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	∑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, Udeaja & 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	∑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

Catergory 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.

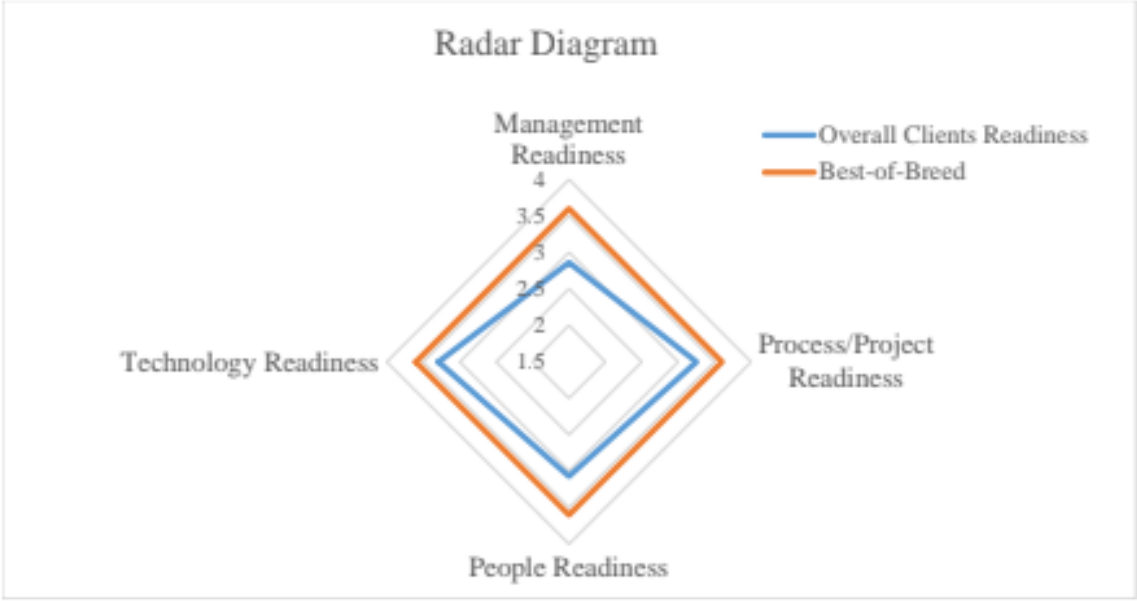

Figure1: Radar Diagram showing average e-readiness of clients compared to best-of-breed

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	∑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 other to achieve value for money.

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