approaches for partnering with Quantity Surveying firms in Nigeria. The Strategic approaches identified from literature are based on the different partnering aspects that exist and the result of the responses obtained is presented in the Table 6:

Table 6: Strategic Approaches for partnering with QS firms

S/No	Strategic Approaches for partnering with QS firms	Mean	Std. Deviation	Rank
1	Relational Aspect	3.65	0.936	4
2	Components and Factors Aspect	3.38	0.804	7
3	Procurement Aspect	3.58	0.758	5
4	Stages Aspect	3.42	0.703	6
5	Trust Aspect	4.31	0.884	1
6	Communication Aspect	4.27	0.778	2
7	Innovation, Outcome and Performance	3.81	0.849	3
8	Culture Aspect	3.08	1.129	8

From Table 6, the 8 strategic approaches for partnering with QS firms that were identified, the mean values had a broad range, from the lowest value of M=3.08 (SD=1.129) for “Cultural aspect” to the highest value of M = 4.31 (SD = 0.884) for “Trust aspect”. This indicates that respondents believe the best strategic approach for partnering with QS firms is the approach hinged on “Trust aspect”. As the name implies, the “Trust aspect” considers Trust to be the focal point and strategic approach to be adopted when partnering with QS firms. Abdul-Nifa (2013) stated that realizing the full potential of partnering requires the element of trust to be inculcated within the partnering parties.

DISCUSSION OF RESULTS

The study was to identify the key components required to develop a framework for partnering with QS firms as the aim suggested. From the findings of the study, over two-thirds of the respondents had been involved in one form of partnering arrangement or the other. The ranking analysis identified four key enablers, with mean values above the benchmarked value of 4, as drivers/enablers for partnering with QS firms. These were “*Trust*”, “*Communication*”, “*Collaboration & Cooperation*” and “*Commitment*”. The most important driver/enabler being Trust aligns with previous studies (Ngowi and Pienaar, 2005; Karlsen et al., 2008), which identified Trust as significant in realizing the full potential of partnering. The enabling factor of trust in partnering enhances working relationships and could solve some issues that may arise with collaborative working (Abdul-Nifa, 2013). Also, the study identified Trust as a critical success factor, amongst others to partnering with QS firms in Nigeria. This is in line with the study of Awodele and Ogunsemi (2007) which identified Mutual Trust as the critical success factor for partnering in the Nigerian construction industry. Out of the 17 identified success factors, 10 were considered highly important based on Lu *et al.* (2008) who bench-marked the mean values of 4 on a 5-point Likert scale, with the most important being “Mutual Trust”. As seen by (Nyström 2005), trust and common goals are the most important components in partnering. As stated in Abdul-Nifa (2013), the issue of trust in partnering has been widely researched, and is commonly cited as one of the most important critical success factors to successful partnering (Akintoye *et al.*, 2000; Abdul-Nifa, 2013; Drexler and Larson, 2000; Olsson and Epsling, 2004; Ola-awo & Roslan, 2016; and Chan *et al.*, 2005). It is therefore no surprise that quantity surveyors also consider *Trust* to be the most critical factor to successful partnering with QS firms. The analysis further revealed the strategic approach for partnering with QS firms based on the different partnering aspects identified in literature. The most suitable approach for partnering with QS firms, with a mean value of 4.31 was *Trust*. Quantity surveyors consider *Trust* as the most important component to partnering and therefore suggested that Trust should be the basis and approach to any partnering arrangement. This is the basic idea of a framework suggested by Ngowi and Pienaar (2005). The framework was developed to build and maintain trust within construction alliances. The findings showed that the sharing of culture by the partners in the alliance made it easier for them to trust each other and proceeded with the efforts of building the alliance more quickly. Furthermore, the findings of the research also revealed that successful partnering with QS firms is not just hinged on the ability to develop and maintain trust alone. Having trust will ensure successful partnering coupled with the other important enablers and success factors. However, there is the need to further maintain and monitor this successful partnering by ensuring effective communication and exchange continues between the parties until the Ideal partnering relationship is formed. It is this ideal partnering that will be introduced into subsequent arrangements for other firms to partner with QS firms.

Framework Development

As mentioned earlier, the absence of rules, regulations and a framework to guide partnering implementation in the Nigerian construction industry as well as lack of technical knowledge on how best partnering project can be delivered compounds the problem of its slow adoption and implementation in Nigeria (Ola-awo & Roslan, 2016; Ola-awo *et al.*, 2018). Also, in Olatunji *et al.* (2017), unclear or lack of a defined partnering methodology/procedure was regarded as a highly significant barrier to partnering in quantity surveying firms; and as such, proposed that a framework for partnering with QS firms should be developed.

Numerous strategic approaches in the form of frameworks, models and guidelines have been formulated by previous studies to aid the implementation of partnering. These strategic approaches can be classified according to their focus namely; relational, component & factors, procurement, trust, stages, communication, and finally innovation, performance & outcome (Abdul-Nifa, 2013). Therefore, after an extensive literature review and based on the findings of this study, a framework was proposed for firms' partnering with Quantity surveying firms in Nigeria. The proposed framework followed other researches on partnering that developed frameworks based on an identified partnering aspect/focus. This research identified the strategic approach to be "Trust", therefore the framework places trust in centre stage towards establishing successful partnering with QS firms to reduce the gap within current partnering knowledge especially as it relates to QS firms. The findings from the study have shown that apart from Trust, partnering with QS firms could be assisted by the presence of certain enablers and success factors. By identifying the trust-enabling attributes and taking into consideration these enablers and success factors, the ideal partnering arrangement with QS firms could be developed by ensuring that the successful partnering is further maintained and monitored by effective communication and exchange.

Accordingly, this framework is developed within the Nigerian context. The framework developed in this research is as shown in the following Figure 1:

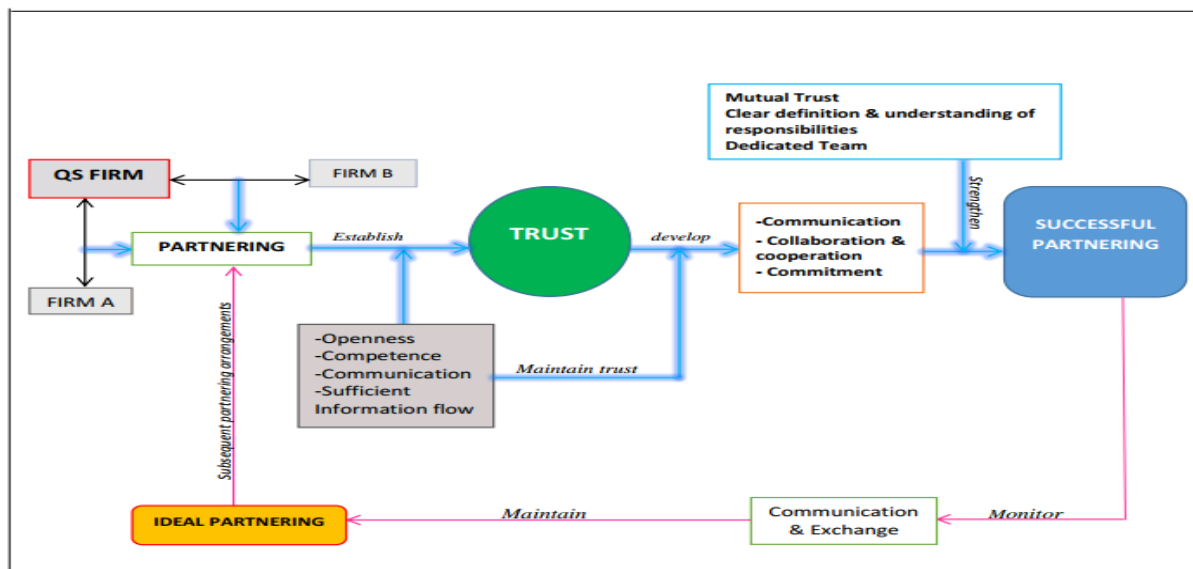


Figure 1: Proposed framework for partnering with Quantity surveying firms in Nigeria

The framework in Figure 1: views firm A or/and B entering a partnering relationship with a QS firm. The central element of this framework is to establish Trust between the parties. This is done by the presence of four key trust attributes: Openness, Competence, communication and sufficient information flow. It is imperative that the Trust which is established is further maintained throughout the project, by the same trust attributes, prior to progressing to the next point of the partnering relationship.

Once trust is established, the partnering alliance shall next aim to develop the other important enablers. These enablers include: *Communication, Collaboration & Cooperation and Commitment*. The next stage is to introduce critical success factors of Mutual trust, clear definition and understanding of responsibilities and dedicated team, which will further strengthen the partnering alliance. With the presence of Trust, key enablers as well as critical success factors in place, successful partnering can then be achieved.

Furthermore, in line with the aim for partnering in achieving business sustainability, once successful partnering is achieved, it is monitored and maintained using communication and exchange so as to establish the ideal partnering which will be implemented in subsequent partnering projects. This is signified by the pink arrow loop in the framework. The loop feature in this framework is important to show that Trust is dynamic as it deals with the trust attributes that are dependent on ever changing human behaviour and actions.

CONCLUSION AND RECOMMENDATION

This research set out to develop a framework for partnering with Quantity surveying firms in Nigeria. After an exploration of theoretical concepts as well as the methodology applied in gaining the insights of the practitioners, a framework for partnering with QS firms in Nigeria was developed. The highlight of the framework was the establishment of Trust as the central element to partnering with QS firms. Therefore, the findings of this research still reiterate what some other researches on partnering have identified – TRUST. In other for partnering with QS firms to be successful, Trust is a central element. Parties to any partnering arrangement must set out a first objective of establishing Trust and further maintaining it throughout the entire process. In entirety, it can be concluded that Trust plays a dominant role in ensuring successful partnering with QS firms in Nigeria.

The recommendations are as follows:

- i. ii. The developed framework should be adopted to guide firms on how to engage in partnering arrangements with Quantity surveying firms in Nigeria.
- ii. iii. Furthermore, since the scope of the work is limited to partnering with QS firms, where only quantity surveyors were the respondents, a framework for partnering in the Nigerian construction industry should be developed based on the knowledge and experience of other stakeholders (clients, contractors, architects, engineers) in the Nigerian construction industry.

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UPSKILLING ARTISANAL COMPETENCIES FOR IMPROVED PROJECT DELIVERY IN EKITI STATE- NIGERIA

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ABSTRACT

In Nigeria, and Ekiti State in particular, the quality of labour works is not comparable with bigger cities as there is a lack of exposure and finesse in delivery. This has led to clients importing workmen from other cities to carry out some trades and skills for them on their projects. This paper aims to examine the skill shortages and related challenges with a view to improve infrastructural delivery in Ekiti State. Highlighting the need for improved government and stakeholder focus on the construction industry through adequate monitoring and provision for training, skills development, and technological growth to ensure sustainability of artisanship, sixty questionnaires were administered using convenience sampling to senior artisans and middle level technicians within Ekiti state to elicit adequate information on the unbecoming phenomenon. Adequate interpretation and assistance were offered by the study team to explain to the artisans and the language used in drafting the questionnaires were made simple to meet the purpose. Fifty questionnaires were found useable for the analysis. Means and Relative Importance index (RII) were used to analyse the responses received. Findings suggest that ageing of current workmen, lack of young willing apprenticeship, lack of modern skills and technology, interest in quick money schemes and lack of adequate structures in place by the overseeing stakeholders contribute largely to this poor delivery of artisanal skills on construction projects within the state. Government and relevant stakeholders will have to actively assist in the improvement of the output of the local construction industry to develop capacity of local artisans and make policies to ensure the sustainability of that sub-sector of the built environment. Being an emerging area of interest especially in this location and the fact that the study was based on a convenient sample, the conclusions reached from this study cannot be generalized. Expected future research should include the influence of quick-money schemes and especially commercial motorcycle transporting schemes on younger would-be apprentices in the state. The need for adequate training of apprentices with updated technology for improved delivery was also suggested.

Keywords: Artisanal skills, Competencies, upskilling.

INTRODUCTION

Nigeria, just like many other developing countries is pressured to meet up with accelerated globalization especially in the deployment and adoption of technology (Lai, 2007). Upskilling artisanal competencies for improved education and project delivery has put the country in a dramatic dilemma which must be addressed, or the country faces the ill consequences (Kraak, 2016). The construction industry is one of the sectors that plays a significant role in the socio-economic growth of any country. Kissi, Saddick and Agmeyang (2018) noted that apart from being a major contributor to GDP of a country, the sector is also responsible for necessary infrastructural projects development to improve the quality of life of its citizens. Infrastructure is the basic physical and organizational structure needed for the operation of a society which may include industrial buildings, bridges, health service, roads, and so on. Agbonlahor (2016), submitted that there are two types of infrastructure which are hard and soft infrastructure. Hard refers to the large physical network necessary for functioning of a modern industrial nation. Whereas soft infrastructure refers to all the institution which are required to maintain the economic, health, cultural and social standard of a country. In any case, technology and technical

improvement offers a rapid remedy since the enterprise or services is necessary for an economy to function. Ekiti state, being almost equidistant to two major capital cities in the country should not be so deprived of needed construction project skills and right personnel with the requisite competencies for delivery. It is based on this background that the study was conducted to examine and assess the acute shortage of artisanal skills in Ekiti State.

LITERATURE REVIEW

Utting (2010) referred to skill challenges within the construction industry as difficulties encountered by skilled workers in achieving occupation and delivery of a project. This may be due to locational, technical or economic challenges. Furthermore, Okigbo (2012) noted that infrastructure is one of the most complex and resource-driven projects in Nigeria requiring specialist skills and causing challenges related to delay in administration and delivery of projects. This is associated among other factors of skills challenges facing workers in the Nigeria. Olaseni and Alade (2012) aptly identified that there's a shortage of skilled labour across the economy and investments that exists in infrastructure delivery. These are likely to drive further demand. In effect, the skill challenge for infrastructural delivery in Nigeria will result to artisanal components of infrastructural works not being delivered to budgeted time, quality, cost and safety benchmarks." Other causes identified include the poor image associated with construction labour as a certain type work done by less intelligent (blue collared) people, lack of commitment by government and the construction industry core stakeholders toward training and development, aging of skilled workers in the industry, lack of adequate apprenticeship system, decline in the number of new entrants into skilled trades, poor funding and ineffective state of vocational education and training system in the country, tradesmen and other technical human resources needed for infrastructure project are scarce because of lack of training and motivation and also poor safety working conditions, delay in working hour. All these socio-cultural factors contribute to the challenges of lack of skilled workers for infrastructure delivery (Aigbavboa, Oke and Mokasha, 2016; Bokinni, 2005; Njoku, 2007; Obiegbo, 2002; Wasti *et al.*, 2016).

Construction professionals

According to Designing building (2020), A construction professional is *"someone who has a career in a construction-related discipline. This can include architects, contractors, engineers, surveyors and so on. They will normally have achieved certain educational and training qualifications which provide them with the knowledge, expertise and skills necessary to carry out their role effectively. They may also be a member of a professional institution, such as the Institution of Civil Engineers (ICE), the Chartered Institute of Building (CIOB) or the Chartered Institute of Architectural Technologists (CIAT)."* Oyedele (2012), opines that these highly trained professionals actively involved from pre-construction through to the post construction stages and manage both human as well as material resources for the building projects implementation. The Nigerian list of the expected professional training with an outline of the educational requirements is as outlined below:

- Architect: Typically holds at least a 4-year degree in architecture. To use the title "architect" the individual must be a member of the Nigerian Institute of Architects and registered with the regulatory body.

- Builder- holds a degree in building. He must be a member of The Nigerian Institute of Building (NIOB) and must be registered with the council of registered builder of Nigeria (CORBON) to be addressed as a builder.
- Civil Engineer – holds a degree in civil engineering and must be a member of The Nigerian Society of engineer (NSE). Must be registered with the Council of Regulation of Engineering (COREN) to be addressed as an Engineer.
- Building Services Engineer - Often referred to as an "M&E Engineer" typically holds a degree in mechanical or electrical engineering. Must be registered with the Council of Regulation of Engineering to be addressed as an Engineer.
- Quantity Surveyor - holds a degree in quantity surveying. Must be a member of the Nigerian Institute of quantity surveyors (NIQS) and registered with quantity surveyor's registration board of Nigeria (QSRBN).
- Town planners- hold a degree in urban and regional planning and must be a member of the Nigerian Institute of town planners (TOPREC) or (NITP) as the case may be.
- Land Surveyors: holds a degree in surveying and must be a member of The Nigerian Institute surveyors (NIS) and registered with surveyor's registration council of Nigeria (SURCON).

Semi-professionals (middle level technical cadre)

The Semi-professionals are the middle level technical cadre personnel trained to be supervisors, foremen overseers, and technical draughtmen. They usually obtain their training from polytechnics, technical colleges, or trained on the job over a long period of time. They are generally charged with the responsibility of coordinating the activities of craftsmen and artisans (Olaseni and Alade, 2012). Craftsmen may be electricians, welders, plumbers, and any person highly skilled or who practices a craft related to construction project. If adequately qualified, they may become masters of the trade and subcontractors during their career.

Skills challenges

Apart from service delivery challenges, the shortage of skills has resulted in loss of institutional knowledge, uncoordinated housing developments, and it has also endangered the performance of projects.

Inadequate skill tutor: The history of skilled labour is traced to Egbu and Robinson (2005) who noted that individuals with tacit knowledge are central to the creativity required in the design and construction of innovative projects. Lawless and Pellegrino (2007), opine that it is so inadequate that technical and project management support necessary for developing road networks and other major projects may become highly difficult to come by in Nigeria. However, problem-solving personnel are often required for innovative infrastructural projects that are often ill-defined and complex to implement (Aigbavboa *et al.*, 2016; Daniels, 2007).

Lack of Experience, Knowledge and Technical Competence

The construction industry in Nigeria is suffering from an acute shortage of skilled manpower. This is partly because Nigeria has been experiencing a two-faced brain drain scenario for some decades, with highly skilled personnel migrating to developed countries and urban areas in search of more rewarding opportunities. The consequence of this trend is that Nigeria and Ekiti

state as a microcosm has had to depend on expatriates from other countries and other cities to execute infrastructural projects. This comes at highly exorbitant costs and poses a major challenge to government's quest to implement high impact projects which are often complex.

Ageing and Retirement of skilled Workers: Currently, training is insufficient to keep pace with the demand for qualified skill workers. This situation is aggravated by an aging workforce and the high retirement rates of experienced workers (Hwang, Thomas and Haas 2009). Aging and retirement have been repeatedly identified as a factor responsible for the shrinking of skilled and qualified tutors in the construction industry (Obiegu, 2002; Bokinni, 2005). Utting (2010) and Obiegu (2002) reported that the average age of skilled and qualified workers in the Nigerian construction industry is too high. The problem is made worse by the demographic decline in the number of young ones ready to enroll into skilled trade careers in construction Obiegu (2002) warned that if adequate care is not taken, skilled artisans in the Nigerian construction industry will go on extinction.

Inadequate Planning and Poor Scheduling

Infrastructure projects in Nigeria are hampered by inadequate planning and poor scheduling. Any project that is not well planned is bound to fail (Akinola and Bashir, 2019). Parties to infrastructural project implementation in Nigeria often put in place inadequate plans before commencement of work and tend to use inexperienced professionals in project planning, with dire consequences on the project. Even when there are capable people to draw up the project plan, time constraints arising from a variety of factors make it difficult for planning officials to follow pre-established guidelines and deliver an implementable plan that would guarantee the success of the project.

Poor Monitoring and Scope Tracking

Scope is the term used to describe the totality of deliverables expected at the end of a project. All project implementation plans, cost estimation, schedule, quality specifications and baselines are normally articulated based on the initial project scope (Fageha and Aibinu, 2013). This implies that any change in project scope during execution will affect the whole project plan and would require a reviewed budget, schedule and quality. Whenever a change in scope occurs, scarce project resources are diverted to activities that were not part of the original scope, leading to pressure on the original schedule and budget. An evaluation of failed infrastructure projects in Nigeria indicate that project scope change usually arises from wrong initial scope definition, unanticipated risks and uncertainties and sudden change in financing which leads to change requests and then change in expected deliverables which also affects the whole project team.

Many times, poor scope management has resulted to disputes that have impacted negatively on the project in terms of delays and cost overruns and could sometimes litigation end in discontinuation of the project (Ogunsanmi, 2016). Most construction companies in Nigeria do not integrate a suitable change management plan which enables the adoption of a proactive approach in managing the needs of stakeholders throughout the project life cycle. Such companies are therefore unable to select the key success factors together with the client, which accounts for their inability to establish Key performance indicators (KPI) or milestones to measure the performance of the project scope. Sometimes, changes are communicated in an

untimely manner which introduces confusion amongst the project team and eventually lead to project delay, abandonment or failure.

Political Instability and Community Interference

The lack of continuity in government policy has also been of adverse effect on Nigeria's infrastructural drive. Successive governments in Nigeria tend to discontinue projects started by their predecessors (Babatunde, Opawole and Akinsiku, 2012). Other politically related reasons for discontinuation of projects in Nigeria include rising inflation which affects the price of raw materials and increases the funds required to complete a project several fold following changes in government (Flyvbjerg, Garbuio and Lovallo 2009). When the cost of such projects is reviewed upwards many times by successive governments, such that the amount of money required to complete them is much higher than the amount required to deliver a new project, the tendency is to abandon them, hence such projects are regarded as having failed. Community leaders on the payroll of the company even when such persons are not meant to perform work of any kind during the project. Failure to meet requested demands from these community organisations sometimes lead to disruption of on-going work, vandalization of equipment, theft of materials and abduction of expatriate workers by community youth groups (Isidinho and Sabran, 2015). This attitude by host communities has put a stop to many infrastructure projects in Nigeria.

Poor Communication and Leadership

Poor communication and leadership between government agencies in Nigeria and contractors has been found to be of detrimental effect on many projects and has caused revocation of contracts by government, with attendant litigation which has led to the termination or failure of several projects. Effective communication is necessary for the success of any project. Sound communication practice helps to enhance teamwork and ensure better collaboration whereas poor communication results in misunderstanding, delays and disputes. Construction is a highly fragmented, dynamic and dissimilar sector, effective communications is vital for the success of projects in terms of performance objectives such as productivity, profitability and re-work opportunities (Baiden, Price and Dainty, 2006).

Cost overruns and time delays

These are factors that lead to cost increases, underrated or budget overrun, involves unexpected costs incurred in excess of budgeted amounts due to an underestimation of the actual cost during budgeting. Invariably, factors that have been identified as reasons for cost overrun in most projects are design errors, scope change, inappropriate and inadequate procurement, complexity of project and post execution phase (Tshele and Agumba, 2014; Tshidavhu and Khatleli, 2020).). The causes, effects and methods of minimization of construction project delays in Nigeria revealed that cash flow problems, shortages of construction materials, client's financial difficulties, inadequate consultant experience and incompetent project team were causes of delay in construction projects (Aibinu and Jagboro, 2002).

Method of procurement

The various method used in acquiring the project and the planning for its usual takes a long process which normally involves the tendering procedures, evaluation of tender, award of the project to the best tenderer. Girmscheid and Hartmann (2002) noted innovative potential that is

created by procurement strategy can only be used if the organizational culture of construction firms is open to performance improvement.

Organizational Structure

It has been argued that the present nature and structure of the industry indicates that many processes are replicated so much that non-value-adding activities and inefficiencies are propagated unabatedly. Therefore, for the industry to improve its performance, the industry needs to change its prevailing culture, and by implication, supply-chain member firms need to change their culture towards a culture that supports continuous improvement. The evolution of appropriate organizational culture will not only allow information sharing between projects and teams, and across organizational boundaries, but will also support the construction sector in adopting new processes, which improve quality and productivity (Sommerville and Craig, 2006).

Public procurement

Requirement on publicly funded projects requires procurers of major construction and infrastructure projects with a capital value and lasting twelve months or longer, to support skills development and the apprenticeship commitment. Incentivizing skills investment through procurement is already common practice on many major infrastructure projects (Oni, Amusan, Owolabi & Akinbile, 2019).

Risk management

Oftentimes, projects do not go as planned so risk management is one of the major project management issues that project managers must deal with. Management experts can tell how seasoned a project manager is with his ability to oversee risks that might creep up in a project anytime. These risks can be an uncertainty in financial market, hidden flaws in the project plan or unknown factors that can impact the success of a project.

Solution to skills shortage in the Construction Industry

Pappas (2004) identified proposals such as educating all stakeholders that the competitive low-bid process is ineffective and detrimental to the users and contractors. Promoting the use of performance information to solve the problem of skilled artisanal shortage in the construction process. Utilising performance information not just to pre-qualify, but also to influence the selection of the contractor using information systems and decrease subjective decision-making (Awe, Stephenson & Griffith 2009). Promoting the concept of paying more for proven performance. Changing the emphasis from project manager to performing contractor in construction education. Change the paradigm from the owner hiring the project manager to the contractors having their own project manager. Possible solutions to the craft worker shortage identified by previous research such as (Awe, Stephenson & Griffith 2010; Pappas 2004) include conducting needs assessment to train workers on a regular basis. Conducting supervisory human relations training, tying documented wage progress to skill outputs; Providing training incentives; Giving long-term preferential treatment to tenured employees; Improving the image of the construction industry; Increasing the pay; and Reducing demand for labour through the use of automation and technology. Among all possible solutions, appropriate training is quite a promising solution to solving the labour shortage in the construction industry (Awe, Stephenson & Griffith 2010).

RESEARCH METHODOLOGY

This study adopts a quantitative research approach with a pragmatic worldview. Questionnaires were developed and administered to a total number of 60 artisanal stakeholders in a field survey through a convenience sampling procedure. The stakeholders included skilled and in-training bricklayers, iron benders, site carpenters, plumbers and plaster of Paris (pop) specialists on selected construction sites within the state. Research assistants were on field to explain details to some artisans where needed. Fifty-three 53 questionnaires were duly filled and returned. After a careful screening process, 50 questionnaires which forms 83.33% of the total questionnaires distributed was found satisfactory and analysed for this study. The result is presented in table 1 below.

Data Collection, Analysis and Discussion of findings

Table 1: Respondents demographic

Characteristics	Frequency	Percentage
Gender		
Male	36	72
Female	14	28
Total	50	100
Age		
18-25	4	8
26-35	9	18
36-45	15	30
46 above	22	44
Total	50	100
Artisanal background		
Masonry {bricklayers}	11	22
Carpentry & Joinery	16	32
Meatal works	8	16
Aluminum	3	6
Services	9	18
POP	3	6
Total	50	100
Years of Experience		
1-5	7	14
6-10	11	22
11-15	13	26
16-20	12	24
21 above	7	14
Total	50	100
Qualification		
ND	6	12
HND	19	38
B.Sc/B.Tech	18	36
Non-trade tested (Apprentice)	5	10
Trade tested	2	4
Total	50	100

Source: researcher's field survey, 2020

Table 1 shows the respondents demographic for this study, 72% of respondents were male while 28% were female, this indicated that males are more involved in participation other than female. 44% of the respondents are above the age group 46, 30% fall between the age of 36 -40 years of age which explains that respondents are old enough unlike the age group 18-25 with 8% as the lowest. Majority of the respondents are affiliated with Carpentry and Joinery as their area of specialization with 32%, followed by masonry with 22%. Meanwhile, services were usually

grouped into plumbing and electrical services and these accounted for 18% of the respondents, leaving the artisans specialised with steel works {welders, iron benders and steel fabricators} with 16%. Only artisans specialised on plaster of Paris {POP} and aluminum works accounted for 6% each. In essence these categories of respondents constitute the prominent activities in the construction industry from foundation stage up to finishes stage of all construction works. Thus, the study was conveniently spread across different specialty and it considered satisfactory.

The experience of an artisan is measured by the years of engagement with specialised skills. Majority of respondents have spent considerable years of experience in the industry, it can be deduced that respondent with year experience of 11-15 years has the highest percent with 26%, followed by 16-20 years while respondents with 1-5 years and with 14% respectively were very few. The qualification of the respondents reveals that majority 38% have diplomas {National and Higher National diploma}, 36% have first degree. These categories form the majority of the responses. However, some respondents have engaged in apprentice route which are not recognize by the government until it has passed the Trade test. This are referred to as trade-tested artisans and others with only apprenticeship certificate are non-trade tested. The rigorous route of these categories accounted for the low response rate recorded in this study. Trade-tested and non-trade tested artisans were 4% and 20% respectively. The summary of the respondent's characteristics is presented in Figure 1.

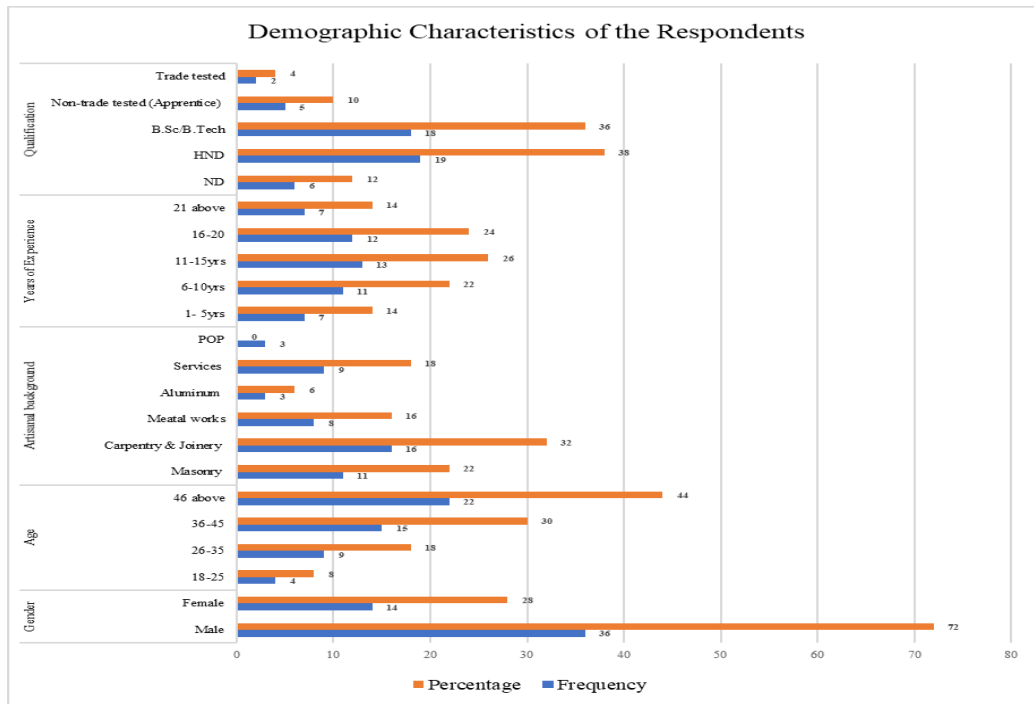


Figure 1: Demographic characteristics of respondents

Table 2 identifies current skill challenges affecting infrastructure delivery in Ekiti State Nigeria.

Table 2: Factors negatively influencing the artisanal skills in infrastructure delivery

Variables	MEAN	RII	RANK
Ageing of work force in the industry	4.20	0.84	1.
Government negligence to vocational training of workers	4.20	0.84	1.
Poor site safety/ working environment	4.18	0.84	1.
Lack of planning and implementation strategies	4.12	0.82	4.
Poor construction industry image	3.98	0.79	5.
Project cost overrun	3.92	0.78	6.
Lack of experience, knowledge, and technical competence	3.86	0.77	7.
inadequate skill tutors	3.74	0.75	8.
Contractor organizational structure	3.68	0.74	9.
Geographical location	3.54	0.71	10.

Source: researcher's field survey, 2020

It was found that ageing of work force in the industry and government negligence in training of construction worker ranked first with RII 0.84 each. Coincidentally, the findings support the statements of Akinbile *et al.*, (2019) that challenges faced by construction site operatives is largely traced to ill funding from government in training, uncertainty of project continuity amongst other factors. Although, Okigbo (2012) argued that the causes of these challenges are not limited to the government but also articulated to the citizens.

Poor site safety and working environment was ranked third with RII 0.84, Lack of planning and implementation strategies was ranked fourth with RII 0.82, Poor construction industry image was ranked fifth with RII 0.79. This shows a significant relationship with (Agwu, 2014; Olatunji, 2020) who noted that the increased fatalities within the country construction industry is associated with Poor site safety culture. Regular safety audits are required to eliminate potential site hazards.

Then, the project cost overrun was ranked sixth with RII 0.78, with mean value of 3.20 this simply explains the negative impact on business as explained in (Jandali, 2018). Lack of experience, knowledge and technical competence was ranked seventh having RII 0.77 and mean value of 3.86. Inadequate skill tutors ranked eight with RII 0.75, Contractor organizational structure was ranked ninth with RII 0.74, and Geographical location was ranked tenth with RII 0.71.

Table 3: Effects on factors constraining infrastructure delivery in Ekiti State

Variables	Mean	RII	Rank
Schedule delay due to labour shortage	5.04	1.01	1.
Decrease in quality of work	4.80	0.96	2.
More re –work	4.72	0.94	3.
Paying extra money for labour	4.54	0.91	4.
Delay in delivery of work	4.14	0.83	5.
Increase in project cost/ cost overrun	4.10	0.82	6.
Poor performance of work	4.06	0.81	7.
Reduce productivity of work	3.88	0.78	8.

Source: researcher's field survey, 2020

Table 3 assesses the effects of challenges on infrastructure delivery in Ekiti State Nigeria. The findings demonstrated that the effects could be prioritized starting with Scheduled delay due to labour shortage was ranked first with RII 1.01 having a mean value of 5.04. Decrease in quality

of work was ranked second with RII 0.96, More re –work was ranked third with RII 0.94, Paying extra money for labour was ranked fourth with RII 0.91, Delay in delivery of work was ranked fifth with RII 0.83, Increase in project cost/ cost overrun was ranked sixth with RII 0.82, Poor performance of work was ranked seventh with RII 0.81, and Reduce productivity of work was ranked eighth with RII 0.78. However, RII analysis showed that 75% of the factors representing (6 highest priority factors) were accountable for about 90% of the overall effects of challenges faced in the deliveries of infrastructure in the state. This is supported in (Aibinu and Odeyinka, 2006). This indicates a slightly noticeable difference among the different factors, and none stands out as non-contributing factors to a large extent of the effects.

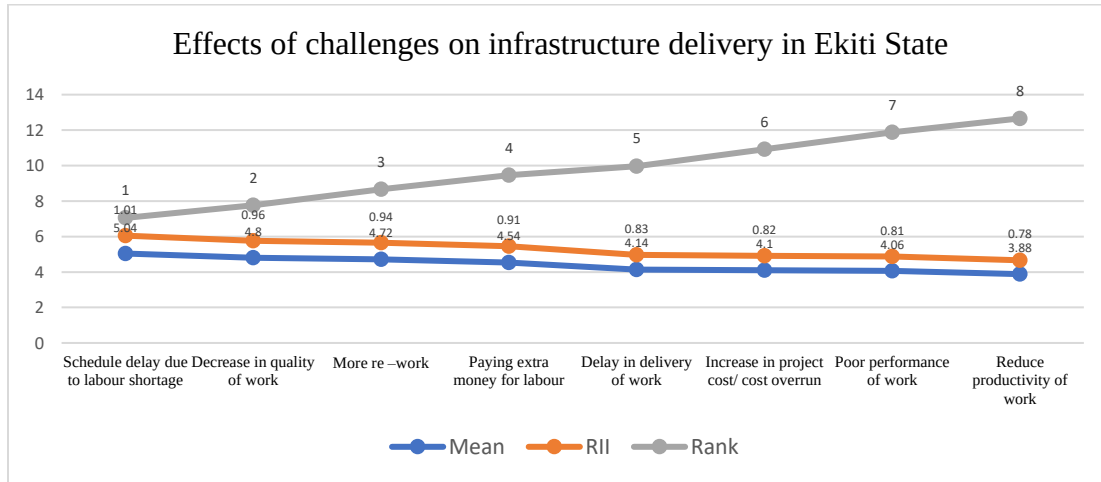


Figure 2: Effects on factors constraining infrastructure delivery in Ekiti State

Suggested way out to skill challenges on infrastructure delivery in Ekiti State

Table 4 presents suggestions on possible solution to skill challenges on infrastructure delivery in Nigeria. The table include ranking of the suggested way forward.

Table 4: Factors promoting artisanal skills in infrastructure delivery

Variables	Mean	RII	Rank
Promote the concept of paying more to proven performance	6.10	1.22	1
Implement a training program for construction workers	5.36	1.07	2
Provide a good working environment	4.61	0.92	3
Provide adequate incentive scheme to workers	4.43	0.89	4
Increase mobility of labor	4.42	0.88	5
Increase payment to construction workers	4.30	0.86	6
Initiate and enforce code of conduct to ensure strict adherence of members.	4.16	0.83	7
Address nepotism in the award of contracts	3.98	0.79	8

Source: researcher's field survey, 2020

The general ranking of factors within each factor type provides useful information for the key players in the construction industry when formulating ways of combating deliveries of infrastructural projects. Promote the concept of paying more to proven performance ranked first with RII 1.22 and mean value of 6.10. Implement a training program for construction workers ranked second having RII 1.07 and mean value of 5.36. This further explains the gray areas of

practices in the construction industry that requires a more attention as presented in Akinbile *et al.* (2019). In addition, the provision of a good working environment ranked third with RII 0.92 and a mean value of 4.61 while Provide adequate incentive scheme to workers ranked fourth with RII 0.89 having a mean value of 4.43. The indication of these factors is that a contextual factor impacting to this disturbing rate of failure is associated to competencies to manage the increase in major and complex infrastructure. This is therefore requiring that project participants require a new level of training program and skill sets to remain skilled for successful project delivery. Below the Table are initiate and enforce code of conduct to ensure strict adherence of members and address nepotism in the award of contracts with Relative Importance Index of 0.83, 0.79 and mean values of 4.16 and 3.98, respectively. However, Foster, (2019) identified areas of solutions that ranges from cost overruns, contractual problems, poor stakeholder management which are all related and supported in this study.

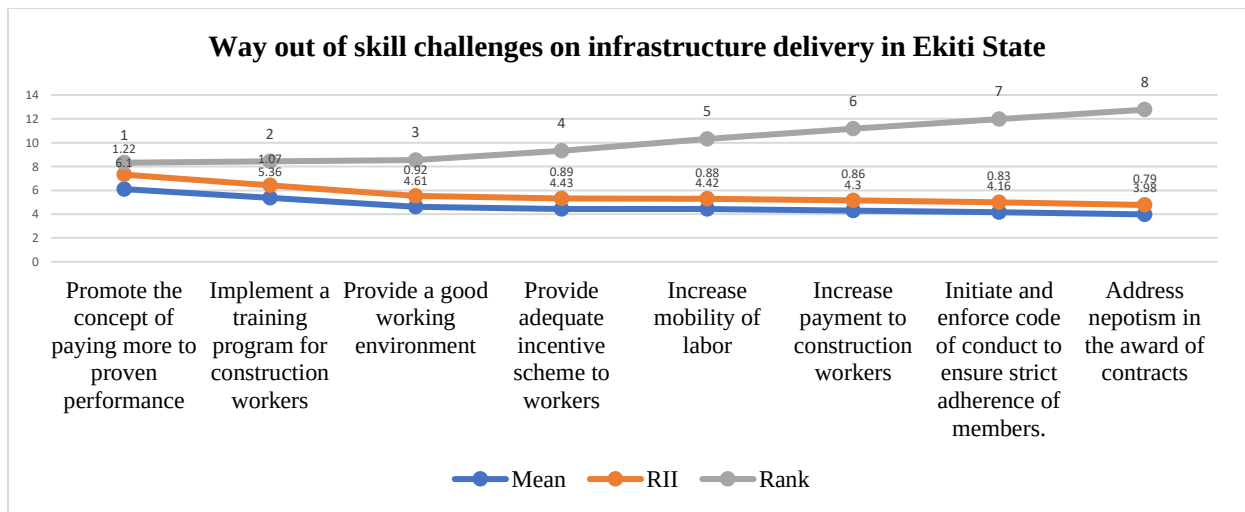


Figure 3: Factors promoting artisanal skills in infrastructure delivery

CONCLUSION AND RECOMMENDATIONS

This study discussed skill challenges especially the artisans for infrastructural delivery in Ekiti State, but with the aid of a quantitative survey utilizing mean scores and relative importance index, ageing of work forces was identified as the most influential factor to the skill shortage in Ekiti state. This is likely so because younger generation of would be apprentices are not interested in learning skills but rather prefer easier money-making schemes as the currently existing system looks largely unattractive to them in terms of returns. Findings suggest that ageing of current workers, lack of young willing apprenticeship, lack of modern skills and technology, interest in quick money schemes and lack of adequate structures in place by the overseeing stakeholders contribute largely to this poor delivery of construction projects in Ekiti state. There is an urgent need for a statewide policy to harness the skills of the retiring generation, remodel it to make it more attractive to younger incoming apprentices, and reshape it for the newly incoming generation. This will also assist in the improvements in the output of the local construction industry to develop capacity. Suggestions made for future research, especially bother on; the reduction of the influence of quick money schemes especially commercial motorcycle transporting schemes on younger would be apprentices in the Ekiti area. The need

for adequate training of apprentices with updated technology for improved delivery is also suggested.

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DIMENSION OF CORPORATE CULTURE IN QUANTITY SURVEYING FIRMS IN ABUJA, NIGERIA

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ABSTRACT

The way of achieving organisational goal cannot be altered without identifying and understanding the key attractor and drivers of culture that enable corporate agility and success. For an employee, understanding the culture of an organisation determines the level of personal and corporate achievement. Hence, identification of corporate culture is required in response to market imperatives. Therefore, this paper aims to assess the effect of corporate culture on the performance of quantity surveying firms. The paper adopted questionnaire survey on the population of quantity surveying firms in Abuja. The questionnaire was formulated on the rubric of dimensions of corporate culture and its effects on the performance of employee working in quantity surveying firms. Data collected were analysed using mean item score and categorical multiple regression analysis. The findings indicated that every employee has different values and beliefs that he or she works with. Also, the dimensions of corporate culture applicable to quantity surveying firms are hierarchical and distinct based on the perspectives of principal and senior partners of the firm. The paper concluded that corporate culture has a positive impact on employee's performance and recommended that principal partners should orientate employees on the dimensions of culture of their organisation.

Keywords: Corporate culture, dimensions, performance, quantity surveying firms

INTRODUCTION

The construction industry is often used as a barometer of economic growth especially in any developed and developing country. This brings about the infrastructure and economic development of the nation. Thus, the construction industry plays a significant role in the economy. The activities of the industry are also proportional to the achievement of socio-economic developmental goals. This view was corroborated by Oladinrin, Ogunsemi, and Aje (2012), that the construction industry, by its nature, has many special problems and requirements that contribute to developmental growth. Some of the problems are a result of the way the industry run and carry out its activities. Literature had noted that the Nigerian construction industry is faced with many challenges just like the United Kingdom construction industry upon which it is modeled (Olanipekun and Abiola, 2012; Aibinu and Odeyinka, 2006). Studies also highlighted that the industry is associated with problems such as low productivity, poor quality, high fragmentation, instability, lack of standards, time and cost overruns, and unsatisfied clients, among many other management difficulties due to difficulties in corporate culture.

According to Guiso, Sapienza, Zingales (2015) defined corporate culture as “a set of norms and values that are widely shared and strongly held throughout the organization”. Corporate culture is a collective mind conditioning that separates the members of one group or individual category from another. It is what guides corporate behaviour, directing how employees think, behave, and feel. It is the systematic set of assumptions that define day-to-day working and patterns of behavior. Corporate culture affects professional services, and people are the professionals involved in any organization. Quantity Surveying Firms (QSFs) are professional-service based which provide consultancy and related management services to their clients (Moyanga and Agboola, 2020; Abidin, Yusof, Hassan and Adros, 2011), and the service they render can be influenced by the kind of culture in such organization.

Oyediran (2011) posited that the non-performance of employees in Qsfs is attributable to a lack of relevance to culture. Shaw (2015) also stresses that quantity surveying practice is on the brink in the UK due to the obscurity of the culture to the quantity surveying practice. It is difficult to identify culture with Quantity Surveying firms. There is a lack of quantity surveying firms due to the lack of culture. This led to a feeling of inferiority complex on part of quantity surveyors to other professionals when commissioned on projects (Kawu, 2011). Therefore, the main purpose of this paper is to assess the dimension of corporate culture and its effects on quantity surveying firms in Abuja. The study aims in assessing the dimension of corporate culture that are peculiar to quantity surveying firms in FCT Abuja.

LITERATURE REVIEW

Corporate Culture Perceptive

Corporate culture is a crucial legacy or model for shaping corporate behaviour and performance in both the public and private sectors of an organization. Nonetheless, a subsequent issue is to what degree controllers can actually relate culture. Corporate culture is seen as the organization's personality: the group's shared beliefs, values, and behaviours. It is to change symbols, pragmatic and unifying, stable and difficult of a group of people. The way things are done within an enterprise is in a clear form of corporate culture. It is what controls corporate behaviour, influencing how employees think, behave, or act and feel. It is the systematic collection of hypotheses that characterize daily working schedules.

Reason for Corporate Culture

Corporate culture is the most vital aspect in the scope of behaviour performance in any institution, particularly when it comes to understanding the framework in corporate structure. It means that the success of the organization in attaining its objectives and targets can be affected by the kind of corporate culture. In order to explore the dimension of culture, we need to be clear on why this corporate culture may be essential, needed or relevant. Individual authors analysed the significance of culture to an organisation. Literature as considered it important, (Shaw, 2015; O'Reilly, 1989 and Kreps, 1990), since employees face choices that cannot be properly controlled. For instance, a company with prestige for outstanding client service. Both managers

and employees are encouraged to save on the effort required to produce the best care. Providing the best effort is expensive, and the likelihood of prevention is minimal, especially if the abdicating is only partial: it is difficult to prove that the care remained only slightly substandard. In fact, the negative consequences of diminished sincerity won't be immediately felt. A negative episode is capable of destroying a longstanding reputation for excellence. Hence, without the proper motivation, managers and employees are likely to withhold on the quality of their services.

Measuring Corporate Culture

The concept of corporate culture began to develop rapidly in the late 1970s and 1980s, leading to numerous researchers to create a survey to the degree in corporate culture. The most critical organization within the corporate culture is the essential assumption that the pre-conscious organization Schein (1985). Such an assumption can be laid out all the way through a complex intuitive strategy of mutual examination among internals and facades. In expansion, Schein examined, that the estimation of quantitative strategy isn't astute to be conducted by means of studies for the reason that it reflects the theoretical categories.

In conjunction, concurring to (Siehl and Martin, 1988) qualitative method can be utilized to look at the corporate culture; in any case, the benefits may conceivably be acquired at a full toll while typically the assembled information cannot structure the nuts and bolts for precise contrasts. Corporate culture can be inspected hypothetically through contrasts among the sections within the organization, it is additionally exceptionally imperative to differentiate the member's reply within the organization to get it the highlight culture. Information can be gathered from various divisions within the same enterprise which is able to help within the difference.

There are various ways to measure corporate culture; this could be tested in accordance with the dimension of the culture. The attributes of the culture can be discernible, for instance, quantitative methods or fully aware of attitudes and values. corporate culture has been categorized as behaviours, standards, and values centering on the conscious components. However, Jogulu and Pansiri (2011) affirmed that it is possible to measure corporate culture using the combination of subjective and quantitative strategies that incorporates interviews, questionnaires, and studies to explore and examine the social phenomenon.

A few theoretical ponders were performed in the quantitative degree of corporate culture conducted by different researchers; for the time being (Cooke and Lafferty, 1989) a cultural questionnaire was generated in "Organizational Culture Inventory" as well as in addition (Denison, Nieminen and Kotrba, 2014).

Understanding Corporate Culture Dimensions

Corporate culture may be acknowledged, analysed and identify. A number of organisations are creating major returns and a high level of performance in carrying it out. Many focus on

identifying employee's attitudes, client satisfaction, behavioral attitude, the work environment such as structure, physical artifacts, and communication channels that form the tangible or intangible aspect of performance.

Corporate culture is the immaterial (intangible) as well as the tangible (material) aspects comprising the norms or assumptions that are regularly engaged for support by those inside the organization. "Corporate culture can be seen in the nature of the buildings, the offices, the organization's shops and the image projected in advertising, dressing-code, brand and general public relations. A culture may be invisible, taken for granted, assumed, a status quo that we live and participate in but do not question" (Jansson 2013 and Bola, 2001)

Geert Hofstede's concept of culture dimensions describes the effects of a society's culture on the values of its members, and how these values relate to behavior. The theory has six dimensions which include power distance, masculinity versus femininity, individualism versus collectivism and Uncertainty avoidance. Others are long term performance orientation versus short term and indulgence versus restraint. Both dimensions provided a general summary and an approximate interpretation of other societies, what to expect from them and how to act towards groups from other countries. Inference from this theory reveals that culture was assessed from a national perspective. In view of this culture was assessed from the construction enterprises in China Liu *et al.* (2006). The assessment was done with the framework developed by Cameron (Choi, Seo, Scott and Martin, 2010). The framework has two interestingly conflicting dimensions which are the hierarchy culture (which is internally-focused and concerning stability and control) and market culture (which is the external focus but wanting stability). The framework implies that culture has dual dimensions of internal and external focus which ultimately explains their integration and adaptation. Also, Sarros *et al.* (2005), described culture in an organization as a multi-level construct that has an internal people-focused dimension and external – focus on environment and business-specific dimensions, that is corporate culture is seen as a multilevel model that has both internal people-focused dimension and external business- and environment-specific dimensions. The study focuses mainly on the internal aspect, that is the people focus due to a numerous number of literatures as dwell in the external factors. Olanipekun (2012) assertion was built on the in-depth empirical analysis carried out using the Organizational Culture Profile (OCP) model. The model has seven supportive factors, with emphasis on reward, performance orientation, competitiveness, social responsibility, stability and innovation. Also, researchers have identified different dimensions of culture, for instance, Aftab, Rana and Sarwar (2012) identified four organizational culture dimensions such as involvement, consistency, adaptability, and corporate mission. In another study, Sinha and Arora (2012) established seven levels of cultural culture, such as creativity, communication, environment, humanistic function, engagement, systems, and outcome orientation. Similarly, Fakhar, Zahid and Muhammed (2013) recognised five organizational culture dimensions such as customer service, employee participation, reward system, innovation & risk-taking, and communication system. Also, Qawasmeh, Darqal and Qawasmeh (2013) identified six dimensions of organizational culture,

such as performance appraisal, conflict resolution, leadership & team-work, training, quality, and final mission, vision and values.

In addition, Ezekiel and Darius (2012) identified four organizational culture dimensions namely, involvement, consistency, adaptability, and mission. Handy (1985) identified four kinds of organizational culture as a Power culture, Role culture, Achievement culture and Support culture. Hellriegel, Slocum and Woodman (2001) have identified four forms of culture: bureaucratic culture, clan culture, innovative culture and organizational culture in the same vein, Hua-Lin, Shih-Yun, Chun-Weilu and Sheng-Hsu. (and) identify four dimensions: bureaucratic culture, innovative culture, Supportive culture, and Effective culture.

Sinha and Arora (2012) also explored the role of organizational culture dimensions such as innovation, communication, the environment, the humanistic workplace, commitment, systems and the resulting orientation on the business performance of the electricity plant in India.

Results indicated that all seven dimensions have a positive and moderate relationship with business performance. After the empirical analysis was done, the seven factors were re-categorized into three dimensions. The three dimensions reflect the focus of the factors in organizations. The factors of supportiveness and emphasis on rewards were put together and labeled people-orientated dimensions. These factors are congruent with two dimensions identified by Linnenluecke and Griffiths, (2010). They are namely 'humanistic workplace' where 'the organization respects and cares for individuals and 'development of the individual'. Grouping supportiveness and emphasis on rewards together is consistent with the dimension labeled 'concern for people' Vianen (2000). The factors of competitiveness and performance orientation, competitiveness and innovation were grouped together having reflected dimension similar to goal accomplishment (Olanipekun, 2012). The remaining two factors of stability and social responsibility formed a third group where the factors reflected a concern for aspects in the external environment beyond the organization. These aspects correspond to the dimension labelled 'environment' in the study by Ashkanasy, Broad-foot and Falkus (2000) and thus labelled so. corporate culture in an organization' can exhibit one, two or to three dimensions of culture are single, dual or multidimensional respectively.

Deduction from the study for both empirical, organizational culture profile, Geert Hofstede's theory and the framework developed by Ali and Rehman (2011) shows that the dimension of corporate culture can be summaries into, using supportiveness, reward orientation, performance orientation, competitiveness, social responsibility, stability, and innovation for both internal and external focus because many scholars and researchers agreed that they are the best because they dip into to the major character of corporate culture and cover the basic assumption of various model (Brenyah & Tetteh, 2016; Schein, 2010; Olanipekun, 2012 Hofstede, 2011; Ashkanasy, Broad-foot and Falkus (2000); Harrison & Stokes, 1993; Handy, 1985). China Liu *et al.* (2006) stated that the framework has two interestingly conflicting dimensions which are the hierarchy culture (which is internally-focused and concerning stability and control) and market culture (which is the external focus but wanting stability).

Performance Measure in Quantity Surveying Firms

Didier (2002) suggests that the success consists of attaining organizational objective that you have been given in a convergence of client orientations. Performance is not a specific discovery of an outcome, but rather a contrast of the result with the targeted objectives. Unlike other authors, Didier Noyé perceives this concept to be in fact a contrast of the outcome and the goal. Which is, since both outcomes and goals differ, most often, from one field of operation to another. Also, Performance is ascribed to corporations, business units or firms, support or functional units, teams and workgroups and individuals. Olanipkun (2012) define as the accomplishment of a given task measured against presently known standards of accuracy, completeness, cost, and speed. Contractually performance is deemed to be the fulfilment of an obligation, in a manner achieving the goals from all liabilities under the contract in a corporation or firm, Kellen (2003) defines organization performs operations in a manner that benefits and allows the company to survive and thrive. Business performance while doing what tomorrow would result in calculated value outcomes. (Lebas and Euske, 2002).

RESEARCH METHODOLOGY

This paper is to assess the dimension of corporate culture peculiar to quantity surveying firm and its effect on performance of quantity surveying firms. The paper adopted questionnaire survey, using the population of registered quantity surveying firms practising in FCT Abuja. The sample frame was obtained from Abuja State Chapter of Nigerian Institute of Quantity Surveyors. Hierarchies perceptive of quantity surveyors in quantity surveying firms will provide a robust assessment of the corporate culture within. This population was sampled using simple random sampling technique. The questionnaire was structured on the rubric of dimensions of corporate culture and its effects on the performance of quantity surveying in the study area. A total of 108 questionnaires were distributed and 84 are retrieved for analysis representing response rate of 78%. This is above the usual rate of 20 – 30% for questionnaire survey in construction management studies (Fellow and Liu, 2008). This response rate was considered adequate and consistent with Mugenda and Mugenda (2003) who suggests that any response rate above 50% is generally representative for a descriptive study. Data collected were analysed using mean item score, mean rank and categorically regression. Stepwise regression analysis was used to determine the effect of corporate culture on the performance of quantity surveying firms.

DATA PRESENTATION AND DISCUSSION

The table below shows the Background of the respondent

Table 1: Background of Respondents

Characteristics	Frequency	Percentage
Professional cadre as a quantity surveyor		
Probationer	31	36.9
Member	30	35.7
Fellow	13	15.4
Total	84	100.0

Years' of experiences		
20 years Below	55	65.5
21-30years	13	15.4
31-40years	16	19.04
51 and above	-	-
Total	84	100.0
Firms been in existence		
20 years Below	62	73.8
21-30years	22	26.2
31-40years	-	
51 and above		
Total	84	100.0
Practicing as a construction professional		
20 years Below	60	71.4
21-30years	24	28.6
31-40years		
51 and above	84	100
Total		
Educational Qualification of the Staff		
PHd		
Masters	25	29.8
Bsc/Btec/Hnd	59	70.2
Diploma/OND		
WASE/NECO		
Total	84	100.0

Researchers' Field Work (2020)

The demography of the respondents in this paper, as presented in Table 1, shows that the respondents in quantity surveying firms are on their professional cadre as a quantity surveyor, 36.9% have are probationer, 35.7% are a member and only 15.4% are fellow, 65.5 has frequency below 20years experience as this comprises of the probationer and member, 15.4 has frequency of 21-25 years of experiences are about only 19.04 has a frequency of above 25years of experiences. Findings show that 71.8% of firms exist below 20years, while 16.2% are existing between 21-25 years of existence. The data also indicates that 71.4% have been practicing as a construction professional while only 28.6% are practicing between 21-25years. It can be deduced from the data that the respondents were academically qualified with 70.2% having bachelor degree. Apart from the encouraging educational qualification of the respondents, there were also professionally qualified with 51.1% having attained the corporate member of the Nigerian Institute of Quantity Surveyors (NIQS). Thus, responses to culture from the respondents can be relied upon. Table 2 shows the results of Dimension of culture peculiar to QSFs.

Table 2 **Dimension of culture peculiar to QSFs**

CORPORATE CULTURE	HIERARCHY	MEAN	MEAN RANK	GROUP MEAN	GROUP MEAN RANK
Performance Orientation Culture	Principal Partner	3.99	2	4.00	1
	Senior Partner	4.0	1		
Innovation Culture	Principal Partner	3.84	2	3.97	2
	Senior Partner	4.10	1		
Competitiveness Culture	Principal Partner	4.0	1	3.90	3
	Senior Partner	3.8	2		
Supportiveness Culture	Principal Partner	3.69	2	3.87	4
	Senior Partner	4.05	1		
Social Responsibility Culture	Principal Partner	3.69	2	3.85	5
	Senior Partner	4.0	1		
Reward Culture	Principal Partner	3.58	2	3.74	6
	Senior Partner	3.9	1		
Stability Culture	Principal Partner	3.63	2	3.68	7
	Senior Partner	3.73	1		

Researchers' Field Work (2020)

From Table 2, the mean score for all corporate culture dimensions in quantity surveying firms is more than the midpoint of the 5-point scale (2.50) used for this study. This indicates that all the dimensions of corporate culture identified; with mean scores, not less than 3.5; are current in the quantity surveying firms. This is in agreement with Line (1999), that every organisation has a culture whether it knows or not. The currency of all the dimensions of corporate culture in quantity surveying firms is also in agreement with the multiple culture theory of Web book (2012). Web book (2012) stated that in reality, there might be multiple cultures within organizations.

Using the hierarchical perspective, the mean scores for the response of the various hierarchies on the dimension of corporate culture as revealed in Table 1 The Principal partners rank first Competitiveness Culture, while the senior quantity surveyors rank first Innovation Culture, Supportiveness Culture, and Social Responsibility Culture. both the principal and senior partner rank performance orientate culture first.

In general terms, the dominant corporate culture in quantity surveying firms is the Performance Orientation Culture with an overall mean score of 4.0. Closely following the Innovation Culture of MIS 3.97 after competitive culture of 3.90. The less dominant corporate cultures are Stability Culture, Reward Culture and Social Responsibility Culture of MIS of 3.68, 3.74 and 3.85 respectively. The implication from the findings of this objective is that quantity surveying firms are organisational culture orientated which contradicts the general belief that culture is strange to the firms. Quantity surveying firms also have multiple dimensions of corporate culture, because all the factors (types) that constitute the dimension of corporate culture are present in the quantity surveying firms. The dimensions stated in (Sarros *et al* 2005) are people-oriented, goal accomplishment and environment; and all are exhibited in quantity surveying firms as indicated by the findings of this study.

The regression analysis of the effect of corporate culture on performance measures are presented in Table 3

Table 3 Regression coefficients on effect of corporate culture on performance measures

	MODEL 1 BUSINESS PROCESS RE- ENGINEERING			MODEL 2 MARKET ORIENTATION			MODEL 3 COMPETITIVENESS			MODEL 4 SERVICE FLEXIBILITY		
Dimension of culture	B	t-value	p-value	B	t-value	p-value	B	t-value	p-value	B	t-value	p-value
Constant	6.047	9.813`	.000	5.846	10.227	.000	4.858	8.671	.000	3.212	3.478	0.001
Innovation Culture												
Supportiveness Culture							-.881	-6.444	.000			
Performance Orientation Culture	-.479	-3.340	.001	0.307	3.882	.000	.327	4.590	.000	.238	2.960	0.004
Social Responsibility Culture												
Reward Culture												
Competitiveness Culture										.351	2.212	.030
Stability Culture												
F-value	11.155			14.079			18.216			15.549		
Sig	.001			.000			.000			.030		
R	.346			.508			.637			.664		
Adj. R²	.109			.240			.384			.412		

Researchers' Field Work (2020)

The stepwise regression analysis indicates that the six out of the seven types of corporate culture (stability, innovation, competitiveness, performance orientation, corporate social responsibility and reward) have significant contribution to one or more of the eight performance measures of quantity surveying firms. The performance measures are business process re-engineering, market orientation, competitiveness, value creation, service quality and service flexibility. Others are customer satisfaction, and employee satisfaction.

Corporate culture of performance orientation culture influence six performance in quantity surveying firm (Table 2). Competitiveness culture influence four in quantity surveying firm while reward culture has effect on three performance measures of quantity surveying and other are solely influence by performance orientation and competitive culture. from the foregoing, the influence of performance orientation and competitiveness culture cannot be ignored or over emphasised. Competitiveness culture is in agreement with (Abidin, Yusof, Hassan and Adros, 2010). (Abidin et al., 2010) describe cost leadership as one of the competitive strategies applicable in quantity surveying firms. The strength of performance orientate culture can be attributed to the dominance and level of importance of culture in quantity surveying firms (Table 3). Performance orientation culture however is less dominant and least importance from Table 3, however indicates that performance-oriented culture is a current corporate culture in quantity surveying firms.

DISCUSSION OF FINDINGS

The findings indicated that majority of the respondents had most staffs have below 20 years of experience in practice and in construction, coupled with the relevant education level needed to enhance the reliability of the information that they provided. However, the general opinion of the quantity surveyor in the quantity surveying firms favour the dominance of Performance orientation culture, innovation, competitiveness and supportiveness culture. The least dominating corporate culture is stability culture and the reward culture. Study is corroborated by (Zahariah, Razanita and Erlane, 2009) study examining dimensions of corporate culture, namely teamwork, communication, reward and recognition and training and development on employees' commitment towards the organisation.

Supportiveness culture in quantity surveying firms is difficult to execute that most staff of quantity surveyors at all levels are barely standard in their workplaces but shifting locales, collaborative and supportive are subsequently hampered. This may anticipate this sort of hierarchical culture from giving critical impact on the execution of amount looking over firms. (Sarros et al., 2005) assert that Supportiveness culture emphasises team and people orientation, sharing information freely and general collaboration within an organisation. The non-consistency of any of the performance rating by supportiveness culture in quantity surveying firms can be ascribed to the less consideration given to supportiveness culture in quantity surveying.

CONCLUSION AND RECOMMENDATION

The study assessed the dimension of corporate culture in quantity surveying firms in Nigeria. The study enumerates all the dimensions. The findings contradict the general belief that culture is strange to the firms. Also, quantity surveying firms exhibit multiple dimensions of culture because all the factors (dimension) that constitute the dimension of corporate culture are current in quantity surveying firms' performance. The study recommends that principal partners of Quantity Surveying Firms should orientate employees on the various dimensions of culture of their organisation.

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THE ADOPTION OF E-TENDERING SYSTEM FOR NIGERIAN CONSTRUCTION CONTRACT-ISSUES AND THE WAY FORWARD

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ABSTRACT

The awareness of e-tendering has been noticed in the construction industry for years now. Recent literature reviewed showed major benefit derived from the practice, which include; value for money and transparency. The aim of the study is to evaluate the factors that ‘bottlenecked’ the adoption of e-tendering in order to proffer solutions to it. It adopted the purposive sampling method. Instrument used was a structured questionnaire distributed to professionals in Akwa Ibom State. Out of the 140 copies of questionnaire administered, only 95 copies were completed and successfully retrieved with response rate of 68%. Data analysis used descriptive statistical tools such as percentages, frequency and the Mean Quantity Score (MQS) to generate rating of the variable of interest. A 5-point Likert scale ranging from “extreme positive” (5) to “extreme negative” (1); where any mean value of response can be adjudged above 3 as positive and vice versa. It also adopted a direct interview as a case study with a staff of Bureau of Public Procurement (BPP), Akwa Ibom State which reveals dearth of e-readiness but proposes future adoption of the system. Data were presented on tables based on responses from respondents. Findings shows that about 54.74% were aware of the e-tendering particularly from literatures while 3.16% actually partially involved in the process leaving the extent of usage at 10.53% which is adjudged very low. This decline is attributed to lack of e-readiness by government and stakeholder which ranked 1st with mean quantity score (MQS) of 4.75. The paper concludes that there is very low and partial involvement in e-tendering by professionals due to lack of e-readiness by government and stakeholders in e-policy implementation. It recommended review and adequate incorporation of e-tendering clauses in the standard form of contracts by regulatory bodies, sponsored/passed e-tendering bills by lawmakers, workshops etc. amongst others.

Keywords: connectivity, paperwork, procurement-tendering, e-readiness.

INTRODUCTION

Prior to the advent of internet, contracts procurement activities were seen by many to be routine and repetitive exercise. Most organization assign people on specific procurement task, separate procurement offices, making the process labor-intensive, dominated by paper-works, costly and inefficient (Seah, 2004). This perception has been modified by expanding capabilities of World Wide Web (WWW) internet facilities in recent years to enhance the performance of tasks. It is now a fact that the much-anticipated global village is a reality. In this era of digitalization, the horizon of bidding ecosystem is now invigorated with the digital transformation. E-tendering system have eliminated all the issues of traditional tendering process and made it a seamless exercise (Black *et al.*, 2005).

E-tendering is gradually gaining acceptance by both public and private organization. Many entities in the most developed nation have transformed from manual-based to electronic tendering (e-tendering) processes in order to address issues of transparency, tender manipulation

processes and lack of efficiency (Oladapo, 2005). In Nigeria, the adoption of manual based had been in existence. However, a web-based system that supports key steps in the tendering process has been modeled by construction professionals in order to solve those issues. In addition, large organizations usually have to handle multiple procurement needs applying different kinds of information systems developed by various contractors and suppliers; such process will become inevitably long and cumbersome in conventional e-tendering system when the categories of jobs are not well sorted out. (Wood, 2002). A subject of serious concern is that there is no availability of facilities for participating in e-tendering by construction professionals that runs few packages for word processing (Ms-Word) and spread sheeting (Ms Excel) (Lou & Ashalwi, 2009). However, a high level of proficiency in ICT is required for the use of e-tendering facilities, thus the necessary requirement in terms of proficiency are far from being met (Olukayado & Adeyemi, 2011).

Yahaya *et al.* (2019) had evaluated Nigeria Public sector e-tender (NPS e-tender) based on group decision making and concluded that (NPS e-tender) can lead to a more proficient tendering process. Some other researchers developed software's for web e-tendering usages after recognizing various advantages in its promptness, fairness, transparency, eco-friendly nature, less expenditure among others. However, it is noted that there has not been significant wide usage, if any, in the country (Bardon, 2009). Therefore, who is to be blame for this narrow usage margin? Why is the traditional approach-the manual activities still in operation? Do the challenges of implementation outweigh the benefits? Is it that the country is not in e-readiness? These questions form the background of this research paper, pointing that adoption of e-tendering is the key if this nation is to take its center stage in the global village.

THEORETICAL FRAMEWORK

E-tendering portals are “secured dedicated websites”, set up for the exchange of information and tender documents electronically over the internet. As outlined by Ibem & Laryea (2015), the goal is to have a complete shift from paper-based manual tendering to fully automated electronic means of communication; thus, speeding up interaction and communication between different parties involved in order to increase productivity and efficiency.

The paper is revolved round the theory of Technology Acceptance that the adoption of any innovation or especially IT based requires investment in computer-based tools to support decisions making, planning and communication. Although, it may be risky.

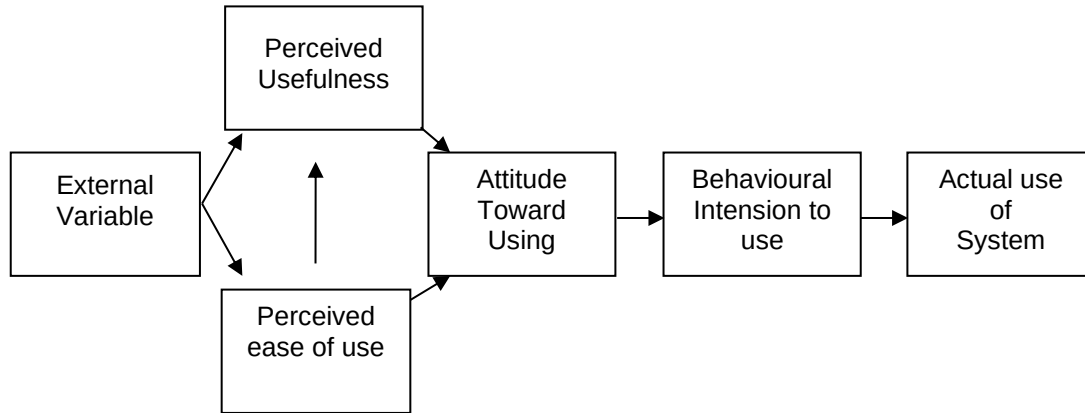


Fig. 1: *Technology Acceptance Framework*

Source: Kamel (2004)

This theory is based on two assumptions: perceived usefulness of the system such as improved performance, enhanced productivity, effectiveness and efficiency in operations etc; and the perceived ease of use of the new systems such as ease to learn, ease to use, ease to control and ease to remember. It brings an understanding that acceptance and the use of new technology is a function of the user's feelings about the system and its perceived benefit.

Concepts /process of e-tendering

E-tendering is basically an expression used to described the dissemination and receipt of tender information, expression of interest (E01) in tendering, receipt of tender documents, submission of tender sum and final selection of successful tender for a contractor via the internet (Black *et al.*, 2005). The ultimate goal of e-tendering being a shift from manual paper methods to fully electronically enabled means of communication will also strengthen the remote accessibility and international coverage of the system. (Parida & Parida, 2005).

Technically, the e-tendering concept combines a number of processes that take place before the award of contract. It involves e-notification, e-access, e-submission, e-evaluation, e-awarding (Seah, 2004). With this system, tender specification, advertising, tender aggregation as well as the evaluation and placing of the contract can be prepared at ease (see table 2.1 on the next page).

E-tendering systems are relatively simple technical solution based around e-mail and electronic document management. It involves uploading tender document on to a secure website with secure login, authentication and viewing rules. Hunja (2014) outlined the process as follows:

- Outline publishing of tenders advertised on e-tendering portal by government agencies or companies.
- Bidders enrolment at the online tendering platforms to generate user ids and password.
- Uploading the requisite document (PDF) and mention the bid online.
- After payment of fees online, bidders submit candidacy before the closing date.
- Finally, bid results get publish online

Betts *et al* (2006) outline steps in e-tendering as follows:

Table 2.1: Steps in e-tendering

Qualification and registration	Qualification registration Issue user name and password
Public invitation	Tender advertisement Tenderers view Advert notice
Tender submission	Tenderers fees for tender documents Download tender document Tender documents distributed by client Tenderers submits tender
Closure of Tender	Close tender Client opens tender
Tender evaluation	Tender evaluation & reports Request for information
Award of Tender	Award tender acceptance of tender Sign the formal agreements
Archiving	Retention of document

Source: (Betts *et al.*, 2006)

Bottlenecks in adopting e-tendering system

Hunja (2014) gave highlight on some of the major challenges that hamper the adoption of e-tendering system:

- i E-readiness by the government and private sectors: e-readiness demands the adoption of important applications of ICTs in offering interconnectivity between clients, contraction and stakeholders. Being considered a traditional industry, the response is look warm let alone implementation in construction procurements.
- ii Unreliable functional sites with the tendency of crashing due to numerous bidders accessing it at once or weather/climate disruption. Irregular power supply sources will tender the process.
- iii Security challenges: confidential document getting leaked, unauthorized modification to the tender, data integrity after assembly (Eadie *et al.*, 2010)
- iv Cost of Installation: Samuelson (2008) stated that it involves huge investment cost to adapt and maintain e-tendering. Ranging from basic hardware facilities, software's, dedicated server, connection to internets, etc; are all traceable to high cost.
- v User Acceptance/Resistance: The general attitude of "construction conservatives- it's easier the old way. The old way has been productive over the years and changes are unnecessary (Olukayado and Adeyemi, 2011).

- vi Unethical Contractors/Suppliers/Investors/Developers and corrupts officials will fight to continue with paper-based tendering which is full of leakages (fear of potential loss of bribery).
- vii Existence of legal framework for e-tendering: It presents its users with several legal impediments, partly because the law that governed e-transactions is either non-existent or under-developed (Black *et al.*, 2005).
- viii Cyber espionage/crime: These include internet hacking, viruses, intruding, pirating, illegal trading, fraud, among others. All these have destructive impact on trust and transparency in the process.
- ix Inadequate training and re-training of staff on the use of sophisticated ICT tools and software's for proper adoption of e-tendering.

Benefits accrued from e-tendering adoption

The benefits that construction professionals and government agencies, department and ministries could gain when implementing e-tendering system; opined by Lavelle & Bardon (2009).

- i.* International tenders: e-tendering eliminates the barrier of borders and opens a global spectrum of tenders worldwide.
- ii.* The trend of digital tendering will result in carbon footprints to save our “mother” earth.
- iii.* Industry perspectives: it increases tender opportunities, promote transparency and competition; assures fairness irrespective of the remoteness or the geographical area of tenderers.
- iv.* Government perspectives: it yields better value for money of taxpayers; standardized tendering process across the government; reduction in administrative processes; fairer and faster evaluation of tenders submitted (RICS, 2007).
- v.* General perspectives: Virtual elimination of errors due to strict process; it eliminates automatically, non-complaint bid/saves time, money as forms are downloaded electronically. (Ibem & Laryea, 2015)
- vi.* Easy to shortlist: the details of all bidders are visible online to the tenderer issuers. The profile and quotes of all bidders can be compared easily without assorting a bundle of documents.
- vii.* E-tendering eliminates unhealthy inducements; bidders give absolute priority to bidding values, resulting in lower quotes.
- viii.* Eco-friendly: it is an endeavour towards a paper-free world.

RESEARCH METHODOLOGY

A cross sectional survey type of research was employed. A structured questionnaire was used to obtain information from a population comprising Engineers, Architects, Quantity Surveyors, Contractor, government MDAs (Ministry, Departments and Agencies) in Nigeria. The Non-

Probability sampling technique employed was the purposive sampling method. The administration of the research questionnaire was carried out in Akwa Ibom State alone due to Corona Virus pandemic in the country. Out of 140 copies of questionnaires that were administered, 95 copies were properly completed and retrieved. The questionnaire making the effective response rate of 68% was subjected to a pre/pilot survey of selected professionals showing their proper understanding of the instrument with no ambiguity, the result obtained being in the same direction with the final copies of the instrument adjudging it both valid and reliable (Gordon, 2002).

To further add credibility to obtained data and show how reliable the data obtained becomes to the objectives of study, the researcher makes use of interview schedule. There was an open-ended question that gave respondent an opportunity to express his or her opinion in the unrestricted manner. The method of analysis adopted for this study was descriptive statistics like percentages and frequency were used. The study also made use of a 5-point Likert scale ranging from “Extreme positive” (5) to “Extreme negative” (1); where any mean value of response can be adjudged above 3 points as positive and vice versa. It also uses Mean Quantity Score (MQS) to generate rating of the variables of interest. MQS is a descriptive statistical tool that describes the variables of interest in terms of central tendency. This was considered valid due to the research being largely descriptive and exploratory in nature. Data presentations were tabulated based on responses from respondents.

RESULTS AND ANALYSIS/FINDINGS

Table 1: level of awareness about e-tendering

level	frequency	percentage
Aware	80	84.21%
Not Aware	5	5.26%
Not Certain	10	10.53%
Total	95	100%

Source: Field Survey, 2020

The levels of awareness on the part of respondent is very high with 84.21%. this indicates that the respondents have knowledge of procurement through the web, only 5.26% indicate their unawareness while 10.53% of the respondents are not certain of knowledge about such procurement method.

Extend of usage in procurement practices

Table 2: extent of usage in procurement practice

extent of usage	frequency	percentages
Very high	—	—
High	—	—
Moderate	—	—
Low	—	—
Very low	10	10.53%
Not in use	85	89.47%
Total	95	100%

Source: Field Survey, 2020

The extent of usage has been depicted very low in the figure 10.53% while 89.47% respondents have not made use of electronic media in performing tendering related activities. This is in consonance with lack of implementation of policies by government and standard form of contracts.

Source of awareness of e-tendering

Table 3: channels of awareness by respondents

channel of awareness	frequency	percentages
Academic / Professional publication	52	54.74%
Involvement in tendering	3	3.16%
Website / Social Media	20	21.05%
TV/Radio Newspaper Advertisement	6	6.32%
News from developed countries	10	10.53%
Other states in Nigeria	4	4.21%
Total	95	100%

Source: *Field Survey, 2020*

The main source of awareness of e-tendering was academic/professional publication with 54.74% and website/social media with 21.05%. However, the source of awareness is not much through involvement as the sector records only 3.16% but from academic/professional enlightenment and website/social media.

Table 4: major reasons for non – usage of e-tendering platform.

Factors	5	4	3	2	1	Mqs	Rank
Legal & security issues	58	25	9	3	-	4.45	2 nd
e-readiness by government/private	75	96	4	-	-	4.75	1 st
Unethical Practices prevalence	48	29	13	5	-	4.26	4 th
dequate implement of policy by government							
Proficiency of Practicing Stakeholders	60	22	7	4	2	4.41	3 rd
	35	25	17	10	8	3.94	5 th

source: *Field Survey, 2020*

Major factors that hampers the adoption of e-tendering is highlighted with e-readiness by government / private sector being ranked 1st with MQS 4.75 – depicting the dearth of essential facilities & infrastructures, poorly executed policies and poor efforts at improvising the created portals.

Consideration of usage of e-tendering in future

Table 5: future consideration of e- tendering

response	frequency	percentages
Strongly yes	78	82.11%
Hopefully	12	12.63%
No/Never	5	5.26%
Total	95	100%

Source: *(Field Survey, 2020)*

Professionals in the construction industry have indicated their willingness to welcome future usage of e-tendering platform. Reasonably, 82.11% affirmed strongly yes; 12% are hopeful because of the critical condition of infectious disease spread in the country; 5.26% are not in agreement to adopting this platform in the future citing cyber-crime as impediment.

DISCUSSION OF FINDINGS

The awareness of new elections technology is the first step in the course of its adoption. As such, about 84.21% are knowledgeable about this electronic tendering. Most respondent about 54.74% were aware through literature from academic and professional journal seconded by 21.05% from internet web and social media platform. It is ridiculous that only 3.16% got the awareness by involvement in the practice. However, this awareness level reported, it is disheartening that the extent of partial usage remains 10.53% - very low leaving 89.47% of sampled respondent not participation at least partially. The “Very Low” participant agreed that they were partially involved mostly in the purchase documentation process of e-tendering. Government and stakeholder e-readiness and ranked 1st with MQS 4.75 as the major hindrance to the adoption of e-tendering due to dearth of infrastructure and poorly executed and implemented policies. Although most respondent are aware of the role of Economic and Financial Crime Commission (EFCC) in combating Fraudulent Act, respondent are depressed of the current situation cyber-crime prevalent in the country. However, majority about 82.11% have good future prospect for adoption of e-tendering. This is on the premise that another pandemic may strike in the future disrupting contact activities as well as the fact the world is turning e-technology global village soonest.

CASE STUDY: INTERVIEW SCHEDULE

The study conducted a brief session interview with a project quantity surveyor who works with the Bureau of Public procurement, Akwa Ibom State. The Following valid points were extracted from the interview session:

- i. Prior to this interview, traditional selective tendering has been adopted by the state government.
- ii. The Bureau of public procurement had just been created out of Ministry of Lands and Housing in the States as such no e-tendering procurement has been conducted.
- iii. Due to the Corona Virus Pandemic delaying the construction sector’s progress, there is need to prevent this in future and adopt e-tendering system.
- iv. The only e-tendering process adopted in her perspective was only on the online purchase of bid documents
- v. She was positive that the Akwa Ibom State government shall in future embrace fully the e-tendering platform.

CONCLUSION AND RECOMMENDATIONS

The result of the findings has established that e-tendering involvement among professional in th construction industry is very low or non-existing in Akwa Ibom State. This is due to the fact that

government policy and implementation in the state is not yet geared towards e-readiness. However, a very low turnout of professionals who engaged has done that partially without regulations. Majority are of the opinion that the future holds positively good for e-tendering adoption. Therefore, with the prospective of the world becoming a “global village” as well as unforeseen future pandemic that may disrupts “contact-to-contact activities” it is imperative that all embrace e-tendering option. Based on the challenges that bottlenecked the implementation of e-tendering. The following suggestions were proffer:

- i. There should be a review by industry professional bodies in the standard form of contract clause to adequately accommodate and enforce adoption of e-tendering by stakeholders in the construction industry.
- ii. The National Information and Technology Development Agency (NITDA) and Government Bureau of Public Procurement (BPP) should engage government participation fully in infrastructure and provision of relevant e-tendering facilities.
- iii. Professional bodies and its regulated counterparts by curbing cyber-crime and frauds must ensure professionals are adequately trained and re-trained thro seminars, workshop/conferences on software handlings, basic hardware’s and other e-tendering facilities; making it affordable and accessible.
- iv. Government through National Assembly and State Assembly should sponsor e-tendering bill and passed same into law so as to boost the legal existence of the practice.

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