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# RE-THINKING POST-CONTRACT COST CONTROLLING TECHNIQUES IN THE NIGERIAN CONSTRUCTION INDUSTRY

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## ABSTRACT

*The challenges of cost and time overruns, construction disputes and client dissatisfaction have plagued the construction industry in Nigeria. This may be as a result of the approaches used in monitoring construction costs. The execution phase of a construction project relies on post-contract cost controlling techniques, such as cash flow monitoring, interim valuations, final account preparation, monitoring activities, site meetings and documentation of activities on site. These techniques are imperative for project success. The purpose of this paper is to assess the various techniques used in post-contract cost control in Nigeria, in terms of their effectiveness. The data was gathered from one hundred and thirty five (135) cost and project managers in Nigeria. The Kendall's coefficient of concordance was used to test the post-contract cost controlling techniques identified, through an extensive literature review along with one sample run test.*

*The findings reveal that monitoring material cost was the most effective and important technique with a Kendall's W score of 1.33 and 11.44 respectively. Cash flow monitoring had the lowest score of 7.85 for effectiveness, while variation management had the lowest score of 6.88 for importance. The effectiveness of the techniques was further evaluated using one sample run test. The findings show that sixteen out of the eighteen techniques were not effective from an overall point of view. The cost controlling techniques used in the Nigerian construction industry are deficient and generally ineffective. Therefore, there is a need to research alternative post-contract cost controlling techniques for the construction industry in Nigeria.*

**Keywords:** Construction Industry; Cost; Cost Controlling Techniques; Nigeria; Post-contract.

## 1. INTRODUCTION

Cost management is the bedrock of a successful project. Project cost controlling activities are based on the output of project planning, tender evaluation and estimates (Rad, 2002; Samphaongoen, 2010). The entire process of cost management has the aim of ensuring that there is cost accountability and management. Therefore, cost controlling is vital for any construction project around the world. Shehu *et al.* (2014) noted that the major factors associated with project delays are the contractor's influence and financial management. Cost overruns are very common wherever project delays occur (Jainendrakumar, 2015; Olawale and Sun, 2013). The major factors identified for cost and time overruns are risk factors with regard to financial and political influence, the cost of construction materials, design changes, inaccurate estimations of time and cost, project complexity, lack of training on the part of the project manager, difficulty in collecting cost data and the cost of conducting cost control (Dada and Jagboro, 2007; Eshofonie, 2008; Liang, 2005; Olawale and Sun, 2013). Project cost and time overruns have been studied by many authors over the decades, but research has not focused on the pertinent techniques used by cost and project managers during the construction process. The techniques used by cost and project managers for cost control during construction are very important in determining if the project will complete on time and within budget.

The Nigerian construction industry has suffered a low growth rate and contribution to the gross domestic product of the country (AfDB *et al.*, 2013; NBS, 2012). Within the last five (5) years, the construction industry in Nigeria has not grown as expected. The challenges faced by most construction industries around the world in terms of cost and time overruns are not peculiar to the Nigerian construction industry.

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The inaccuracies of construction cost estimates are affected by political, economic and geographical issues, security, time and legal factors (Oyedele, 2015). These factors have influenced the accuracy of construction estimates in Nigeria, hence cost and time overruns are prevalent. The contractor selection process is also cost based, which is associated with project delays and cost overruns (Olaniran, 2015). Post-contract cost controlling techniques in the Nigerian construction industry have not been a major research area. However, contractors' performance has been the major focus (Bala *et al.*, 2009; Chukwudi and Tobeckukwu, 2014; Fagbenle *et al.*, 2011; Inuwa *et al.*, 2014a; Inuwa *et al.*, 2014b; Odediran *et al.*, 2012). The lack of in-depth analysis of the effectiveness and importance of the post-contract cost control techniques in the Nigerian construction industry is apparent. The techniques employed by contractors in Nigeria may be an influence on the performance of contractors.

## 2. POST-CONTRACT COST CONTROLLING TECHNIQUES IN THE NIGERIAN CONSTRUCTION INDUSTRY

According to Jagun (2006) Quantity Surveyors are the cost managers of construction projects in Nigeria. Hence, Quantity Surveyors are trained in the art and science of cost management for building, industrial, civil engineering, mechanical and electrical aspects of construction. According to Ashworth (2010) the Quantity Surveyor is heavily involved in the cost control processes. This stage starts from the planning to the issuing of certificates. The most critical phase of a project is always the execution phase. Based on exiting literature, the post contract cost controlling techniques used in the Nigerian construction industry were extrapolated for this study. The major techniques identified for post-contract cost control in Nigeria are listed in the table below with their description.

Table 1: Post-Contract Cost Controlling Techniques in Nigeria

S/N	Post-Contract Cost Controlling Technique	Description	Reference
1	Cash flow	Flows of cash for day to day activities for relevant activities on site. Allows the contractor to calculate the profit and other expenditure.	(Ashworth, 2010; Sanni and Durodola, 2012; Sanni and Hashim, 2013)
2	Taking corrective action	Errors and omissions identified during the construction process are corrected.	(Ashworth, 2010; Sanni and Durodola, 2012)
3	Monitoring overheads	Monitoring specific activities which may lead to more expenses. Some of these activities are identified in preliminary items of work.	(Ashworth, 2010; Sanni and Durodola, 2012)
4	Monitoring labour cost	The cost of labour and other rates are monitored.	(Ashworth, 2010); Sanni and Durodola, 2012)
5	Monitoring material cost	The material costs are monitored, effect of demand and supply and the exchange rate.	(Ashworth, 2010; Sanni and Durodola, 2012)
6	Monitoring Equipment cost	Hiring cost of equipment and plants are regularly considered.	(Ashworth, 2010; Sanni and Durodola, 2012)
7	Managing variations	Variation management is essential. There are always alterations and changes during the course of construction.	(Olawale and Sun, 2010; Ashworth, 2010; Sanni and Durodola, 2012)
8	Monitoring completed units	This process involves monitoring the progress of work.	(CII, 2000; Ashworth, 2010)
9	Unit rate	Single rate cost estimating method used during and before construction. Cost estimating of	(Olawale and Sun, 2010; Ashworth, 2010)

S/N	Post-Contract Cost Controlling Technique	Description	Reference
		the various building elements are calculated using this method.	
10	Interim valuations	Interim certificates may be issued for payment. Allows the client to make payment based on work done gradually.	(Ashworth, 2010)
11	Incremental Milestone	This is a technique for earned value analysis. It is used to measure completed work and outline the cost and during further calculations.	(CII, 2000; Leu and Lin, 2008)
12	Establishing baselines	Cost baselines are established to evaluate the planned cost against the actual cost.	(Ankur and Pathak, 2014; Leu and Lin, 2008; Czarnigowska, 2008)
13	Identifying indicators of cost overruns	Certain indicators which may lead to cost overruns may be identified. These may be inflation, economic changes or stakeholders' involvement.	(Ashworth, 2010; Olawale and Sun, 2010; Sanni and Durodola 2012)
14	Financial statement and summarizing profit and loss	Financial statements and other financial documents such as the profit and loss summary are used in identifying and evaluating the expenditure and calculating the final profit.	(Sanni and Durodola, 2012; Ashworth, 2010)
15	Site meetings and post project reviews	Final site meeting is documented to evaluate the performance of the project, in this instance, cost, expenditure and profit are evaluated.	(Puvanasvaran <i>et al.</i> , 2010); Berger, 1997; Chukwubuike <i>et al.</i> , 2013)
16	Historical data	Data from previous similar projects are used during construction cost control.	(Sanni and Durodola, 2012)
17	Cost Forecasting	A technique used to evaluate the cost needed to complete the project, this may be carried out using earned value analysis.	(Sanni and Durodola, 2012; Czarnigowska, 2008).
18	Using established budget and targets	Bills of quantities are used during construction activities for managing construction cost.	(Sanni and Durodola, 2012; Ashworth, 2010)

The eighteen post-contract cost controlling techniques identified in the table above will be used for this investigation. The effectiveness of the techniques will be assessed.

### 3. PROBLEM STATEMENT

The problem of cost and time overruns has affected a number of construction companies in Nigeria (Bala *et al.*, 2009). Also, there has not been an adequate study into the post-contract cost control techniques used in the construction industry. Most emerging small and medium scale construction organizations in Nigeria have not been competing well, in recent years, with the larger construction firms. Hence, liquidation of construction companies and loss of jobs in the construction sector has been prevalent, although it may be difficult to pinpoint the challenges exactly that most small and medium scale construction firms are experiencing in terms of post-contract cost controlling techniques at the moment.

There is a need to investigate and ascertain the role of post-contract cost controlling techniques in terms of effectiveness.

#### 4. HYPOTHESES

The following hypotheses was used to evaluate the eighteen identified post-contract cost controlling techniques in Nigeria.

- H0: Post-contract cost controlling techniques identified are not effective for cost control activities in the Nigerian construction industry.
- H1: Post-contract cost controlling techniques identified are effective for cost control activities in the Nigerian construction industry.

The next section addresses the data collection, and testing techniques.

#### 5. METHODOLOGY

A theoretical sampling technique was used to define the sample population and the number of respondents. Walliman (2006) noted that theoretical sampling, which is a form of non-probabilistic sampling, targets the population with adequate knowledge and experience. The targeted population were chosen based on experience and knowledge level. Cost and project managers in Lagos, Nigeria were selected because of their influence in construction projects. The respondents had a minimum of fifteen and maximum of thirty eight years of experience in the construction industry. Subsequently, the population size was selected based on a quarter of construction companies in Lagos. There are over one thousand construction companies according to the Lagos State Ministry of Housing (Sanni and Durodola, 2012). Therefore, two hundred and fifty (250) questionnaires were distributed to construction companies in Nigeria, however, one hundred and thirty five (135) questionnaires were obtained. The questionnaire was designed based on the five point (5) Likert scale format. The format is displayed as thus:

Table 2: Likert Scale Format for Data Collection

1	2	3	4	5
<i>Not relevant</i>	Not effective	Moderately effective	Effective	Highly effective

The questionnaire was used to elicit information from cost and project managers who were the only two categories of respondents in this survey. The theoretical sampling technique was used to target cost and project managers with at least fifteen years' experience in the construction industry. SPSS 22 was used to test the data for effectiveness.

##### 5.1. KENDALL'S COEFFICIENT OF CONCORDANCE

The study also utilized Kendall's coefficient of concordance to assess the agreement between the respondents and also to rank the effectiveness based on the Kendall's W score. Kendall's coefficient of concordance is used to measure the agreement of judgement of a set of variables (Legendre, 2005). Mehta and Patel (2012) noted that Kendall's W test is a scaled Friedman's test with the formula:

$$W = \frac{Tf}{N(K-1)} \quad \text{Eq: 01}$$

The test produces the p values which are the asymptotic p value. If the p value is less than 0.05 this is acceptable, also the Kendall's coefficient of concordance W should also be less than 0.05 for acceptable values (Mehta and Patel, 2012). The ranking produced by Kendall's W coefficient of concordance is a form of measure of association (Mehta and Patel, 2012). The author further noted that Kendall's W is a measure of the degree to which the K applicants agree with the N judge. This measures the level of

effectiveness or importance for the various post-contract cost controlling techniques which are used by small and medium scale construction firms in Lagos, Nigeria.

## 5.2. HYPOTHESIS TESTING (ONE SAMPLE RUN TEST)

The hypothesis involved accepting or rejecting the null hypothesis based on one sample run test. The one sample run test addressed the randomness of data in an observed sequence. According to Singh *et al.* (2013, p.9) “a run test is used for examining whether or not a set of observations constitutes a random sample from an infinite population. The test for randomness is of major importance because the assumption of randomness underlies statistical inference”. The test for randomness in the Likert scale non-parametric data observed the occurrence of the responses as a measure of the hypothesis. The hypothesis test also utilized the significance value, which should be less than 0.05. The hypothesis test aimed to address the effectiveness of post-contract cost controlling techniques individually and juxtapose it with the findings of the Kendall’s coefficient of concordance. Therefore, the tests addressed the core aims but the hypothesis looked at the overall impact of post-contract cost controlling techniques in the Nigerian construction industry.

The Kendall’s coefficient of concordance and the one sample run test for randomness were carried out using SPSS22. The findings of the Kendall’s coefficient of concordance and the one sample run test for randomness are presented in the next section.

## 6. FINDINGS

The result of Kendall’s coefficient of concordance test from SPSS 22 is displayed in the table below. The results ranked monitoring material cost as the most effective technique with a score of 11.55. Interim valuation is the second most effective technique with a score of 11.05. The established working budget, which is the bill of quantities, is ranked third with a score of 10.90. The findings also revealed that variation management is not effective for the construction industry in Nigeria. This technique had the lowest score of 8.16. Cash flow monitoring, which is usually used by contractors, had the second lowest score of 8.17.

Table 3: Kendall’s Coefficient of Concordance for the Identified Post-Contract Cost Controlling Techniques

Post-contract cost controlling technique	Mean	Rank
Monitoring Material cost	11.55	1
Interim valuations	11.05	2
Using established working budget	10.90	3
Taking corrective action	10.39	4
Monitoring Overheads	10.22	5
Monitoring Equipment cost	10.08	6
Using Historical Data	10.07	7
Monitoring Labour cost	9.94	8
Similar projects	9.41	9
Monitoring completed Units	9.39	10
Incremental Milestone	8.85	11
Identifying cost overruns	8.75	12
Forecasting at completion	8.63	13
Cost Ratio	8.57	14
Profit and loss summary	8.52	15
Unit rate	8.40	16
Cash flow	8.17	17
Variation Management	8.16	18

The Kendall's *W* score for agreement is given as 0.046. This implies that there is a low level of agreement between the respondents. In this instance, the respondents have given diverging views about the various techniques. Therefore, it is important to assess the techniques, based on their individual significance and randomness.

### 6.1. FINDINGS FROM THE ONE SAMPLE RUN TEST

As can be seen in Table 4 below, the findings revealed that the null hypothesis for each of the post-contract cost controlling techniques is retained. There are only two techniques which take corrective action and use the established working budget with a significance of 0.021 and 0.045 respectively, which rejects the null hypothesis. This implies that the post-contract cost controlling techniques identified are not effective for the Nigerian construction industry.

Table 4: Null Hypothesis Test for the Post-Contract Cost Controlling Techniques Identified

S/N	Null Hypothesis	Sig.	Decision
1	Cash flow is not effective	0.372	Retain null hypothesis
2	Using historical data is not effective	0.478	Retain null hypothesis
3	Using similar projects is not effective	0.918	Retain null hypothesis
4	Taking corrective action is not effective	0.021	Reject null hypothesis
5	Monitoring labour cost is not effective	0.0831	Retain null hypothesis
6	Monitoring material cost is not effective	0.143	Retain null hypothesis
7	Monitoring equipment cost is not effective	0.672	Retain null hypothesis
8	Monitoring overhead cost is not effective	0.084	Retain null hypothesis
9	Variation management is not effective	0.277	Retain null hypothesis
10	Cost ratio is not effective	0.850	Retain null hypothesis
11	Incremental milestone is not effective	0.601	Retain null hypothesis
12	Monitoring completed units is not effective	0.091	Retain null hypothesis
13	Identifying cost overruns is not effective	0.759	Retain null hypothesis
14	Forecasting at completion is not effective	0.163	Retain null hypothesis
15	Using a unit is not effective	0.091	Retain null hypothesis
16	Profit and loss summary is not effective	0.140	Retain null hypothesis
17	Interim valuations are not effective	0.907	Retain null hypothesis
18	Using an established working budget is not effective	0.045	Reject null hypothesis

88.89% of the techniques identified are not effective for post-contract cost controlling in Nigeria. Therefore, the null hypothesis  $H_0$ , stating that "*post-contract cost controlling techniques identified are not effective for cost control activities in the Nigerian construction industry,*" will be retained.

## 7. DISCUSSION

The findings of the Kendall's coefficient of concordance reveals that monitoring material cost is the most effective cost controlling technique in the Nigerian construction industry. This finding has been corroborated by Sanni and Durodola (2012) in the assessment of cost control practices in the metropolis of Lagos, Nigeria. Although monitoring material cost was ranked second to using established working

budgets in the author's findings, the impact of material cost monitoring, such as monitoring the cost of cement in Nigeria, is enormous. Most complex construction projects in the country require a lot of building material importation from Europe and Asia. Building materials such as windows, doors, ceramics, tiles, sanitary and plumbing appliances, have been imported into Nigeria over the years (Oruwari *et al.*, 2002; Ugochukwu *et al.*, 2014). The effect of inflation, fluctuating foreign exchanges, the rising cost of importation and custom duties have led to a many cost overruns in the Nigerian construction industry. Ugochukwu *et al.* (2014) conducted a survey which was based on the perception and patronage of imported building materials in Nigeria. The findings revealed that most building material sellers and contractors usually patronize "BUA" imported cement compared to the local "Dangote cement". Dangote cement is very popular in Nigeria, however, the prices of this cement brand fluctuate quarterly. This also influences the overall costs of construction projects in Nigeria.

Cash flow is viewed as a very important post-contract cost controlling technique but in the Kendall's coefficient of concordance test, the findings revealed that cash flow is the second least effective post-contract cost controlling technique in Nigeria. Sanni and Hashim (2013) stated that cash flow is the most effective technique for cost controlling. However, the tests conducted in this study have disclosed otherwise. Variation management was ranked as the least effective. This may be as a result of contract documentation and adequate preparation. Also, the quantity surveyor's experience matters in variation management; this has been corroborated by the findings of Sanni and Hashim (2013) in their assessment of construction cost control practices in Nigeria.

These factors have also influenced contractors and quantity surveyors' approaches towards the interim valuations and preparation of working budgets for tender. The null hypothesis was retained for sixteen out of the eighteen techniques, showing that the process of post-contract cost controlling in Nigeria is ineffective. However, the results showed that taking corrective action and conducting interim valuations are effective, yet these are only two techniques out of the eighteen techniques in the study. Therefore, the post-contract cost controlling techniques used in Nigeria are not effective, based on the findings of this study.

There is a need to explore the alternative means of controlling post-contract cost. However, the cost planning phase of construction in Nigeria needs to address certain aspects, which deal with contingency funds, profit and overheads. The addition of contingencies to the cost plans or budget is a management function. In most construction companies, profit and overheads are twenty (20) to thirty five (35) percent. The contingency funds are between five (5) to ten (10) percent of the total contract estimate. These figures have to be reviewed to allow for the changes in the construction industry, which may result from cost fluctuation for building materials.

## **8. CONCLUSION**

Post-contract cost controlling techniques identified in the literature have been ranked and tested for effectiveness, and monitoring material cost is the most effective technique. This is as a result of the immense pressure to import high quality materials, which are not readily available in Nigeria. Cash flow and variation management are the least effective techniques. This may be as a result of the challenges posed by the regularly fluctuating material cost. It would be cost effective if more quality building materials were manufactured inside Nigeria. This would reduce the dependence on foreign building materials for construction projects. Notwithstanding this, the economic situation in Nigeria also has an overall impact on construction projects. However, it is evident that activities which involve monitoring the rise and fall of construction material costs in Nigeria are necessary. Further hypothesis tests have also shown that most present post-contract cost controlling techniques are ineffective, and in fact, only two techniques were found to be effective at all. Therefore, there is a need to implement new practical approaches for conducting post-contract cost control. Modern cost management methods such as target costing, kaizen costing, value engineering and earned value analysis may be incorporated with the present post-contract cost controlling techniques in the Nigerian construction industry, thereby reducing the challenges of cost and time overruns.

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