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

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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, FSCIArb, 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
9th -10th November 2020 *Federal University of Technology, Minna*

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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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, NPVi, 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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