



Assessment of Cost Control Techniques on Road Construction Project Delivery in FCT Abuja, Nigeria

Alabi, S.S.^{1a}, Anifowose, M.O.^{1b} & Ocheba, S.²

¹Department of Quantity Surveying, Federal University of Technology, PMB 65 Minna Niger State, Nigeria

²Department of Architecture, Federal University of Technology, PMB 65 Minna Niger State, Nigeria

lasucoqscconsultant@gmail.com; anifowosemo@futminna.edu.ng

Corresponding author: anifowosemo@futminna.edu.ng

Abstract:

The advancement of technology in the last century has contributed to the increase in the number of complex construction projects that require proactive management. Cost control should be seen as an important management tool that is crucial to the survival of a construction company. This study examining the various cost control techniques used in road construction projects and the effect they have on project delivery. The emphasis here is limited to study the Contractor's point of view. The main concern of the study is to assess the impact of cost control techniques used in road construction projects with a view of project delivery using Inferential Data Analysis. The other focusing areas are to identify cost control techniques used, the challenges of cost control techniques and examine the most effective cost control technique. The preliminary data for this research has been collected through a literature review and well-structured questionnaire survey targeted contractors of Road Construction. This study reveals six commonly used cost control techniques which include Cash Flow Analysis, Valuation of work in Progress, Cost Control, Materials Management, Budgetary Control and Cost Value Reconciliation. The findings further illustrate that the most frequently used cost control techniques in road construction projects was Cash Flow Analysis (CFA). The study concludes that cost control techniques have strong impact on road construction project delivery and lack of knowledge on the use of available tools and technology affect the practice of cost control techniques. It is recommended that Quantity Surveyors should involve in road construction and construction firm should try applying other techniques on projects for better performance.

Keywords: Construction, Road, Control, Cost, Techniques.

INTRODUCTION

The Construction industry is a key sector in every country as it is heavily interrelated with the economy as a whole. It affects, and is affected by; the gross domestic product of a nation. Moreover, the construction industry is dependent on different types of input such as human capital, financing and outcomes from other industries (Murendeni and Clinton, 2018). According to Aliu (2014) the built environment consists of Building, Civil and Heavy Engineering works. The construction industry has impact on the environment, economy, and society, explained by (Kucukvar & Tatari, 2013; Onat *et al.*, 2014). The construction industry is one of the most active sectors propelling the Nigerian economy. The construction project can vary from extremely profitable to barely worth it and sometimes end up costing the contractor more than what he or she is getting paid to complete it (Urmila, 2015). In construction industry the aim of project control is to ensure the projects finish on time, within budget and achieving other project activities. The advancement of technology in the last century has contributed to the increase in the number of complex construction projects that require proactive management. Adjei *et al.* (2015); Sanni and Hashim (2013) concluded that "cost control is an element of financial control since it supplements managerial control process in the organisation". Cost control should be seen as an important management tool that is crucial to the survival of a construction company. According to Adjei *et al.* (2018), cost control practice is a process whereby the cost of the construction project is monitored, evaluated and compares the planned budgeted cost with the actual site cost for decisions to be made to bring the cost on track. The need to control cost is important in order to eliminate the unnecessary

wastages of resources. The practice of cost control is a required task for the survival and growth of every construction organization in every nation. The rehearsal of cost control assists organizations to eliminate and/or reduce unnecessary wastage of resources in the execution of construction projects (Bahaudin *et al.*, 2012; Adjei *et al.*, 2017). The cost control principles are also expected to act as telltale or offer early warning system, notifications of possible budget difficulties at predetermined periods for corrective measures to be decided to solve the cost variances. Opatunji (2018) establish the cost control techniques used among construction Practitioners such as Budgetary control, Cash flow analysis, Earned value management, Cost reduction on site, Material management, Risk analysis, Cost planning, Work programmes, Valuation of work in Progress few among others. In the opinion of Adjei *et al.*, (2017); Khamidi *et al.*, (2011) the project quantity surveyor or the cost engineer needs to apply the cost control techniques to develop a series of options for the other project members to consider and select one of the best options that fit within the approved budget limit. In the construction industry, very little study has been conducted on the challenges of cost control. Researchers such as Adjei *et al.*, (2017); identified challenges of Cost Control Practice in the construction industry with very limited literature review and Kirun and Varghese (2015); a literature review was conducted to identify major problems, the techniques used for identify the problem is Delphi techniques. In order to address those problems, this research is aimed to examine various cost control techniques used in road construction projects and the effect they have on project delivery.

LITERATURE REVIEW

The Evolving Roles of Professional Quantity Surveyor in Road Construction

The construction industry comprises of many stakeholders such as clients, design professional, construction professionals, and operational teams. The major professionals in the industry in terms of their initial contact with the client and involvement with the design and construction stages of the construction projects includes engineers (notably civil, electrical and mechanical), building engineers, quantity surveyors or cost estimators and architects. The civil engineers are concerned with public constructions (i.e. roads, dams, quays, shipyards, and bridges) (Olanrewaju and Anahwe, 2015). The RICS (1971) emphasized that the distinctive competencies or skills of the quantity surveyor (QS) are associated with measurement and valuation which provide the basis for the proper cost management of the construction project in the context of forecasting, analysing, planning, controlling and accounting. A quantity surveyor is a professional in the road construction who has the ability to analyse both cost components and practical physical construction works of a project in a successful way so as to be able to apply the results of his analysis in solving problems peculiar to each project (Timothy and Amos, 2016). Quantity surveyors are involved in various types of construction including mining, petrochemical plants and refineries construction and installations (Olanrewaju and Anahwe, 2015). The traditional role of QS on road construction mainly concerns cost management such as cost estimation, the advice at design stage, Cost control, valuations, variations and final accounts.

Cost Planning

As a process, cost planning is difficult to define concisely. This difficulty exists because the cost planning process involves a diversity of procedures and techniques that are used simultaneously by the quantity surveyor (QS) or construction economist (Boussabaine, 2013).

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Kirkham (2014) are of the view that traditionally, cost planning will typically follow the conventional outline design-scheme, design-detailed design process. Similarly, Kissi and Adjei-Kumi (2017) stated that, cost planning covers every aspect of cost control in a construction project thus from the inception to completion with the aim of delivering project to satisfy the client's expectation, which is within budget, at the desired quality and delivered within the agreed time.

Cost Control and Monitoring

Cost control is a process where the construction cost of the project is managed through the best methods and techniques so that the contractor does not suffer losses when carrying out the activities of the project (Opatunji, 2018). One of the aims of cost control according to George, *et al.* (2012) is to construct at the cheapest possible costs consistent with the project objectives. Cost control involves the measurement of the performance of a design against a standard i.e. cost target/cost plan and taking any remedial actions where necessary. Cost control can be classified into pre-contract and post contract cost control. Pre-contract cost control starts at the inception stage to the tender action stage while post contract cost control starts from the project planning stage to the completion stage. From this it is obvious that cost control should be continued through the construction period to ensure that the cost of the building is kept within the limits. The control of project cost is not an easy task and it requires knowledge of applying cost controlling techniques (Opatunji, 2018).

Cost Control Techniques

The primary responsibility of project management is to control the cost of the project, time, performance and quality goals. Cost management is a one of the important tasks which drives project to a successful completion. This includes resource planning, cost budgeting, cost estimating and cost control. This cost management process can be enhanced through different software's, tools and techniques in order to control the costs. According to 'Project management book of knowledge (PMBOK)' there are few techniques which would be useful for monitor and control construction project. According to Malkanthi, *et al.* (2017), most of the contractors in Sri Lanka believed that they can reduce about 50% of their overhead cost by using proper cost controlling techniques. Some contractors have already achieved more than 50% overhead reduction through cost controlling techniques. Thus, a proper cost controlling can be considered as an essential component in the construction industry. Various cost control tools and techniques are adopted by the project managers with the aim of mitigating the cost uncertainties during project implementation. According to Rodriguez (2011); Scott (2012); Burke (2013); Cooray *et al.* (2018); over the years, cost control techniques have evolved and some of those techniques are; Earn value management (EVM), Programme Evaluation and Review Techniques (PERT), Critical Path Method (CPM), To-complete performance index (TCPI), Risk Analysis, Cost value reconciliation (CVR), Monte Carlo simulation, Whole life costing etc. Other Techniques identified by (Opatunji, 2018; Anyanwu, 2013) include: Performance reviews and Variance Analysis, Budgetary control, Cash Flow Analysis, Site Meetings, Record keeping, Valuation of work in Progress, Elemental Analysis, Cost optimization techniques, Cost Reduction on site, Cost Planning, Work Programs, Material Management in addition to that, software applications such as Asta Power Project, Primavera, Microsoft Project are available to control the costs incur in the road construction projects (Cooray *et al.*, 2018).

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Challenges of Cost Control Techniques

Adjei, *et al.* (2017) identified the following challenges of cost control techniques in his research:

1. Lack of consistency in cost management by managers/Project Quantity Surveyor
2. Lack of knowledge on the use of available tools and technology
3. Abandonment of complicated strategies
4. Using obsolete Methods and Concepts
5. Lack of financial commitment in projects
6. Lacking PCC processes and systems suitable to the enterprise

Other Challenged Identified by Malkanthi, *et al.*, (2017) include:

1. Fluctuation in prices of Raw Materials
2. Poor Project Site Management
3. Lowest Bidding Procurement Method
4. Inappropriate Government Policies
5. Wrong method of Cost estimating
6. Duration of the project

RESEARCH METHODOLOGY

This research depended on both qualitative and quantitative information obtained through a questionnaire survey conducted among professionals working at the level of project managers, site managers, etc., in the construction industry. The questionnaire was developed based on the information gathered during the preliminary survey which was in the form of onsite interviews. The preliminary questionnaire was prepared using the knowledge gained from the literature review.

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query (Mohamed, 2017). Kolo (2003) supported that; population is a group of people that have a similar character which the researcher may have on them. The target population for this study comprise of Thirty (30) construction firms in Abuja metropolis registered with Federation of Construction Industry in Nigeria (FOCI), Nigeria. However, only one professional was administered in each firm. The sample frame for this research consisted of Quantity surveyors, Project Managers and Civil Engineers working in construction firms (dealing with road construction only) in Abuja registered with and contained in the list of contractors compiled by FOCI Nigeria. For this research, primary sources of data collection were employed. The primary data was gotten from the administration of well-structured questionnaires.

After collecting the information from the respondents via the structured questionnaire, the data gathered were carefully analysed in relation to the stated objectives. The data were analysed using descriptive statistical method (Percentile, Frequency, Mean Item Score and Relative Importance Index) with the aid of SPSS statistical package.

Mean Item Score is being ranked from 1.00 to 5.00. The formula for Mean item score (MIS) is as equation 1.0.

$$MIS = \frac{\Sigma W}{N} \quad (1.0)$$

Where: Σ = Summation, W = Weight, and N = Total number respondent

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The decision rule here states that:

- If $R \geq 50\%$ then Correlation is strong.
- If $R < 50\%$ then Correlation is weak.

RESULTS AND DISCUSSION

The survey started by identifying the respondents' backgrounds such as their genders, experiences in terms of years, level of education, discipline and professional membership. It helped to ensure that the data collected were reliable. The research was focussed on finding out the cost control technique(s) used in road construction project. Table 1 shows that contractors believe that Cash flow analysis as cost control techniques is the highest used in road construction project with 24% and response count of 6 follow by valuation of working in progress which account for 20% with a count of responses from respondents as 5. Cost value reconciliation and material management had 16% with a count of responses from respondents as 4 each. Finally, budgetary control and cost planning had the smallest amount of responses a count of 3, counting for 12% for each cost control techniques. This implies that cash flow analysis is the most effective cost control technique, use in road construction project.

Table 1: Cost Control Technique(s)

Cost Control Technique(s)	Frequency	Percent
Cash Flow Analysis (CFA)	6	24
Valuation of Work in Progress (VWP)	5	20
Cost value reconciliation (CVR)	4	16
Material Management (MM)	4	16
Budgetary control	3	12
Cost Planning	3	12
Total	25	100

Source: Researcher's Data Analysis (2020)

Table 2 shows the challenges of the cost control techniques used in road construction project. Challenges such as lack of knowledge on the use of available tools and technology, lack of financial commitment in projects and fluctuation in prices of raw materials were ranked first (1st), second (2nd) and third (3rd) with a mean score of 4.36, 4.24 and 4.20 respectively. Lack of consistency in cost management by managers/project Quantity Surveyor ranked fourth (4th) with a mean score of 4.16, lowest bidding procurement method with a mean score of 4.12 ranked fifth (5th) while poor project site management was on the sixth (6th) rank with a mean score of 3.88.

Table 2: Challenges of the Cost Control Techniques Used in Road Construction Project

S/No	Challenges of Cost Control Techniques	MIS	Rank	Remark
1	Lack of knowledge on the use of available tools and technology	4.36	1st	Agreed
2	Lack of financial commitment in projects	4.24	2nd	Agreed
3	Fluctuation in prices of Raw Materials	4.20	3rd	Agreed
4	Lack of consistency in cost management by managers/Project Quantity Surveyor	4.16	4th	Agreed
5	Lowest bidding Procurement method	4.12	5th	Agreed
6	Poor Project Site Management.	3.88	6th	Agreed
7	Using obsolete Methods and Concepts	3.84	7th	Agreed
8	Inappropriate Government Policy	3.80	8th	Agreed
9	Lacking PCC processes and systems suitable to the enterprise	3.72	9th	Agreed
10	Wrong method of Cost estimating	3.68	10th	Agreed
11	Abandonment of complicated strategies	3.64	11th	Agreed

Source: Researcher's Data Analysis (2020)

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Using obsolete methods and concepts had a mean score of 3.84 and ranked seventh (7th) while on the eight (8th) rank was inappropriate government policy with a mean score of 3.80. Challenges such as lacking PCC processes and systems suitable to the enterprise and wrong method of cost estimating ranked ninth (9th) and tenth (10th) with a mean score of 3.72 and 3.68 respectively. The least ranked challenge was abandonment of complicated strategies which came eleventh (11th) with a mean score of 3.64.

Table 3 shows the research data for this research. Archival data were collected on Initial Contract Sum (ICS) and Final Contract Sum (FCS) from ten (10) recent projects.

Thus, it was revealed that cost control techniques have effect on the cost of various road construction projects executed by construction firms in Abuja.

Inferential Data Analysis

Pearson Correlation was employed as a tool for inferential analysis in the study to establish the effect of cost control techniques on road construction project delivery.

Results and Discussion for Pearson Correlation Analysis

One analysis was carried out using the Pearson Correlation Analysis in order to establish the impacts of cost control techniques on road construction project delivery

Table 3: Analyse Effect of Cost Control Techniques on Road Construction Project Delivery

Project year	Project particulars (Title)	Type of technique used	Initial Contract sum (N)	Final contract sum (N)	Cost difference (N)	% difference
2015	A	Cash Flow Analysis (CFA)	969,000,000.00	860,000,000.00	-109,000,000.00	-11.25
2015	B	Valuation of Work in Progress (VWP)	833,000,000.00	784,000,000.00	-49,000,000.00	-5.88
2015	C	Cash Flow Analysis (CFA)	4,200,000,000.00	4,254,250,000.00	54,250,000.00	1.29
2016	D	Material Management (MM)	808,000,000.00	840,300,000.00	32,300,000.00	4.00
2017	E	Budgetary control (BC)	684,700,456.30	650,588,089.92	-34,112,366.38	-4.98
2017	F	Cost value reconciliation (CVR)	329,756,362.24	319,147,828.80	-10,608,533.44	-3.22
2018	G	Cash Flow Analysis (CFA)	107,555,555.20	119,334,577.28	11,779,022.08	10.95
2019	H	Valuation of Work in Progress (VWP)	2,248,000,000.00	1,212,000,000.00	-1,036,000,000.00	-46.09
2019	I	Valuation of Work in Progress (VWP)	1,056,000,000.00	855,000,000.00	-201,000,000.00	-19.03
2019	J	Cost value reconciliation (CVR)	1,366,449,752.08	2,265,201,407.06	898,751,654.98	65.77
					Average	-0.84
					Min.	-46.09
					Max.	65.77

Source: Researcher's Data Analysis (2020)

It was observed from the analysis that there exists a strong, positive and significant relationship between the initial contract sum and final contract sum. The correlation coefficient (R value) observed was 75% indicating strong degree of association between the variables. The positive correlation observed between the variables indicates a tendency that an increase in the initial contract sum will lead to an increase in the final contract sum and decrease in the initial contract

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sum will lead to decrease in the final contract sum. Thus, Table 4 summarised the results of these analysis

Table 4: Results of Pearson Correlation Analysis

Analysis No.	Variables		Observations		Inferences Strength of Relationship	Remark
	X ₁	X ₂	R (%)	P _{value}		
1	Initial Contract Sum	Final Contract Sum	75.00	0.012	Strong	S

Source: Researcher's Analysis of Data (2020)

KEY: S = Significant

Summary of Findings

The study was set out to address the cost control techniques used in road construction projects. To solve this, the study assessed cost control techniques used in road construction projects and the impact they have on project delivery. To achieve this aim, data was collected from construction firms (dealing with road construction only) in Abuja. The retrieved data was analysed with the aid of descriptive statistics. The following are the discoveries made from the analysis carried out from the study:

- i. The most frequently used cost control techniques in road construction projects was Cash Flow Analysis (CFA) with 6 frequency and 24%.
- ii. Lack of knowledge on the use of available tools and technology (MIS=4.36) was the most agreed challenges of the cost control techniques used in road construction project.
- iii. There was a strong, positive and significant relationship between the initial contract sum and final contract sum. However, increase in the initial contract sum will lead to an increase in the final contract sum and vice versa.
- iv. There exists a statistically significant impact of cost control techniques on road construction project delivery.

CONCLUSION AND RECOMMENDATIONS

Conclusion

From the study, the cost control techniques investigated, only 6(six) out of 19(nineteen) are used on average in the road construction in Abuja, Nigeria and also few Quantity Surveyors (Cost Manager) are involved in the critical cost management of road construction projects on like building projects. The study reveals that cost control techniques have strong impact on road construction project delivery. The research shows that lack of knowledge on the use of available tools and technology affect the practice of cost control techniques.

Recommendations

The focal point of this study was to examine various cost control techniques used in road construction projects and the effect they have on project delivery.

Based on the study, the following recommendations are being made;

- i. Quantity surveyors should involve in road construction due to the area of their discipline as cost expertise which they have better attitude towards using these techniques.

- ii. The cost manager should also exhibit the foresight in predicting and arresting those constraints that are associated with road projects which may either retard the progress of work or extend the predetermined project duration, thus increasing project cost.
- iii. Construction firm should try applying other techniques on projects for better performance.
- iv. Construction firms should endeavor to send their employees to attend workshops, seminars and other training programs that will enlighten them on how to use the other techniques.

REFERENCE

- Adjei, K. O., Aigbavboa, C. O. and Thala, W. D. (2017). Corrective measures for construction project cost control, International Conference on Construction and Real Estate Management (ICCREM 2017), Nov. 10th – 12th, 2017, Guangzhou, China, Publishers: American Society of Civil Engineers (ASCE), Accepted paper.
- Adjei, K. O., Aigbavboa, C. O. and Didibhuku, T. (2018). The need for Change Management concept in construction project cost control, 10th cidb Postgraduate Conference, 25-27 February 2018, Port Elizabeth, South Africa.
- Aliu N.O. (2014). Evaluation of procurement methods on building projects in Abuja, An Unpublished M-Tech Thesis submitted to Department of Building, Federal University of Technology, Minna.
- Anyanwu, C.I. (2013). Project Cost Control in the Nigerian Construction Industry, International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print) 2319 – 6726 www.ijesi.org, Volume 2 Issue 12, December. 2013, PP.65-71
- Bahaudin, A. Y., Elias, E. M., Dahalan, H. and Jamaluddin, R. (2012). Construction cost control: A review of practices in Malaysia, The 3rd International Conference on Technology and Operations Management, Sustaining Competitiveness through, Green Technology Management, Bandung – Indonesia, July 4-6, 2012.
- Boussabaine, A. (2013) Cost Planning of PFI and PPP Building Projects, Routledge, Canada.
- Burke, R. (2013) Project management: Planning and control techniques. 5th edn. New Jersey, Wiley.
- Cooray, N.H.K., Somathilake, H.M.D.N., Wickramasinghe, D.M.J., Dissanayke, T.D.S.H., and Dissanayke, D.M.M.I. (2018). Analysis of Cost Control Techniques Used on Building Construction Projects in Sri Lanka. International Journal of Research. Available at <https://edupediapublications.org/journals>
- George, S. (2012) Construction Materials Management. First Edition, Newyork: Amazon, P.36-40.
- Kirkham, R. (2014) Ferry and Brandon's Cost Planning of Buildings, John Wiley & Sons, UK.
- Kirun, S. S. and Varghese, S. (2015) A Study on Cost Control using Delphi Techniques in Construction Projects, International Journal of Science Technology & Engineering, Volume 2, Issue 5, November 2015 ISSN (online): 2349-784X.
- Kissi, E and Adjei-Kumi, T. (2017) Exploring cost planning practices by Ghanaian construction professionals, nt. J. Project Organisation and Management, Vol. 9, No. 1, 2017
- Kothari C.R (2011). Research methodology methods and techniques, second edition.
- Kucukvar, M and Tatari, O (2013). Towards a triple bottom-line sustainability assessment of the US construction industry. "The International Journal of Life Cycle Assessment", 18, 958–972.
- Malkanathi, S.N., Premalal, A.G.D. and Mudalige, R.K.P.C.B. (2017). Impact of cost control techniques on cost overruns in construction projects. Engineer. Vol. L, No. 04, pp. 53-60.
- Murendeni, I. and Clinton, A. (2018) Effective Construction Project Leadership: Identifying knowledge gaps, 10th cidb Postgraduate Conference, 25-27 February 2018, Port Elizabeth, South Africa.
- Olanrewaju, A. & Anahwe, P.J. (2015). Duties and responsibilities of quantity surveyors in the procurement of building services engineering. Creative Construction Conference.
- Opatunji, O. A. (2018). An Evaluation of Cost Control Techniques in Nigerian Construction Industry, International Journal of Science, Engineering & Environmental Technology (IJONSEET), 3(2):11-17.
- Scott, W. J. (2012). TCPI: the tower of power Paper presented at PMI® Global Congress. North America, Vancouver, British Columbia, Canada. 20-29 October 2012. Newtown Square: Project Management Institute.
- Timothy, O. O., and Amos, A. O. (2016) Are Quantity Surveyors Competent to Value for Civil Engineering Works? Evaluating QSS' Competencies and Militating Factors, Journal of Education and Practice www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.7, No.16, 2016

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