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Accuracy of Labour Cost Estimate Towards Sustainable Construction Projects Delivery in Nigeria

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Abstract

The sustainability of any construction project depends greatly on the accuracy of cost estimates to meet time and budget. Despite these concerns, the accuracy of construction labour cost estimate in Nigeria still remains unclear. Hence, this study aimed to identify the factors affecting accuracy of labour cost estimation towards sustainable development. The objectives of the study include to identify the factors and evaluate the degree of agreement to which these factors are significant from construction contractors and consultants' perspectives. A sample of 100 contractors and consultants each were randomly selected from the list of registered contractors and consultants by the Bureau of Public Procurement (BPP) which gives a total number of 200 questionnaires distributed, out of which the responses rates received were 80 (80%) each for the contractors and consultants. Data analysis include Relative Importance Index (RII) for ranking comparison among the contractors and consultants on a scale range from 1-5 for rating their responses. Kendall's coefficient of concordance was used to evaluate the degree of agreement between contractors and consultants' viewpoints related to the ranking of each of the factors. The results of RII revealed that the five topmost factors affecting accuracy of labour cost estimates are experience in pricing construction project, accuracy and reliability of cost information, clear and detailed drawings and specifications, site constraints and perception of the importance of labour cost estimates. The results of Kendall's coefficient indicates a significant and strong degree of agreement between contractors and consultants

towards ranking of the factors affecting accuracy of labour cost estimates. The findings are focused to provide the best way to achieve accurate labour cost estimates for a sustainable project. It was recommended that for an accurate labour cost estimates, the estimator should take into consideration these factors at the inception stage of cost estimation.

Keywords: *Construction industry, Construction management, Cost estimation, Labour cost estimates, Sustainable construction project delivery.*

Introduction

The construction industry in particular has been identified to be one of the key sectors for the economy which possess the potential of stimulating economic growth and development of any nation (Abu Bakar, *et al.*, 2012). This is following its influence on socio-economic development for industrial growth and production of basic amenities which make it a frontier for sustainable development. Though, the long-term sustainability of the industry's significant role in the socio-economic development depends greatly on the level of accuracy of cost estimates to deliver construction projects at the right time and within the expected budget (Hatamleh *et al.*, 2018)

Cost estimation is a procedure of determining the scope of work and the financial resources needed to satisfy the requirements of the project from inception through construction and completion stage (Arif *et al.*, 2015). The structural components of cost estimation of a project involve material cost estimates, labour cost estimates, plant cost estimates, and overhead and profit cost estimates (Barzandeh, 2011). However, as a labour intensive industry, labour cost estimates is regarded as a true reflection of the efficiency and effectiveness of the construction projects delivery. This is because labour cost estimates influence every part of a construction project which covers 30-50% of the overall project's cost depending on their complexity and nature (Kazaz and Acikara, 2015). Morozov *et al.* (2017) found that labour cost estimates are the main elements to operate equipment, and fabricate and install materials on construction sites. For this reason Jarkas *et al.* (2012) asserted that for the projects to be delivered per specified time and within budget, accurate labour cost estimates should be conducted. Despite these concerns, the final labour cost estimates in a lot of cases and due to various factors are higher than the initial estimates. Hence, there is need for an extensive studies to be conducted on the factors affecting accuracy of labour cost estimation, taking into accounts construction industry

contractors and consultants' views. Consequently, the purpose of this paper is to build current understanding of factors affecting the accuracy of labour cost estimates. In doing so, the paper is guided by the following objectives: (1) to identify the factors affecting accuracy of cost estimation, and (2) based on the objective (1) to evaluate the degree of agreement between contractors and consultants' viewpoints related to the ranking of each of the factors.

Literature Review

According to (Akintoye, 2000), labour cost estimates is a technical process of predicting the labour cost of implementing activities in order to accomplish the set objectives of the construction project within a particular time period. Larson and Gray (2011) stated that the labour cost estimation is the process of predicting and forecasting the manpower, time and cost needed to accomplish the project's objectives. Arif *et al.* (2015) define labour cost estimates as the predictive process of quantifying the manpower resources to establish project budget. In general, labour cost estimates is the procedure of examining the specific scope of work in a construction project and forecasting the labour cost of completing the work. Hence, the importance of labour cost estimates has been sufficiently reported in the literature with the ever increasing pressure on construction contractors and consultants to deliver projects of desired quality, cost and on schedule time.

However, many factors can affect the accuracy of labour cost estimates of construction projects. For these reason, several studies in many countries have been carried out to identify specific factors which affect the accuracy of labour cost estimates. These includes; Azman *et al.* (2013) who studied the Malaysian construction industry; Mahamid, (2015) investigated Palestine construction; and more recently Hatamleh *et al.* (2018) examined the Jordan construction industry. Hence, the findings of these studies forms the underlying basis for identifying the factors affecting accuracy of labour cost estimates as outlined in the study's first objective.

Azman et al. (2013) carried out a review to improve the accuracy of initial labour cost estimates in the Public Works Department of Peninsular Malaysia. The authors analysed 83 projects and tender bids, and found out that labour cost estimates is affected by the attitude of quantity surveyors in relation to a number of factors such as; level of bidders competition, location and types of project, design scopes, cost data, and others. They concluded that the availability of sufficient design information and cost data are the most important factors in any approach used in preparing accurate labour cost estimates.

Barzandeh, (2011) presented the most common factors affecting the estimation accuracy based on the analysis of the existing literature and previous research works

to show the harmonization in selection of the factors that affect the estimation accuracy. He focused on 16 factors and studied the repetitiveness of these factors on the previous studies. Similar research by Mahamid, (2015) identified and ranked 41 factors affecting the accuracy of cost estimation for construction projects in the West Bank in Palestine. He investigated the consensus among contractor and consultant toward the ranking of the importance of factors affecting cost estimating accuracy between contractors and consultants.

Hatamleh *et al.* (2018) identified top ten factors affecting the accuracy of cost estimate as clear and detailed drawings and specification, experience of pricing construction projects, perception of estimation importance, equipment (cost/availability/performance), project complexity, clear scope definition, accuracy and reliability of cost information, site constraints, material availability, financial capabilities of the client, and availability of database of bids on similar project (historical data).

Research Methodology

Research Strategy

To gather the data required, this study adopted an exploratory research strategy which involves qualitative approach before conducting quantitative analysis. The qualitative data of the study were based on a literature review and consisted of 20 factors which have been examined by previous researchers in the last 8 years. A preliminary study was first carried out on a small scale of respondents to ensure clarity and avoidance of double barrel questions and also to determine the ease of completing the questionnaire. Four of construction experts having strong background of construction business participated in the preliminary study. In total, 15 factors as shown in Table 1, were selected by experts as the critical factors affecting the accuracy of labour cost estimates in Nigeria. These factors were used to construct a structured questionnaire for the pilot study. Thirty construction contractors and consultant participated in the pilot study. The respondents suggested few changes to the questionnaire regarding the wordings of the questions. The questionnaire was then modified based on the professionals' feedback, before it was finally used at the data collection stage.

The questionnaire consist of two sections. Section A consist of respondents personal particulars such as; membership of professional bodies, years of experience, academic qualification, numbers of projects executed and regular client type. In section B, each respondent was asked to rate the factors affecting accuracy of labour cost estimates on a five-point Likert scale ranging from 1 to 5, where 1 represents "Insignificant" and 5 represent "Very significant".

Table 1. Factors affecting the accuracy of labour cost estimates

S/N.	Factors
1.	Clear and detailed drawings and specifications
2.	Accuracy and reliability of cost information
3.	Labour cost planning and scheduling deficiencies
4.	Time allowed for preparing labour cost estimates
5.	Perception of importance of labour cost estimates
6.	Method of bidding
7.	Experience in pricing construction project
8.	Level of competition
9.	Labour market conditions
10.	Project complexity
11.	Level of workmanship (productivity & performance)
12.	The estimating method used
13.	Variation orders and additional works
14.	Location & type of project
15.	Site constraints

Source: Field work, 2019

Sample Structures

A sample of 200 experienced construction contractors and consultants within F.C.T, Abuja was targeted in the survey, comprising 100 each of contractors and consultants randomly drawn from the Bureau of Public Procurement (BPP) database. Though, there are several methods of administering a questionnaire survey, direct delivery of the questionnaire by hand was preferred using the members' directory. Table 2 shows a summary of the sample responses of the questionnaire survey. From table 2, the response rates were 80(80%) each for contractors and consultants respectively. This was considered adequate for analysis based on the assertion by Spillane *et al.* (2012) that the result of a survey could be considered as biased and of little importance if the return rate was lower than 30% - 40%.

Table 2. Sample responses of the questionnaire survey

Professionals	Number distributed	Number of responses	Percentage returned
1. Contractors	100	80	80%
2. Consultants	100	80	80%
Total	**200**	**160**	

Source: Field work, 2019

Cronbach's Alpha Reliability Test

Cronbach's Alpha coefficient test is used for evaluating the reliability of the instrument. The measure is considered to be reliable if the value of Cronbach's Alpha coefficient equals or exceeds 0.70 (Pallant, 2011; Tabachnick and Fidell, 2013). In this study, the values of Cronbach's Alpha Coefficient for the construct ranged from 0.783 to 0.867. Since these values were more than 0.7, the entire construct as well as the variables was believed to have demonstrated a good reliability to be measured on the same latent trait and scale.

Data Analysis and Discussion

The data was analyzed using the Relative Importance Index (RII) comparison of ranking among the construction contractors and consultants. The performance of each parameter was evaluated based on the importance weighting and the proposed efficiency of each variable. From the responses, RII was calculated using the following formula;

$$RII = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

Where n_1 represents the number of respondents who answered 'very significance', n_2 represents the number of respondents who answered 'significance', n_3 represents the number of respondents who answered 'moderately significance', n_4 represents the number of respondents who answered 'less significance', n_5 represents the number of respondents who answered 'insignificance'.

The overall results of the RII from Table 3 shows that experience in pricing construction project was ranked topmost factor affecting the accuracy of labour cost estimates with RII score of 0.767 (76.7%). While, accuracy and reliability of cost information was ranked second with RII score of 0.763 (76.3%). Clear and detailed drawings and specifications was ranked third with RII score of 0.740 (74.0%). Also, site constraints was ranked fourth with RII score of 0.731 (73.1%). Perception of importance of labour cost estimates was ranked as the fifth factor affecting the accuracy of labour cost estimates with RII score of 0.723 (72.3%). Labour cost planning and scheduling deficiencies was ranked tenth with RII score of 0.678 (67.8%) and method of bidding was ranked as the last factor affecting accuracy of labour cost estimates with RII score of 0.653 (65.3%).

Table 3: RII and overall ranks of contractors and consultants responses

Factors	A	RII	R	B	RII	R	Total sum	RII	RII%	R
Experience in pricing construction project	320	0.800	2	295	0.738	1	615	0.767	76.7	1
Accuracy and reliability of cost information	323	0.808	1	287	0.718	2	610	0.763	76.3	2
Clear and detailed drawings and specifications	307	0.768	3	285	0.713	3	592	0.740	74.0	3
Site constraints	305	0.763	4	280	0.700	4	585	0.731	73.1	4
Perception of importance of labour cost estimates	300	0.750	5	278	0.695	5	578	0.723	72.3	5
Project complexity	290	0.725	6	275	0.688	6	565	0.706	70.6	6
Variation orders and additional works	282	0.705	13	273	0.683	7	555	0.694	69.4	7
Labour market conditions	288	0.720	7	264	0.660	8	552	0.690	69.0	8
Level of competition	285	0.713	8	262	0.655	9	547	0.684	68.4	9
Labour cost planning and scheduling deficiencies	284	0.710	9	258	0.645	10	542	0.678	67.8	10

Level of workmanship (productivity & performance)	283	0.708	11	255	0.638	11	538	0.673	67.3	11
The estimating method used	283	0.708	11	250	0.625	12	533	0.666	66.6	12
Time allowed for preparing labour cost estimates	281	0.703	14	246	0.615	13	527	0.659	65.9	13
Location & type of project	280	0.700	15	243	0.608	14	523	0.654	65.4	14
Method of bidding	284	0.710	9	238	0.595	15	522	0.653	65.3	15
Kendall's coefficient	**0.643**									
Sig.	**0.000**									

***A: Contractors; B: Consultants; Overall sum: Sum of A and B; R: Ranking**
Source: Field work, 2019

From the results, the top five factors affecting accuracy of labour cost estimates are experience in pricing construction project, accuracy and reliability of cost information, clear and detailed drawings and specifications, site constraints and perception of importance of labour cost estimates. However, the same factors were also ranked as topmost in the studies by Arif *et al.* (2015); Enshassi *et al.* (2013); Hatamleh *et al.* (2018) and Toh *et al.* (2012). These factors are interrelated and have direct consequences on sustainable construction projects delivery. Therefore, the estimator should focus on these factors due to their importance as loss of experience in pricing construction projects could lead to poor estimates. Also, the importance of accurate and reliable cost information is to determine the type of work and the resources required which should come from a reliable source to insure an accurate estimates. In addition, without clear and detailed drawings and specifications, some of the information will be missing which could lead to an inaccurate estimates. Similarly, site constraints have a great effect on the labour cost estimates as this could cost extra charges on the initial cost estimates. Finally, the estimator should consider the importance of labour cost estimates during the estimation process so as to achieve a flawless labour cost estimates.

Hypothesis Testing

To achieve the final objective of this study mentioned earlier, one hypotheses was formulated. To test this hypotheses written below, Kendall's coefficient of concordance (W) was performed to estimate the degree of agreement between contractors' and consultants' opinions related to the ranking of each of the tested factors, and whether this agreement is statistically significant. The range of the value W is between 0 and 1 (1 represents the perfect agreement between contractors and consultants, while 0 represents completely no agreement between contractors and consultants).

H_1. There is no degree of agreement between contractors and consultants towards the ranking of the factors affecting accuracy of labour cost estimates.

Also, the results from Table 3, indicates that Kendall's coefficient is found to be 0.643 and the p-value is 0.000 which is below the threshold of 0.05 significance level. In conclusion, there is a significant and strong degree of agreement between contractors and consultants towards ranking of the factors affecting accuracy of labour cost estimates.

Conclusion

This study identifies the top five factors affecting accuracy of labour cost estimates which include experience in pricing construction project, accuracy and reliability of cost information, clear and detailed drawings and specifications, site constraints and perception of importance of labour cost estimates. It also revealed that there is a significant and strong degree of agreement between contractors and consultants towards ranking of the factors affecting accuracy of labour cost estimates.

Drawn from the results, it revealed that the top five factors arises from information related factors and design parameters. This confirms the perceived low productivity of Nigerian construction industry as a result of inaccurate labour cost estimates. In view of the above, it was recommended that the estimator should take into consideration these factors at the inception stage of estimation in order to achieve an accurate labour cost estimates.

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