ASSESSING THE EFFECT OF COST CONTROL TECHNIQUES USED IN ROAD CONSTRUCTION PROJECT DELIVERY (OWERRI METROPOLIS)

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

The construction industry is an essential sector in every country as it is heavily interconnected with the economy as a whole. It affects, and is affected by the Gross Domestic Product of a nation.

It is a known fact that the Nigerian construction industry continues to occupy an important position in the nation's economy even though it contributes less than the manufacturing or other service industries, (Aibinu and Jagboro,2002). The contribution of the construction industry to national economic growth necessitates improved efficiency in the industry by means of cost effectiveness and timeliness, and would certainly contribute to cost savings for the country as a whole. It is also common knowledge that the implementation of the construction project in the industry is usually accompanied with time delay and cost increase as well as owner dissatisfaction ,(Hafez,2001).

In general, most (if not all), construction projects experience time delays and cost overruns during their implementation phase,(Koushki and Kartam, 2004). Numerous researchers, both in the developed and developing nations have also examined and identified the causes of time and cost overrun in the construction industry. Mansfield *et al.*,1994), for example performed a comprehensive analysis of most important factors responsible for project delays and cost overrun in Nigerian construction projects. This analysis indicated poor contract management, financing and payment of completed works, change in site conditions, shortages of materials, design changes, subcontractors and nominated suppliers, other factors were price fluctuation inaccurate estimates, delays and additional works as factors responsible for project delays and cost overrun.

A comprehensive classification of causes of construction delays has also been determined by (Henesy,1993). The classification system included materials, labour, equipment and financial constraints, as the main contributory variable to causes of construction time overrun. The list of major factors causing construction delay in Thailand by (Ogunlana and Proumkunting 1996) included the inadequacy of resources supplied, client and consultant shortcomings and incompetence. (Koushki and Kartan, 2004) studied the impact of construction materials on project time and cost in Kuwait

and identified the project related variable affecting the on-time delivery of materials as material selection, time, type of materials and their availability in the local market.

Time impacts are inevitable on highway construction projects, primarily because of the uniqueness of each project and the limited resources of time and money that can be spent on planning, executing and delivering the project.

Time factors are inherent in all of project construction's undertakings. Highway construction projects have long been recognized as particularly cost, time and risk-laden. Some of the time and cost factors associated with the construction process are fairly predictable or identifiable; others may be totally unforeseen. The highway constructed project may not perform as anticipated because the owner may have unrealistic expectations regarding the delivery time of construction forcing contractors into unrealistic gambles, corner-cutting or commitments that may not be realistic (Frimpong, 2003).

Project success can be defined as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its technical performance, maintained its schedule, and remained within budgetary costs. Project management tools and techniques play an important role in the effective management of a project. Therefore, a good project management lies in the management tools and techniques used to manage the project. Project management involves managing the resources—workers, machines, money, materials and methods used. Some projects are effectively and efficiently managed while others are mismanaged, incurring much delay and cost overruns and negatively affecting the economy,(Frimpong, 2003).

Assessing highway construction projects' delivery time is critical in today's market-driven economy.

1.2 STATEMENT OF PROBLEM

Construction can be considered as a dynamic industry which is constantly facing uncertainties and the many stakeholders in these kinds of projects make the management of costs difficult, which consequently causes cost overruns. Therefore, cost overruns are considered one of the most critical issues during the execution of construction projects (Chan,et al.,2004;Doloi,2011).

As mentioned by Van der westhuizen and fitzgerald (2005), the presence of cost overruns can be a reason for project delays or possible project failures.

1.3 OBJECTIVE OF STUDY

The main aim of the study is to examine various cost control techniques used in highway construction projects and the impact they have on project delivery. Specific objectives of the study are:

- To identify cost control technique frequently used by contractors in highway construction projects.
- To examine the challenges of cost control techniques used in road construction projects.
- To measure the effectiveness of cost control techniques used in road construction projects.

1.4 SIGNIFICANCE OF STUDY

This study will be of importance to building professionals and the general public because it would not only clarify but also create awareness of the extent to which inadequacies in poor assessment of cost control techniques can adversely affect highway project performance. The study will also help contractors, clients, consultants and all parties involved in highway construction projects about ways of improving their current method of cost management and control ,learning how to effectively manage cost so as not to run into loss.

The study will also be of great benefit for other student researchers' who may want to venture into the same subject matter. Having gotten results-both empirically and theoretically, the study will serve as a foundation for future research studies.

1.5 SCOPE OF THE STUDY

This study will undertake an assessment on the effect of cost control techniques used in road construction project delivery in owerri metropolis, Imo state. Examining the project management processes including the use of cost saving techniques and how they impact on a projects timeline and budget . The understudied area covered owerri metropolis which involved asking survey questions from some civil engineers in the state and other government stakeholders. All findings and recommendations from the study may not reflect the true view of the traditional roles and changing roles of civil engineers as the researcher could not cover a wider area due to certain circumstances and constraints.

CHAPTER TWO
LITERATURE REVIEW

INTRODUCTION

This chapter gives an insight into various studies conducted by outstanding researchers, as well as explained terminologies with regards to the impact of cost control techniques on highway construction project delivery.

The chapter also gives a resume of the history and present status of the problem delineated by a concise review of previous studies into closely related highway construction problems.

2.1 ORIGIN OF ROAD CONSTRUCTION

History has it that the first road ever built by humans' dates back to 4000 BC and since then road construction methods has undergone phenomenal changes (Benson and Lay,2016). In ancient times, river transport was much faster and easier than road transport, particularly considering the road construction cost and variation in the transportation capacity. The Romans built stone paved roads in North Africa and Europe to support their military operations. Later the Arabs built roads that were covered with tar. The roads were constructed by preparing earthworks and lifting road foundation at the center for the water drainage (Alabi, 2017).

The road construction techniques gradually improved by the study of road traffic, stone thickness, road alignment, and the slope gradients. The initial road construction materials were stones that were laid in a regular, compact design, and covered with smaller stones to produce a solid layer. The building techniques were simple but they were very effective as they reduced the travel time considerably and connected one place to another by the land route.

2.2 PURPOSES OF ROAD CONSTRUCTION

 Need for investment of road infrastructure as a way of increasing urban and rural productivity and national economic growth and development as become important subject of rewarded attention in almost fewer developing counties (Ekpung, 2014).

Historically many roads were simply recognizable routes without any formal construction. Modern roads are usually smoothed, paved, or otherwise set to allow easy travel. In respect to this (Gupta and Gupta 2010), define road as a path constructed to facilitate the movement of men and materials from one place to another. Roads are

pathways on the earth's surface made by humans with their shapes, sizes, and types of construction so it can be used to move people, animals, and freight vehicles from one place to another easily and quickly. The purpose of transportation infrastructure facilities like roads is to support the flexibility of the populace and moreover decrease the expense of movement of merchandise to a region. This is fundamental since it can maintain the profitability of the national economy, where the worldwide economic sector is influential. As indicated by (Amoatey and Ankrah,2016), road infrastructure continually assumes a critical part in the movement of travellers and cargo. The road serves as an arrangement of flow in the progression of trade, interchanges, and financial turn of events. Foundation of road infrastructure offers accessibility to rural and metropolitan social orders to wellbeing, education, employment and other huge social administrations. This infers that without an efficient transport infrastructure, economic and social progression will be truly hampered.

2.3 Cost Management

Cost management is much more than simply maintaining records of expenditure and issuing cost reports, it means understanding how and why costs occur and promptly taking the necessary response. Thus, the key question to stay competitive in construction industry is effective cost management and control.

Cost management can be defined as the process of planning, estimating, co-ordination, control and reporting of all cost-related aspects from project initiation to operation and maintenance and ultimately disposal. It involves identifying the costs associated with the investment, making informed choices about options that will deliver best value for money and managing those costs throughout the life of the project including disposal. Cost management in the construction industry relates to all cost-related activities from project initiation through to successful occupation stated by (Ashworth, 2010).

According to the Project Management Body of Knowledge (PMBoK) (Project Management Institute [PMI], 2013, 5th Edition), project cost management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling cost so that projects can be completed within budget.

Before construction starts, cost administration centres around cost estimation and cost planning. The goal of the cost estimation is to set up a practical financial plan while advancing Value for Money (VFM) for the owner. Cost planning aims to develop a pre-agreed cost framework in the most economic manner, whilst cohering with programme

requirements, aesthetic considerations, and engineering feasibilities. After construction commences, that focus shifts to cost control and ensuring expenditures are within budget and the pre-agreed cost framework.

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 project manager (Boussabaine, 2013).

Kirkham,2014) was 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. It as a system of bringing cost advice to bear upon the design process.

Accordingly, (Ramabodu and Verster, 2010) contended that cost planning practices ensure that in the early stages of a project, the client/contractor will know what the anticipated final cost of the development will be. Kissi and (Adjei-Kumi, 2017), claimed the concept of cost planning arose out of the need to effectively strategies the cost of a construction project from its inception, through to design, and continuing throughout the entire project. Effective cost advice will place the client in a strategic position to make good decisions when budgeting is based on expert knowledge emanating from all influences. Undoubtedly, cost is one of the most significant benchmarks for measuring the viability of any project Memon et al., (2013); Becker et al., (2014). Concisely, a particular understanding of cost lies in the context in which it is being used. It must be noted that, in the construction discipline, the terminology has a special interpretation appropriate only to this industry.

In the construction industry, cost to the contractor represents all those items included under the heading of his expenditure, while it may differ to the client or consultant. Various studies posit that cost overruns have become part of the life cycle of construction projects (Fugar and Agyakwah-Baah, 2010; Mahamid and Bruland, 2011). These overruns vary significantly from one project to another, and are influenced by various factors (e.g., inflationary pressures; increases in material prices and workers' wages; difficulties in payment arrangements, price fluctuations).

Accordingly, a good cost planning system should entail the following as postulated by (Ostrowski 2013).

i. To make sure the tender sum is pretty much as near as conceivable to the preliminary cost.

ii. To make sure that the capitals available for the project are allotted satisfactorily and reasonably to the components and sub-components

iii. At all times includes the measurement and pricing of approximate quantities

iv. Goal to accomplish best cost at the anticipated level of disbursement

In furtherance, (Ostrowski ,2013) advance that, a decrease in project hazard is an immediate advantage of a good cost planning.

Likewise, (Kissi and Adjei-Kumi, 2017) said the assessment that cost planning management frameworks should incorporate the processes needed to guarantee that the project is finished within the endorsed budget.(Daft, 2012) contend that construction project management procedure remains the accomplishment of hierarchical objectives in a viable and productive way through planning, organising, leading and controlling organisational resources. Therefore, professionals involved in cost planning practices aim to reduce this complexity and quantity of work to the most possible minimum.

Cost estimating

According to Yakubu et al. (2015), Countries all over the world managed their road systems by administrative and functional classifications system and noted that an important government activity of all nation is building and maintaining infrastructure. Furthermore, Yakubu et al.(2015), administrative countries have their roads organised into hierarchical networks according to their main purposes, e.g., national roads for roads leading the provincial centres, principal cities and other cities of national importance. Adedayo et al. (2011) noticed that albeit in developing nations the experts into road utilizes various terms and arrangement however exactly in Nigeria, road construction components or activities are chiefly portrayed to be: site clearance and earthwork, the concrete work or called site drain and culverts, the surfacing and the pavement, the traffic system management and miscellaneous. The following are the dominating terms in road construction; site clearance and earthwork, sub-grade, sub-base, base course, asphalts, surface course, traffic management system like establishment of traffic signs, direction signs, street lights, traffic lights, pedestrian

zebra crossing, guide rail to bridges and others Adedayo et al., (2018). According to (Ola,2011) concluded that, the advanced traffic management system involves real-time traffic data from cameras, speed sensors. (Ibrahim ,2011) express that estimating is the main function of the construction company; the exactness of cost estimates beginning from an early phase of a project through the tender estimate can impact on the achievement or disappointment of a construction project. They also state that many failures of construction projects are caused by inaccurate estimates.

A cost estimate develops the benchmark of the project cost at different periods of improvement of the project. Cost estimates starts at the beginning or inception of a projects till its completion.

During the preliminary or conceptual stage, irrelevant data is open about the project, which makes estimates less precise Adedayo et al., (2018). (Akintola and Eamon ,2011) portrayed estimating as a crucial piece of project management since it transforms into the baseline for following cost control. In the event that the estimate for a project is too low, an organization may well lose money in the execution of the work and if the estimate is high, the organization may well lose the agreement due to overpricing. The motivation behind creating a pre-delicate estimation can be characterised into the following categories: budgeting, controlling and contrasting. There are some estimating methods being used, varying from the very approximate to the exceptionally precise (Akintola and Eamon, 2011). Most organisations have their peculiar estimating norms, developed throughout the long term and regularly updated to reflect changes in operating methods and systems. Furthermore, the variations in labour charges, material costs and exchange rates should be incorporated into the preliminary estimate Adedayo et al., (2018). Holm et al. (2015) records a few explanations behind making estimate, including:

i. Feasibility studies

ii. Selection from alternate design

iii. Appropriation of funds

v. Presentation of bids and tenders

A number of cost prediction models have been developed example, Probabilistic Life-Cycle Cost (LLC) Prediction Model. The absolute project cost in kilometre remains the capacity of a rundown of plausible indicators containing details, for instance, quantities of work items in kilometre. (Mahamid and Bruland ,2010) built up different direct

relapse models for beginning cost estimating for road development exercises as a component of project's actual characteristics, for instance, landscape conditions, ground conditions and soil drill capacity.

The World Bank had built up a worldwide information bank for road development cost in third world countries; the information was created in type of Road Costs Knowledge System (ROCKS). It was designed to develop an international knowledge system of road work costs to obtain average and range unit costs based on historical data that could ultimately improve the reliability of new cost estimates.

Cost control and monitoring

A project is highly unlikely to proceed in all respects entirely according to plan, particularly when the plan has been expressed in some detail. At one level a plan represents a model of the work method and divergences from the plan may be thought of as showing defects in the model. At another level a plan may represent a document of contract, an agreement between two parties concerning how a project will be carried out. According to the A Guide to the Project Management Body of Knowledge PMBOK (2013) defines cost control generally as, "Control Costs is the process of monitoring the status of the project to update the project costs and managing changes to the cost baseline, the key benefit of this process is that it provides the means to recognize variance from the plan in order to take corrective action and minimize risk." 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 ,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 project 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).

Controlling and monitoring of projects occurs when you establish ways to track the course of all activities and events in the project. As project is always a dynamic entity since it must respond to changing conditions if it is to be completed successfully. It is carried out in an environment of ceaseless change and there is a continual need for re assessment and re-appraisal of the project plan. Among the factors liable to alter the course of a project includes such changes in:

i. The technical specification of the project

ii. The project complete date

iii. Budget considerations

iv. Relative priorities of projects

v. Revision of activity duration estimates

vi. Re-assessment of resource requirement for individual activities

vii. Technical difficulties or construction methods

viii. Unexpected weather conditions.

ix. Working conditions

x. The economy

xi. Resource availability

xii. Management and among others

However, some of these changes will have a pronounced impact on the project while others have a mere subtle one. Either way, the changes could affect the project in terms of quality, quantity of work, cost and time. To fully avoid this, a proper cost monitoring and control system must be established. At the onset, there is an important difference between monitoring and control. Monitoring is finding out the state of play. It is having to do with reporting whether one is measuring money or time or any other property in which one is interested. Control is taking whatever steps that are necessary to vary or alter a pattern of events. It is a positive and active operation which its success can be judged by subsequent events .Taking decisions in the exercise of control demands sound information which is the result of good monitoring.

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 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 to monitor and control construction project.

According to Malkanthi, *et al. (*2017), the greater part of the contractors in Sri Lanka accepted that they can reduce about half (50%) of their overhead cost by utilizing legitimate cost controlling techniques. A few contractors have effectively accomplished more than half (50%) overhead reduce through cost controlling techniques. In this way, a legitimate cost controlling can be considered as a fundamental component in the construction industry. Different cost control tools and techniques are taken on by the project managers with the point of moderating the cost vulnerabilities throughout project execution. As stated by Scott,(2012); Burk(,2013) and Cooray et al.(2018); over the years, cost control techniques have evolved and some of those techniques are:

i.   Earn Value Management (EVM),

ii.   Programme Evaluation and Review Techniques (PERT)

iii.   Critical Path Method (CPM),

iv.   To- Complete Performance Index (TCPI)

v.   Risk Analysis

vi.   Cost Value Reconciliation (CVR)

vii.   Monte Carlo simulation

Other Techniques identified by (Opatunji, 2018 and Anyanwu, 2013) include:

i.   Performance reviews and Variance Analysis

ii.   Budgetary control

iii.   Cash Flow Analysis

iv.   Site Meetings

v.   Record keeping

vi.   Valuation of work in Progress

vii.   Elemental Analysis

viii. Cost optimization techniques

ix.   Cost Reduction on site

x.   Cost Planning

xi.   Work Programs

xii.   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).

Earn value management (EVM)

The evolving of EVM

Earned Value Management (EVM) is one of the most widely used techniques in construction. It is a project performance measurement that uses work in progress to indicate what will happen to the work in future, which includes cost, schedule, method of construction and risk to assess progress. Earn value management relies on maintaining a time phased budget baseline (can be in hours or other measurable units) . The basis of this technique was presented by the US Department of Defence (DoD) in the 1960s and was further developed and improved during the 1970s and early 1980s. In 1998, the American National Standards Institute (ANSI) and the Electronic Industries Alliance (EIA) published guidelines for EVM. The use of EVM quickly expanded beyond the Defence sector. It was adopted by many organizations and technology-related agencies. Many industrialized nations also began to utilize EVM in their own procurement programs. An overview of EVM was included in first Project Management Body of Knowledge (PMBOK) Guide in 1987 and expanded in subsequent editions. The construction industry was an early commercial adopter of EVM. Closer integration of EVM with the practice of project management accelerated in the 1990s. In 1999, the Performance Management Association merged with the Project Management Institute (PMI) to become PMI's first college, the College of Performance Management. The United States Office of Management and Budget began to mandate the use of EVM across all government agencies and, for the first time, for certain internally-managed projects (not just for contractors). EVM also received greater attention by publicly-traded companies in response to the Sarbanes-Oxley Act of 2002 (Fleming and Koppelman 2010; PMBOK, 2013). According to (Kwak and Anbari 2012) It has since become a significant branch of project management and cost engineering. In the year 2000, the Project Management Institute (PMI) added the terminology and basic formulas of EVM. Researchers such as Salisu et al. (2016) said project management research works investigating the contribution of EVM to project

success suggests a moderately strong positive relationship. Implementations of EVM can be scaled to fit projects of all sizes and complexities. EVM establishes the analytical relationships between the budget cost, actual cost and the work done to allow better assessment of activity time and budget requirements (Salisu et al., 2016). EVM techniques integrate the project scope, schedule and cost in order to indicate project performances at a particular time or any chosen time for the purpose of ascertaining the time and cost performance of the project within the outlined scope.

Programme evaluation and review techniques (PERT)

A difficult job that a project manager/can attempt is the management of a huge scope project that necessitates coordinating several exercises inside and outside the organization. An innumerable number of details might be considered in planning how to coordinate these exercises, for example, developing a reasonable schedule, and monitoring the project's process. The management of large-scale project such as road construction project, poses numerous challenges. These difficulties have prompted far reaching utilization of project management technique such Project Evaluation and Review Technique (Aja and Chukwu, 2017). Project management techniques provide managers with a systematic quantitative framework for planning, scheduling and coordination of numerous interrelated activities associated with the successful on-time completion of construction projects made up of smaller tasks some of which can be started straight away while some need to await the completion of other activities or can be done in parallel before they eventually commence as observed by (Adebowale and Oluboyede, 2011). Cooray, et al. (2018) stated that Project Evaluation and Review Technique (PERT) was developed and tested as a cost control method which allows management to identify the estimated probability of project completion within a certain amount of time and cost. This method is similar to Critical Path Method (CPM), but PERT is more events oriented while CPM is activity oriented. PERT enables the values of work packages to be assessed in advance. This PERT charts provides the graphical illustration of the entire growth of the project indicating major events, dependent tasks, parallel tasks and tasks that should be accomplished in order, but that do not require resources or finishing time. Thus, PERT is used to schedule, organize, and coordinate tasks within a project as a project management tool (Burke, 2013). PERT is a way of showing the budgeted project cost based on the activity start times. The assumption behind this technique is that cost per unit time for an activity is constant between its start time and its finish time. In this method cost estimates must be made for each

activity. At that point the framework monitors money expenditures for each activity similarly as time expenditures. An assortment of analyse can be performed with this technique, including hammering of explicit activities in the project. A chart can be created showing the cost of the project dependent on every activity starting at its earliest start (ES) time and at its latest start (LS) time. The gap between the cumulative ES and LS lines represent adaptability and cost can be adjusted within these limits artificially delaying the start of non- critical activities.

Critical path method (CPM)

There is a conscious effort at improving the roads in most cities of Nigeria with an aim to provide better travel and transport facilities. Such efforts may also attract more investment in the states. However, in public interest, it is imperative that the disruption of traffic caused by the construction process should be minimised. This would entail the contractor to subdivide the project into smaller subprojects and minimise time of completion of each sub-project, that too at a relatively low cost. The Critical Path Method (CPM) is one of the commonly used network techniques developed to facilitate planning, scheduling and controlling of projects in an integrated manner with the aim to complete them within the constraints of given time (Khurana and Banerjee, 2013). This provides a managerial device which acts as a tool to cater to a variety of needs such as system design, planning and control. According to Gurcharan and Jagdish,(2013), researched intensively and came out with a new technique named critical path scheduling. The company applied this technique in one of his over hauling projects and were able to reduce the over haul time from 125 hours to 78hours. Adoption of critical path method techniques in road construction is rapidly increasing because of the following advantages:

i. If somethings go wrong with the planning of project, it can be easily identified and then concentration of attention and labour is done to correct it.

ii. It helps in preparation of the most economical time table for all the operations of the projects.

iii. It helps in selection of best combination of equipment and labour so as to finish up the project in time.

iv. It assists in working out the effect of variations such as extra-works, change of order of work, and other variations.

v. It makes the most economical use of available resources.

vi. It permits the reviewing of the project at various stages and accordingly allowance may be made to accommodate, uncertainties which were not thought of in original planning.

vii. It rationalizes construction costing and financing.

viii. The study of information and data available from this method suggests alternative scheme also.

The difference between CPM and PERT techniques are as follows:

i. CPM network does not consider the uncertainty factor of various activities. In PERT technique, time is the essential factor to be analyzed and hence it includes the feature of probability in its calculations.

ii. CPM is activity oriented and PERT is event oriented. Hence in case of projects based on PERT calculations, the management will be interested in the start of an event rather than the start of an activity.

According to Gurcharan and Jagdish (,2013), the construction industry has sufficiently advanced in India and it is not possible to predict with reasonable accuracy, the construction cost and the time of performance as associated with each activity of the project. Thus, the basic assumptions of CPM can be fulfilled and the probability feature of PERT is more or less irrelevant in most of the cases. Moreover, PERT technique requires extra labour and cost for working out various time predictions. Hence CPM technique is becoming more and more popular for most of the construction projects. However, it should be remembered that there is a certain amount of overlap between the two techniques and both have their own place in industrial management.

To-complete performance index (TCPI)

As demonstrated by Cooray, et al. (2018), TCPI is one of the deciding rings of Earned Value Management. It is an important instrument for people who are busy with construction field (project chief, group affiliates and different accomplices). TCPI find prediction of the expense execution of the undertaking subject to the advantage of reaming work. TCPI help to show up at set target by refining cost performance of the undertaking (Scott, 2012).

According to the Project Management Body of Knowledge (PMBoK) (Project Management Institute [PMI], 2017, 6th Edition), the TCPI indicates the target cost

performance index (CPI) that is needed to complete the project at the target budget. In simple words: the to-complete performance index is the result of dividing the remaining budget according to the plan by the actually available budget (considering existing cost variances). The TCPI value is in one of the following three value ranges, each of which has a different meaning:

TCPI = 1: the project can continue with the current budget consumption rate

TCPI < 1: based on the current cost variance, the project will be completed at total cost lower than the budget

TCPI > 1: if the project continues working with the present cost variance, it will complete at a budget overrun. Going forward, the actual cost-performance index of the project should meet the TCPI value to allow the project to be completed within the approved budget.

In practice, the TCPI is mostly used in situations where the actual cost exceeds the earned value the to-complete-performance index then indicates at which factor the future cost performance needs to be changed in order to complete the project at the planned budget.

Risk analysis

Construction industry is a highly risky process mostly because of its long-life duration and unique product as a result of construction, and also many different professions are involved in one project. Generally, risks in construction work should be controlled and reduced during design, procurement and construction phase, and the most important activities are defined risk management plan from the very beginning and to assign risks to different project members and to manage their execution A risk is defined as the combination of probability of an event and its impacts on project objectives (Sharaf and Abdelwahab, 2015). A positive consequence presents an opportunity whereas a negative consequence poses a threat. The PMBOK (project management body of knowledge) defines a standard process to identify risk, which is based on an iterative process because new risks may evolve or become known as the project progresses through its life cycle. According to Agnieszka and Mariusz (2015), risk is a measurable part of uncertainty, for which we are able to estimate the occurrence probability and the size of damage. Study evaluates the likelihood of occurrence and degree of impact of the risk events in Nigerian road construction projects. The Federal Government of Nigeria (FGN) is the major client and most Civil/Construction contracts are awarded by

the Ministry of Works (MOW) under the Federal Ministry of Works and Federal Road Maintenance Agency are in charge of all highways projects that includes Trunk A roads, Bridges, retaining walls and storm water drainages. The major problem associated with most road projects in Nigeria is always cost overruns coupled with delay on completion (Nicholas &Awotunde, 2014). According to Nicholas and Awotunde(,2014) a lot has been written in the literature about risk assessment and management issues in various industries. Many studies have explored the definition of risk as related to the construction context. The risk is assumed as a deviation from the desired level. It can be positive or, which most often happens, it can be negative. Risk analysis is a cost management technique aimed at quantifying the undesirable factors and determination of their impact on time and cost of a construction project and also proffering mitigating measures to the negative factors. All projects are subject to risks that can occur during their life span.

Risks imply circumstances where the actual result of an activity or event is probably going to veer off from the estimated/ forecasted value. These risks come along with costs which ought to be managed to avoid the total project cost from escalating. To deal with these costs, risk analysis is utilized in risk cost management. It includes identifying, quantifying, categorizing and controlling risks (Chitkara, 2010).

Ayyub and Bender (2011) proposed a risk-based cost control which involves setting emphasis on risk identification, assessment, acceptability, monitoring, decision analysis and control. It was clarified that potential cost issues can be predicted by using risk analysis and simulation techniques to pinpoint/identify potential areas prone to cost escalation. This is carried out in the planning stage and the execution stage.

Cost value reconciliation (CVR)

Potts and Ankrah (2013) described cost value reconciliation (CVR) as is a cost system utilized by the contractors, which attempts to demonstrate a practical and precise financial situation at any present stage by projecting the cost-effectiveness of the organisation. This also fulfils one of the legal requirements for example it forms the basis for statutory accounts and also just as mentioned earlier above it provides information or identifies troubled areas in the project and provides the opportunity to take required action in solving the problem by the project team in preventing them from recurring on the project (Potts and Ankrah, 2013). This is carried out (cost valuation reconciliation on a monthly basis as agreed for interim valuation) by the Quantity

Surveyor/Cost Engineer of the contractor but also require inputs from the rest of the project team to have an integrated outcome (Potts and Ankrah, 2013). It is also good to note that these reconciliations may be an estimated account and not an exact picture, it is according to the quantity surveyor's knowledge and judgement to the available information (Potts &Ankrah, 2013).

Budgetary control

Budgeting as indicated by Olagunju et al. (2014) from the French word 'Bougette' which implies little sack. It was depicted as a leather bag, which the Chancellor of the Exchequer conveyed to the Parliament of Great Britain. The major historical function of budget both in government and private sector was to set limits for expenses of expenditure in order to control expenditure within those limits. Budgeting is a management tool or technique utilized for short-term planning and control. Traditionally, budget have been employed as a device to limit expenditure, but a much more useful and constructive view is to treat the budget process as a means for obtaining the most effective and profitable use of the company's resource via planning and control. Short term planning is formalized in the budgetary process. According to Ravi (2012), Budgetary control is the establishment of budget relating the responsibility of the executives to the requirement of a policy, and the continuous comparison of the actual with budgeted results, either to secure by individual action the objectives of that policy or to provide a basis for its revision. Budgeting is one of the ways of controlling cost in manufacturing organisations. Cost control is a systematic review of the resources a company uses to achieve its primary objective of profitability; therefore, it can also be referred to as cost management (Olagunju et al., 2014).

Cash flow analysis

Cash flow analysis is a critical aspect of any construction process regardless of its size. It involves managing the inflow and out flow of money to ensure that the project is completed on time and within budget. Inadequate cash flow management can cause a project to hit road blocks in the form of stalled labour and supply of materials which can lead to project failure (blackridge,2013).

Construction works like, highways, underground services, buildings, bridges, and drainage amenities, industrial works, are predictable for their high risk and vulnerability, predominantly, at the preliminary estimate phase where the cost of project's information is incredibly confined. According to Tarek and Yaqiong (2014)

constriction company cannot continue in the genuine construction contract deprived of practical cash flow management. Income is the harmony of inflow and outflow cash on a project throughout an exact timeframe. Studies and investigations have shown that shortfall of liquidity is a huge issue instigating disappointment and frustration of development projects. The cash flow forecasting is advantageous for the project in both the tender stage and during the project construction progress, where the contractors need to ensure that their planned cash reserves is adequate to cover any conceivable financial deficiency of the project. (Bevian, 2016).

i. Because the importance of Cash for day to- day some contractors have suffered a downturn not because their work was not profitable but due to an inability of cash in the short term.

ii. Because of the poor financial management, especially inadequate attention to the cash flow management, construction industry suffers of the largest number of bankruptcies of economic sectors, with many companies failing.

As indicated by Bevian (2016). The cash flow forecast of a construction contract or project deals more specifically with the payments due under a particular construction contract. Cash flow of the construction contract will help to inform a company's overall cash flow as they are intrinsically linked. Cash flow was defined as the actual movement of money in and out of a business. Positive cash flow is termed as the money flowing into a business and is credited as cash received. Monies paid out are termed negative cash flow and are debited to the business. Net cash flow is the difference between the positive and negative cash flows, positive cash flow is mainly derived from monies received in the form of monthly payment certificates, stage payments, releasing of retention and final account settlement. Mei Ye and Abdul Rahman (2010) identified the underlying causes of late payment from the contractors' perspective in the Malaysian construction industry. A survey was used in this study for the purpose to elicit the contractors' perception respondents with at least ten years of working experience agreed with the highest ranked solution which is to understand and research the owner's ability to pay in mitigation of late payment.

Material management

Rathina Kumar, et al. (2018) regard Material management as one of the persuasive pieces of construction projects as the materials represent 55.5%-60.5% of the whole construction cost. Material management is communicated as the path toward giving

proper quantity and quality of proper materials at the spot in the predefined time. The way toward planning of materials, procurement of materials, inventory control, storage of materials, handling and transportation, standardizing the material goes under material management. Much of the time construction projects experience the unapproachable effects of cost overrun and time overdue. These issues can be stayed away from by appropriately carrying out material management which guarantees the convenient progression of materials to the place of work(site) which thus expands the labourer productivity and, accordingly, decreases the expense of the project. Rehearsing order over the material expense can sufficiently reduce the expense of the project on account of the clarification alluded beforehand. Material planning and stock control are the two most basic bits of material management. Material planning characterized as the assurance of the need that satisfies the development need under financial speculation approaches.

Components of Road Construction Project Delivery

Road construction is an intricate, important, and rewarding process. It starts with an idea and culminates in a structure that may serve its occupants for quite a few years, even hundreds of years. As indicated by Supriadi, et al. (2018) the road is a plot of land flattened with a certain gray and hardened surface to be able to serve vehicles passing on it with a strong and secure. In providing a comfort and safe feeling for road users, especially toll roads, on the road surface is given pavement layer with asphalt and/or concrete material classified into two, that is flexible pavement and rigid pavement. Roads are laid outdoors by a large number of diverse constructors and artisans on all types of sites and are subject to all kinds of weather conditions.

An overview of the activities, events, and processes that bring about a road construction from the inception of an idea or a concept in the owner's mind to the completed design by the consultants (Civil engineers, and other stakeholders such as Quantity surveyors) and, finally, to the actual construction of the road by the contractors/highway engineers. Design and construction are two independents but related and generally sequential functions in the realization of a road. The former function deals with the creation of the documents, and the latter function involves interpreting and transforming these documents into reality.

The procedure by which a road project is delivered to its client may be separated into the following components of road construction project delivery stages. In spite of the

fact that there is typically some overlap between adjacent stages, they for the most part follow this order:

i.   Predesign delivery phase

ii.   Design delivery phase

iii.   Preconstruction delivery phase

iv.   Construction delivery phase

iv.   Postconstruction delivery phase

Challenges of Cost Control Techniques

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

1. Lack of reliability in cost management by project managers

Many construction companies will take the initiative to perform or undertake PCC process only when there exist cost problems, predicaments, or thoughtful cost issues. This is a common phenomenon with most construction managers. conversely, the organization will only be executing or delivering the construction project as planned. Although cost manager recognizes the essence of performing PCC process, they fail to pass the concept to the other members of organization to accomplish the cost objectives of the project. Instead of being consistent in the practice of cost control during construction project execution, managers mostly do so irregularly or occasionally when the need arises. Not only is there a lack of PCC processes and systems, but also the many cost managers' maladies, which is a lack of continuous engagement of PCC processes in the delivery of construction projects (Song, 2014 and Adjei et al., 2015).

2. Inadequate acquaintance on the utilisation of available tools and technology

Information is the vital portion for each construction establishment to advance particularly and to be huge in the construction industry (Martin, 2010 and Ademola, 2012). Information on cost control can be considered as specialized and managerial information and the need impacts the showing of PCC (Ademola, 2012). The fight to reliably consider and like complex procedures and steps of cost control using appropriate tools remains a test for explicit experts. (Ademola, 2012).

3. Relinquishment of complicated approaches

Regularly most project manager/site supervisors, quantity surveyors or cost engineers think that it is difficult to join residual knowledge with experiences from past attempts

(Ademola, 2012). The orderly systems where one uses mathematics with computerized base is an issue for some professionals in the everyday activities in managing cost (Ademola, 2012).

4. Using outdated approaches and perceptions

Little and medium development firms are as of now utilizing crude Project cost control (PCC) strategies which rely fundamentally on manual, paper-based information, nature, and past work encounters (Yakubu and Sun, 2014). Song (2014) added that most owners of construction firms have little level of education or no knowledge on cost management which hinders practices of cost control. This makes them rely on previous work experiences acquired from previous projects undertaken. The limitation of current cost management competences, and self-learning narrowed knowledge, continuous development of organizations, and the changing of work environment have turned their previous work experiences and methods into unfashionable ones. The challenge is that these outdated cost management practices cannot be used to solve current real-world situation of cost variances.

5. Deficiency of financial dedication in projects

The most important factor that is being considered by every contractor is the opportunity to remain in business by taking up some construction projects. Most contractors are always concerned with profit or turnover before taking up a new construction project. Contractors are well aware of the need to maintain a flow of cash for the day-to-day activities in project delivery and also maintain a cash flow for the survival of the company. Additionally, some contractors have suffered liquidation or bankruptcy not because their construction work was unprofitable but because of cash flow problem in the short-term during construction project delivery (Sanni and Hashim, 2013).

6. Deficient PCC procedures and framework appropriate to the enterprise

Project change control(PCC) helps protect projects from risks and will ensure it stays on track for delivery, even when things change during the projects life cycle As previously explained, managers of construction companies are very mindful of cost control issues, and have repeatedly stressed it as a necessity. The project managers dependably lean toward a straightforward strategy for performing cost control techniques without following fair treatment which finally become an awful practice. Most project managers are dependably mindful of the need to focus and keep

construction cost on track yet are not set up to put a ton of energy in building up a cost control template for every construction project for use in the PCC cycle, this is a result of the fact that, formulating the cost control process for a project takes a lot of time.

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

i.   Fluctuation in prices of Raw Materials

ii.   Poor Project Site Management

iii.   Lowest Bid Procurement Method

iv.   Inappropriate Government Policies

iv.   Wrong method of Cost estimating

vi.   Duration of the project

2.4   RELATIONSHIP BETWEEN CONSTRUCTION PROJECT DELIVERY TIME AND COST

Chitkara (2005) said the relationship between time and cost is a very important aspect in the control of costs on site as any variation in time has automatic implication on cost. It is important to report and record all the works involving materials, plant and labour on sites. This enables the contractor to be able to know the costs and expenses of the resources used on site and compare with the initial cost budget. Various report techniques used include; daily or weekly and monthly recording, schedule control, site daily diary report and the project budget.

CHAPTER THREE

MATERIALS AND METHOD

3.1 INTRODUCTION

There are various tools available to do research. From administration of questionnaires, face-to-face interviews, online surveys over to new tools like guerrilla testing.

This research basically employed the use of survey design method using the quantitative approach through a well-structured questionnaire to assess the effect of cost control techniques used in road construction projects and the impact they have on project delivery.

3.2 Research Population

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. Polit and Hungler (2001) refer to the population as totality of all subjects that conform to a set of specifications, comprising the entire group of persons that is of interest to this research and to whom the research results can be generalised.

The target population for this study comprised of Thirty (30) construction firms in Owerri metropolis registered with Federation of Construction Industry (FOCI), Nigeria.

3.3 Sampling Frame

Carl *et al*. (2011) postulated that in statistics, a sampling frame is the source material or device from which a sample is drawn. It was further stated that it is a list of all those within a population who can be sampled, and may include individuals, households or institutions. This is an accessible section of the target population (usually a list with contact information) from where a sample can be drawn (Bhattacherjee, 2012). The sample frame for this research consisted of construction firm (dealing with road construction only) in Owerri metropolis registered and contained in the list of contractors complied by FOCI Nigeria.

3.3.1 Sampling technique

The processes this research used when choosing its items from the sample, consists of the element that will form part of the sample, this mean that the sample size, sampling techniques were part of data collection   (Kothris, 2011). For the purpose of this research, this research identified the cost control techniques used in road construction

Table 3.1   As the name suggests, primary data is one which is collected for the first time by the researcher while secondary data is the data already collected or produced by others. For this research, primary sources of data collection were employed. The primary data was gotten from the administration of well-structured questionnaires.

3.5 Method of Data Presentation and Analysis

Data gathered were analysed in relation to the stated objectives. The data were analysed using descriptive statistical method (Percentile, Frequency and Mean Item Score). The data collected on the respondents' general information were analysed using frequencies and percentile. Other objectives were analysed using details contained in Table 3.1

S/N	Objectives	Data Tools	Method of Analysis
1	To identify cost control techniques used in road construction projects.	Questionnaire	Frequency
2	To examine the challenges of cost control techniques used in road construction project.	Questionnaire	Mean Item Score
3	To determine the effectiveness cost control technique, use in road construction project.	Questionnaire	Mean Item Score

Table 3.1: Procedures for analysing the research objectives

3.5.1 Decision rule

The decision rule used for the MIS are summarized in Table 3.2

Table 3.2: Decision Rule for Data Analysis

Scale	Cut-off Point	Interpretation			
	MIS	*Frequency of Occurrence*	*Level of Agreement*	*Level of Significance*	*Level of Effectiveness*
5	4.51-5.00	Very Often	Strongly Agreed	Very Significant	Very Effective
4	3.51 – 4.50	Often	Agreed	Significant	Effective
3	2.51 – 3.50	Fairly Often	Indifferent	Fairly Significant	Fairly Effective
2	1.51 – 2.50	Less Often	Disagreed	Less Significant	Less Effective
1	1.00 – 1.50	Rarely	Strongly Disagreed	Least Significant	Least Effective

3.5.2 Mean item score

Mean Item Score is in ranked from 1.00 to 5.00 and they all have their decision rule as shown in Table 3.2. The formula for Mean item score (MIS) is.

$$MIS = \sum \frac{v}{N}$$ (3.1)

Where: Σ = Summation, V=Values, and N = Total number of respondents

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Data Presentation

The aim of this study is to assess the effect of cost control techniques used in road construction projects delivery in owerri metropolis, Imo state Nigeria. And the approach used in this analysis, was data gotten from the administration of structured questionnaires. The data were analysed using descriptive statistical method (Percentile, Frequency and Mean Item Score).

4.2 Demographic Information

Out of the 30 questionnaires administered to contractors in Imo state, 25 were retrieved and all were ascertained fit for analyses. The 25 analysed questionnaires represent 83% response rate and this is considered suitable for this study following the compliance with 20-30% response rate for questionnaire surveys in construction management studies, as suggested by Akintoye (2000); Moser and Kalton (1999).

Table 4.1 shows respondents having 10-15 years of experience account for the higher percentages of 48% with a count of responses from respondents as 12 followed by 15 year and above which account for 36% with a count of responses from respondents as 9 and finally, the respondents that are 5-10 years accounts for the smallest number of responses a count of 4, accounting 16%. This implies that majority of respondents 10-15 years of cost control relevant.

Table 4.1: Years of Experience

Years of Experience	Frequency	Percent (%)
5 -10 years	4	16.
10-15 years	12	48
15 years & above	9	36
Total	**25**	**100**

Table 4.2 respondents that are MSc/BTech account for the higher percentages of 88% with a count of responses from respondents as 22 followed by BSc/BTech which account for 12% with a count of responses from respondents as 3. While the remaining

two categories, HND and PhD had no respondents. This implies that majority of respondents are MSc/MTech. holders

Table 4.2: Educational Qualifications of Respondents

Educational Qualifications	Frequency	Percent (%)
HND	0	0
BSc/BTech	3	12
MSc/MTech	22	88
PhD	0	0
Total	**25**	**100**

Table 4.3 indications that Civil Engineers have the higher percentage of 60% possessing a count of responses of 15 accompanied by Project Manager possessing a count of responses of 7 giving 28%. However, the respondent that are Quantity Surveyors have the smallest response of 3 giving 12% and other have responses count of zero (0). This implies that Civil Engineers are the majority of respondents for the study followed by Project Manager.

Table 4.3: Profession of Respondents

Profession of the Respondents	Frequency	Percent (%)
Quantity Surveyor	3	12
Project Manager	7	28
Civil Engineer	15	60
Other, please specify	0	0
Total	**25**	**100**

Table 4.4 indications that holders of MNSE have the higher percentage of 88% possessing a count of responses of 22 accompanied by respondents that are MNIQS

possessing a count of responses of 3 giving 12% each. This implies that MNSE are the majority of respondents for the study followed by MNIQS.

Table 4.4: Professional Membership

Professional Membership	Frequency	Percent
None	0	0
MNIQS	3	12
MNSE	22	88
Other, please specify	0	0
Total	**25**	**100**

4.3 Assessment on effect of Cost Control Technique(s) Used in Road Construction Projects

Table 4.5 shows that construction firms 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 suggests that cash flow analysis is the most effective cost control technique, use in road construction project.

Table 4.5: Cost Control Technique(s) Used in Road Construction Projects.

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 (BC)	3	12
Cost Planning (CP)	3	12
Total	**25**	**100**

4.4   Challenges of the Cost Control Techniques Used in Road Construction Projects

Table 4.7 shows the challenges of cost control techniques used in road construction projects. Challenges such as inadequate acquaintance on the utilisation of available tools and technology, deficiency in financial dedication in projects and fluctuation in prices of raw materials were ranked first (1st), second (2nd) and third (3rd) with mean score of 4.36, 4.24 and 4.20 respectively. Lack of reliability in cost management by Project Managers and other road project stakeholders like 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.

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 deficient in PCC procedures and framework appropriate 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 Relinquishment of complicated approaches which came eleventh (11th) with a mean score of 3.64. This result was in agreement with the study of Martin (2010) that knowledge is considered as the key element for every construction organization to do well and to be competitive in the construction sector. It also coincides with the findings of Ademola (2012) that the 'knowledge' of cost control can be considered as technical and managerial knowledge and the lack of it affects the practice of PCC. He further states that the battle to always study and understand complex procedures and steps of cost control using appropriate tools is a challenge for some professionals. The result also agrees with the study Malkanthi*et al*. (2017) were they listed Fluctuation in prices of raw materials, Poor project site management, Lowest bidding procurement method, Inappropriate government policies, Wrong method of cost estimating and Duration of the project as part of other challenges of cost control techniques used in road construction project.

Table 4.6: Challenges of the Cost Control Techniques Used in Road Construction Projects

S/No	Challenges of Cost Control Techniques	MIS	Rank	Remark
1	Inadequate acquaintance on the utilisation of available tools and technology	4.36	1st	Agreed
2	Deficiency in financial dedication in projects	4.24	2nd	Agreed
3	Fluctuation in prices of Raw Materials	4.20	3rd	Agreed
4	Lack of reliability in cost management by Project 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 outdated Approaches and Perceptions	3.84	7th	Agreed
8	Inappropriate Government Policy	3.80	8th	Agreed
9	Deficient in PCC procedures and framework appropriate to the enterprise	3.72	9th	Agreed
10	Wrong method of Cost estimating	3.68	10th	Agreed
11	Relinquishment of complicated approaches	3.64	11th	Agreed

4.5 Effectiveness of Cost Control Technique Used in Road Construction Projects

Table 4.7 shows the effectiveness of cost control technique used in road construction projects. The respondents strongly agreed with a mean of 4.68 that Cash Flow Analysis (CFA) was the most effective cost control technique used in road construction project and thus ranked first (1st). Next were Cost Value Reconciliation (CVR) and Valuation of Work in Progress (VWP) which were ranked second (2nd) and third (3rd) as the effective cost control techniques used in road construction project with a mean score of 4.20 and

3.96 individually. Followed by the Material Management (MM) which was ranked fourth (4th) with a mean score of 3.36. The fifth (5th) ranked cost control technique used in road construction project was Budgetary Control (BC) with a mean score of 2.80 and finally, Cost Planning (CP) was ranked the sixth (6th) cost control technique with a mean score of 2.50.

Table 4.7: Effectiveness of Cost Control Technique Used in Road Construction projects

S/No	Effectiveness of Cost Control Technique Used in Road Construction	MIS	Rank	Remark
1	Cash Flow Analysis (CFA)	4.68	1st	Very Effective
2	Cost Value Reconciliation (CVR)	4.20	2nd	Effective
3	Valuation of Work in Progress (VWP)	3.96	3rd	Effective
4	Material Management (MM)	3.36	4th	Fairly Effective
5	Budgetary Control (BC)	2.80	5th	Fairly Effective
6	Cost Planning (CP)	2.50	6th	Fairly Effective

4.8 Summary of Findings

The study was embarked to address the cost control techniques utilised in road construction projects. To determine this, the study assessed control techniques utilised in road construction projects with a perspective on project delivery. To accomplish this aim, data was collected from construction firms (dealing with construction only) in owerri metropolis, Imo state. 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 frequently used cost control techniques in road construction projects were Cash Flow Analysis (CFA) with 6 frequency and 24%.

ii. Inadequate acquaintance on the utilisation of available tools and technology (MIS=4.36) was the most agreed challenges of the cost control techniques used in road construction project.

iii. Cash Flow Analysis (CFA) (MIS=4.68) was the most effective cost control technique used in road construction project.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1   Conclusion

From the study, assessment of cost control techniques investigated, only 6(six) out of 19(nineteen) are used on average in the road construction project in owerri metropolis, Imo state, Nigeria. Few civil engineers and other road construction stakeholders like Quantity Surveyors (Cost Managers) are engaged with the critical cost management of road construction projects. The research also reveals that cost control techniques have strong impact on road construction project delivery. It was strongly agreed that Cash Flow Analysis was the most effective cost control technique used in road construction projects. Next were Cost Value Reconciliation and Valuation of Work in Progress which were ranked second and third as the effective cost control techniques used in road construction project.

The research shows that Inadequate acquaintance on the utilisation of available tools and technology affects the practice of cost control techniques.

5.2   Recommendations

The point of convergence of this research was to examine cost control techniques utilised in road construction projects and the effect they have on project delivery. These techniques, if properly implemented and more construction cost manager like a civil engineer/ (Quantity Surveyors) are involved, these will bring about tangible reduction in the costs of a road construction project.

In light of the study, the accompanying proposals are being made:

i.   Other stakeholders like Quantity surveyors should be involved in road construction more due to their area of discipline as cost expertise which they have better attitude towards using these techniques.

ii.   Road construction manager, (trained explicitly for this purpose) should also exhibit the foresight in predicting and arresting those constraints that are related with road projects which may either impede the progress of work or extend the predetermined project period, along these lines increasing project cost.

iii.   Construction firms should endeavour to send their employees to attend workshops, seminars and other training programs that will enlighten them on how to use the other techniques. .This will refresh and widen their necessary knowledge for controlling cost of their project.

5.3   Contribution to Knowledge

This research work has been able to assess the effect of cost control techniques and identify the cost control techniques used in road construction project, and the effectiveness of those techniques. Cash Flow Analysis (CFA) was the most effective cost control technique used in road construction project and thus ranked first (1st). Next were Cost Value Reconciliation (CVR) and Valuation of Work in Progress (VWP) which were ranked

 second (2nd) and third (3rd) as the effective cost control techniques used in road construction project with a mean score of 4.20 and 3.96 individually.

Also, this research work examined the various challenges of cost control techniques and assessed the effect of this techniques on the road construction project delivery. Challenges such as inadequate acquaintance on the utilisation of available tools and technology, deficiency in financial dedication in projects and fluctuation in prices of raw materials were ranked first (1st), second (2nd) and third (3rd) with mean score of 4.36, 4.24 and 4.20 respectively.

The outcome of this research work will be beneficial to road project managers and other road project stakeholders as their main aim is to minimize cost. It will also create a path for further researches in this area.

5.4   Areas for Further Studies

Findings of the study give conceivable direction to further research in following areas;

i.   The research was restricted to construction participants in owerri metropolis, Imo state. Further   studies can be conducted in other states of the country.

ii.   Further researches can be done on mitigating solutions to the identified challenges of cost control techniques.

iii.   Other techniques can be implemented and its analysis which can serve as an area for further research.

REFERENCE

Adebowale, S.A. and Oluboyede, E.D. (2011). Network Analysis and Building Construction Implication and Costing of Activities. *Journal of Civil Engineering and Construction Technology*, 2(5), 90-100.

Adedayo, J. O., Ayodeji, E. O., and Kehinde, R. (2018). Developing cost model for preliminary estimate of road projects in Nigeria. *International Journal Sustainable Real Estate and Construction Economics*, 1(2), 182-199, DOI: 10.1504/IJSRECE.2018.10013444.

Ademola, W. O. (2012). *Examining a new approach to cost control methods and mechanisms for SMMEs in construction projects*, MSc Thesis, University of Johannesburg, South Africa.

Adjei, K. O., Aigbavboa, C. O. and Thala, W. D. (2015). Contractors' management team roles for project cost control in Ghana. *Applied Research Conference in Africa (ARCA)Conference*, 27-29.

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)*, Guangzhou, China, Publishers: American Society of Civil Engineers (ASCE).

Adjei, K. O., Aigbavboa, C. O. and Didibhuku, T. (2018). The need for Change Management concept in construction project cost control. *CIDB Postgraduate Conference*, 10, 2527.

Aja, R.O. and Chukwu, W.I.E. (2017). Application of Project Evaluation, Review Technique and Critical Path Method (PERT-CPM) Model in Monitoring Building Construction. *World Applied Sciences Journal,* 35(11), 2401-2413, DOI: 10.5829/.2401.2413.

Agnieszka, D. and Mariusz, R. (2015). Risk analysis in construction project - chosen methods. *Procedia Engineering*, 122, 258 – 265, DOI: 10.1016/j.proeng.2015.10.034.

Ahmad, A.M. (2018). Comparative Analysis of Activity Duration in Project Management. *The International Journal of Business & Management,* 5(12), 158-162, DOI:
10.13140/RG.2.2.14305.40801.

Ahmad, Y. B., Ezanee, M. E., Hishamuddin, D and Roslan, J. (2012).*Construction Cost Control: A Review of Practices in Malaysia,* College of Business, University Utara Malaysia, 06010 Sintok, Malaysia.

Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. *Construction Management and Economics,* 18, 77-89.

Akintola, A. and Eamon, F. (2011). A survey of current estimating practices in UK. *Journal of Construction Management and Economics*, 18(2), 161–172.

Aljohani, A., Ahiaga-Dagbui, D. and Moore, D. (2017). Construction Projects Cost Overrun: What Does the Literature Tell Us? *International Journal of Innovation, Management and Technology*, 8(2), 137-143.

Aliu N.O. (2014). Evaluation of procurement methods on building projects in Imo state. *An Unpublished M-Tech Thesis submitted to Department of Building, Federal University of Technology, and Minna.*

Amoatey, C. T. and Ankrah, A. N. (2016). *Exploring Critical Road Project Delay Factors in Ghana* (Emerald Publishing Limited),Bingley, United Kingdom.

Anyanwu, C.I. (2013). Project Cost Control in the Nigerian Construction Industry. *International Journal of Engineering Science Invention*, 2(12), 65-71, ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726.

Ashworth, A. (2010). *Cost Studies of Buildings* (5th ed.). Harlow: Prentice Hall.

Ayodele, E. O. and Alabi, M. O. (2014). Effect of Cost Control on Building Projects Delivery in Nigeria. *Civil and Environmental Research*. 6(2), 76-79, SSN 2224-5790(Paper) ISSN 2225-0514 (Online) 2014.

Ayyub, A. and Bender, W. (2011). *Risk-based cost control for construction*, available at *www.cwu.edu/benderw/RiskbasedcostcontrolAACEPittsburghBendersubmission.doc*.

Babic, N.C., and Rebolj, D. (2016). Culture Change in Construction Industry: From 2d toward Bim Based Construction. *Journal of Information Technology in Construction,* 21, 86– 99.

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 onTechnology and Operations Management, Sustaining Competitiveness throughGreen Technology Management, Bandung* – Indonesia.

Becker, N., Helgeson, J. and Katz, D. (2014). Once there was a river: a benefit-cost analysis of rehabilitation of the Jordan River. *Regional Environmental Change*, 14(4) 1303–1314.

Benson, F. J. and Lay, M. G. (2016) "Roads and highways". Encyclopedia Britannica, https://www.britannica.com/technology/road.

Bevian, I. A. (2016). Implications of Cash Flow Forecasting on Highway Projects in Iraq. *Anbar Journal of Engineering Science*, 1(7), 55-62, ISSN: 1997-9428.

Bhattacharjee, A. (2012). *Social Science Research: Principles, Methods, and Practices.* University of South Florida Tampa, Florida, USA: Creative Commons Attribution-Non Commercial-Share Alike 3.0 Unported License.

Boussabaine, A. (2013). *Cost Planning of PFI and PPP Building Projects*, Routledge. Canada.

Burke, R. (2013) *Project management: Planning and control techniques* (5th ed). New Jersey: Wiley.

Carl, P., David, A.,Kris, B., Katharine, M.M., and Brian, G.P. (2011). Differential Evolution with DEoptim: An Application to Non-Convex Portfolio Optimization. *The R Journal,* 3(1), 27-34.

Chitkara, K.K. (2010). *Construction Project Management: Planning, Scheduling, and Controlling*. New Delhi: Tata McGraw Hill Publishing Company Ltd.

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

Dada, J. O. and Jagboro, G. O. (2012). Core Skills Requirement and Competencies Expected of Quantity Surveyors: Perspectives from Quantity Surveyors, Allied Professionals and Clients in Nigeria. *Australasian Journal of Construction Economics and Building*, 12(4), 78–90.

Douglas, M. (2015). *Sources of data.* Retrieved on 11nd June, 2019 from http://www.onlineetymologydictionary/data

Ekpung, E.G. (2014). Public Infrastructure Spending and Economic Growth in Nigeria: An Error Correction Mechanism (ECM) Approach.*Journal of Social Economics Research,* 1 (7), 129-140.

Fleming, Q. and Koppelman, J. (2010). *Earned Value Project Management (4th Ed.).* Project Management Institute, ISBN: 978-1 -935589-08-2.

Fugar, F.D. and Agyakwah-Baah, A.B. (2010). Delays in building construction projects in Ghana. *Australasian Journal of Construction Economics and Building*, 10(1/2) 128– 142.

George, S. (2012). *Construction Materials Management (1ˢᵗ Ed.).* New York: Amazon, 36-40.

Gurchan, S. and Jagdish, S. (2013). *Estimating Costing and Valuation* (1ˢᵗ ed). Delhi, Nem Chand Jain.

Gupta, B. L. and Gupta, A. (2010). *Highway and Bridge Engineering* (3ʳᵈ ed.). Standard Publishers Distributors, Delhi.

Hamed, T. and Abolfazl, K. (2015). A Theoretical Review on IT Project Success/Failure Factors and Evaluating the Associated Risks. *Conference Paper,* DOI: 10.13140 ⁄RG.2.1.3214.9206.

Holley, P. and Ben Farrow, C. (2012). Expanding Collaboration in Academia: Case Study of the Development of Construction Products. *Journal of Professional Issues in Engineering Education and Practice,* 139, 139–147. https://doi.org/10.1061/ (ASCE) EI.1943-5541.0000130.

Ibrahim, M. (2011). Early Cost Estimating for Road Construction Projects Using Multiple Regression Techniques.*Australasian Journal of Construction Economics and Building,*11(4), 87-101.

Khamidi, M. F.,Waris, A., and Arazi, I. (2011). Application of Earned Value Management System on an Infrastructure Project: A Malaysian Case Study. *International Conference on Management and Service Science,* 8, 1-5.

Khurana, S. and Banerjee, S. (2013). CPM Analysis of Rolai-Rinjlai Road Construction. *Research Journal of Mathematical and Statistical Sciences*, 1(2), 7-15, ISSN 2320– 6047.

Kirun, S. S. and Varghese, S. (2015). A Study on Cost Control using Delphi Techniques in Construction Projects. *International Journal of Science Technology & Engineering*, 2(5), ISSN (online): 2349-784X.

Kirkham, R. (2014). *Ferry and Brandon's Cost Planning of Buildings*. John Wiley & Sons, UK.

Kissi, E and Adjei-Kumi, T. (2017). Exploring cost planning practices by Ghanaian construction professionals, *Int. J. Project Organisation and Management*, 9(1), 83–93.

Kolo F. D. (2003). *Basic research concept for behavioral researchers,* Zaria, Nigeria: RaspaVicko Consultancy Services.

Kothari C.R (2011). *Research methodology methods and techniques*, (2nd ed.).New Delhi: New Age International

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.

Kwak, Y. H. and Anbari, F. T. (2012). History, practices, and future of earned value management in government: perspectives from NASA,*Project Management Journal*, 43(1), 77–90.

Ling, F. Y. Y. and Ang, W. T. (2013). Using Control Systems to Improve Construction Project Outcomes. *Engineering, Construction and Architectural Management*, 20(6), 576-588.

Martin, L. (2010). *Transfer mechanisms of knowledge and skills in co-operations between emerging and established civil engineering contractors*. PhD Thesis, University of Cape Town, South Africa.

Mahamid, I. and Bruland, A. (2010). Preliminary cost estimating models for road construction Activities. *Proceedings of the FIG Congress– Facing the Challenges Building the Capacity*, 12-16.

Malkanthi, 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.*Journal of the Institution ofEngineers,* 04, 53-60, DOI: 10.4038/engineer. v50i4.7275.

Malkoc, G. (2017). The importance of road maintenance. World Highways. Available from http://www.worldhighways.com/categories/maintenance-utility/features /the importance-of-road-maintenance.

Mei Ye.K and Abdul Rahman. H (2010). Risk of Late Payment in the Malaysian Construction Industry. *International Journal of Mechanical and Industrial Engineering,* 4(5), 503511, ISNI: 0000000091950263.

Memon, S.A., Hadikusumo, B.H.W. and Sunindijo, R.Y. (2015). Using Social Interaction Theory to Promote Successful Relational Contracting between Clients and Contractors in Construction. *Journal of Management in Engineering.* 31, 1–7, https://doi.org/10.1061/(ASCE)ME.1943-5479.0000344.

Moser, C.A. &Kalton, G. (1999). *Survey Methods in Social Investigation (*2nd ed). Gower Publishing Company Ltd, Aldershot.

Memon, A.H., Rahman, I.A., Aziz, A.A.A. and Abdullah, N.H. (2013). Using structural equation modelling to assess effects of construction resource related factors on cost overrun. *World Applied Sciences Journal*, 21(13), 6–15.

Murendeni, I. and Clinton, A. (2018) Effective Construction Project Leadership: Identifying knowledge gaps. *CIDB Postgraduate Conference*,*10,* 25-27,Port Elizabeth, South Africa.

Nicholas, C. and Awotunde, G. B (2014), *An Evaluation of Risk Events Impacting Highway and Road Construction Projects in Nigeria,*https://www.researchgate.net/publication/265602951

Ola, O.T. (2011). Road and its economics importance to man. *International Journals of Civil Engineers*, 1(1), 69–73.

Olagunju, A., Imeokparia, L., Afolabi, T. S (2014).Budgetary Control: A Tool for Cost Control in Manufacturing Companies in Nigeria. *European Journal of Business and Management,* 6(37), 98-108. ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online).

Olanrewaju, A. &Anahwe, P.J. (2015). Duties and responsibilities of quantity surveyors in the procurement of building services engineering. *Creative Construction Conference,* 1, 267-272.

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.

Onat, N. C., Kucukvar, M. and Tatari, O. (2014). Integrating triple bottom line input–output analysis into life cycle sustainability assessment framework: the case for US buildings. *The International Journal of Life Cycle Assessment*, 19, 1488–1505.

Osipova, E. (2015). Establishing Cooperative Relationships and Joint Risk Management in Construction Projects: Agency Theory Perspective. *Journal of Management in Engineering,* 31(6), https://doi.org/10.1061/(ASCE)ME.1943-5479.0000346.

Ostrowski, S.D. (2013). *Estimating and Cost Planning Using the New Rules of Measurement* John Wiley & Sons, USA.

PMBOK. (2013). A Guide to the Project Management Body of Knowledge, (PMBOK Guide). USA: *Project Management Institute*.

PMBOK. (2017). A Guide to the Project Management Body of Knowledge, (PMBOK Guide). (pp. 266). USA: *Project Management Institute*.

Polit, D.F., Beck, C.T., Hungler, B.P. (2001). *Essentials of Nursing Research: Methods, Appraisal, and Utilisation (5th ed.).* Philadelphia: Lippincott.

Potts, K. &Ankrah, N., (2013). *Construction Cost Management: Learning from Case Studies*. (2nd ed). Abingdon, United Kingdom: Routledge.

Ramabodu, M.S. and Verster, J.J.P. (2010). Factors contributing to cost overruns of construction projects. *Proceeding of the Built Environment Conference*, 5, 131–143.

RathinaKumar, K., Lalitha, P., Prasanna, K.I and Ravekumar, C. (2018). Construction Material Management through Inventory Control Techniques.*International Journal of Engineering &Technology*, 7(3), 899 -903.

Ravi, M.K. (2012). *Taxmann's Cost Management* (4th ed). India: Taxmann.

Salisu, G.D., Hassan, A. K and Abubakar, A. M. (2016). The Fundamentals of Earned Value Management in Construction Projects: Applications and Simulations. *The Nigerian* Institute *of Quantity Surveyors (NIQS) National Training Workshop in Makurdi, Benue State. Conference Theme*, Budget & Capital Project Monitoring and Evaluation in an era of change.

Sanni, A. F. and Hashim, M. (2013). Assessing the challenges of cost control practices in Nigerian construction industry. *Interdisciplinary Journal of ContemporaryResearch in Business*, 4 (9), 367 – 374.

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*, 1-20.

Sharaf, Mahmoud. M. M. and Abdelwahab, H. T. (2015). Analysis of Risk Factors for Highway Construction Projects in Egypt. *Journal of Civil Engineering and Architecture*, 9, 526533, DOI: 10.17265/1934-7359/2015.05.004.

Song, L. (2014). Cost control for small and medium-sized enterprises (SMEs). *Journalof Chemical and Pharmaceutical Research*, 6(5), 409-412.

Steen, M. (2012). *Human-Centred Design as a Fragile Encounter, Design Issues*. 28(1), 72– 80.

Supriadi, L. S. R., Wisesatama, B. and Latief, Y. (2018). Development of work breakdown structure (WBS) dictionary for road construction works. *The 2nd International Conference on Eco Engineering Development,* 195,doi:10.1088/17551315/195/1/012007.

Sylvia, C. O., Musonda, I. and Justus, A. (2018). Value-in-use sustainability factor as a driver for asset management of road transport infrastructure. *CIDB Postgraduate Conference*, 25-27.

Tarek, Z, and Yaqiong, L (2014). Cash flow modelling for construction projects. *Engineering, Construction and Architectural Management*, 21(2), 170-189, https://doi.org/10.1108/ECAM-08-2012-0082.

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,*7, 16, ISSN 2222-1735(Paper) ISSN 2222- 288X (Online).

World Bank, (2013). *Nigeria Economic report May 2013*, available at wwwwds.worldbank.org

Van Marrewijk, A., Veenswijk, M., and Clegg, S. (2014). Changing collaborative practices through cultural interventions. *Journal of Building Construction and*

Planning   Research,   42,   330–342,
https://doi.org/10.1080/09613218.2014.867619.

Waston, J. (2001). *How to Determine Sample Size: Tip sheet #60.* University Park, P. A:
University Cooperative Extension, Pennsylvania State University. Retrieved
from http://www.extension.psu.evaluation/pdf/TS60.pdf on 7/4/2013.

Yakubu, A. D., Adama, A. and Ibrahim, S. (2015). Hypothetical Framework for
Incorporating Land Administrative Paradigm to Enhance Housing Affordability
in Imo state. *International Journal of Administration and Governance*, 1(14),
134-137.

Yakubu, O, and Sun. M. (2014).Construction Project Control in the UK: Current
Practice, Existing Problems and Recommendations for Future Improvement.
InternationalJournal   of   Project   Management.   33(3),   623-697,   *DOI*:
10.1016/j.ijproman.2014.

APPENDICE A

QUESTIONAIRE

<div align="right">

Department of Civil Engineering,

Faculty of Engineering,

Nnamdi Azikiwe University,

P.M.B 5025, Awka, Anambra State.

</div>

Dear Respondent,

PILOT QUESTIONNAIRE ON ASSESSING THE EFFECT OF COST CONTROL TECHNIQUES IN ROAD CONSTRUCTION PROJECT DELIVERY IN OWERRI METROPOLIS, IMO STATE NIGERIA.

My name is IHEANACHO Isaac Uchenna, a student of Department of Civil Engineering, Faculty of Engineering, Nnamdi Azikiwe University Awka, Anambra State conducting a research on the above title.

Please note that all information provided will be used for academic purposes only, therefore do not include your name or telephone number in your response. Your participation in filling of questionnaire will be helpful.

Thank you very much for your support.

IHEANACHO, Isaac Uchenna   .   Engr. B. Njotea

Department of Civil Engineering,   Project Supervisor

Nnamdi Azikiwe University Awka,

 P.M B. 5025,

Awka.

SECTION A: GENERAL INFORMATION ON RESPONDENT

Please tick [√] the correct option or provide information where applicable

1. What is your gender?

(a) **Male**   [   ]   (b) **Female**   [   ]

2. How many years of experience have you had in your organization?

   (a) **Below 5 years.**   [ ]   (b) **5 -10 years.**[ ]

   (c) **10-15 years.**   [ ]   (d) **15 years & above**. [ ]

  3.What is your level of education?

   (a) **HND**.   [ ]   (b) **BSc/BTech**.   [ ]

   (c) **MSc/MTech**.   [ ]   (d) **PhD**.   [ ]

   (e) **Other, please specify**…………………………………

  4.Which of the following best describe your discipline?

   (a) **Quantity Surveyor**.   [ ](b) **Project Manager**. [ ]

   (c) **Civil Engineer**.   [ ] (d)**Other ……………**

  5.Professional Membership?

   (a) **None.**   [ ]   (b) **MNIQS.**   [ ]

   (c) **MNSE**.   [ ]   (d) **Other ……………..**

SECTION B

6.Below is a table containing different cost control techniques, kindly indicate by tick [√]

   the cost control technique(s) used in your organization for road construction project.

S/N	COST CONTROL TECHNIQUE	TICK
1	Earn value management (EVM)	
2	Programme Evaluation and Review Techniques (PERT)	
3	Critical Path Method (CPM),	
4	To-complete performance index (TCPI)	
5	Risk Analysis	
6	Cost value reconciliation (CVR)	

7	Monte Carlo simulation	
8	Whole life costing	
9	Performance reviews and Variance Analysis	
10	Cash Flow Analysis	
11	Valuation of Work in Progress	
12	Budgetary control	
13	Cost Reduction on site	
14	Cost Optimization Techniques	
15	Site Meetings	
16	Record keeping	
17	Cost Planning	
18	Work Programs	
19	Material Management	

With each statement, please indicate by tick [√] based on your view and experience the one that best matches the level of effectiveness of cost control technique, used in road construction projects in your organisation. (Grade on scale 1 to 5, where 5 = Very Effective; 4 = Effective; 3 = Fairly Effective; 2 = Less Effective and 1 = Least Effective).

S/No	Code	Cost Control Technique	1	2	3	4	5	Remark
1	CFA 01	Cash Flow Analysis (CFA)						
2	VWP 02	Valuation of Work in Progress (VWP)						

3	CVR 03	Cost value reconciliation (CVR)						
4	MM 04	Material Management (MM)						
5	CP 05	Cost Planning (CP)						
6	BC 06	Budgetary Control (BC);						

SECTION C: Below are the most effective cost control technique, use in road construction project.

Cash Flow Analysis (CFA);

With each statement, please indicate by tick [√] based on your view and experience the one that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	CFA 01	An estimated income analysis will						

		empower the management to plan and control the financial operations accurately.						
2	CFA 02	CFA assistances measure the profitability and financial position within budget.						
3	CFA 03	It is feasible to show up at real benefit and Loss of the contract as it shows just the cash position						
4	CFA 04	It does not give total image of the financial situation of the project concern.						

Valuation of Work in Progress (VWP);

With each statement, please indicate by tick [√]that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	VWP 01	Its significantly important to obtain an accurate valuation of work in progress.						
2	VWP 02	Performed consistently valuations give a very good measure of how you are undertaking cost comparison.						
3	VWP 03	Did valuation of work in progress provide a perspective on cost control of						

		road construction.						
4	VWP 04	Did valuation of work in progress tracks past work against a profit analysis schedule.						

Cost value reconciliation (CVR);

With each statement, please indicate by tick [√] based on your view and experience the one that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	CVR 01	CVR monitors and measure actual expenditure against budgeted						

		project expenditure.						
2	CVR 02	CFA minimising current overspend.						
3	CVR 03	CFA controlling ongoing overspend.						
4	CVR 04	CFA more accurate management of future project pricing.						

Material Management (MM);

With each statement, please indicate by tick [√ that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	MM 01	MM helps to protect against waste and cost overrun.						
2	MM 02	MM maintain						

		minimum of cost material purchasing.					
3	MM 03	Project controls cost coding structure ought to be set up toward the starting the project to keep away from disarray later on in the project.					
4	MM 04	Did MM ensure smooth production operations on site.					

Cost Planning (CP);

With each statement, please indicate by tick [√] based on your view and experience the one that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	CP 01	Early cost checks guarantee preliminary estimate is more precise.						
2	CP 02	Rational appropriation of expenditure all through the design is accomplished.						
3	CP 03	Cost planning gives essential information on the cost correlation between various projects.						
4	CP 04	Cost planning gives better possibility of contrasting various projects.						

Budgetary Control (BC);

With each statement, please indicate by tick [√ that best matches the degree of its impact. (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	BC 01	BC is helpful in setting targets and achievement of the targets.						
2	BC 02	BC is an effective tool for cost control in road construction.						
3	BC 03	Effective BC results in cost control and cost reduction.						
4	BC 04	BC makes financial planning and control easy.						

SECTION D: Challenges of the cost control techniques used in road construction project.

How do you think the following statements affected the choice of control techniques in road construction project? (Grade on scale 1 to 5, where 5 = Strongly Agreed; 4 = Agreed; 3 = Indifferent; 2 = Disagree and 1 = Strongly Disagreed).

S/No	Code	Survey Statement	1	2	3	4	5	Remark
1	CCCT 01	Lack of reliability in cost management by Project Managers and other road stakeholders like Quantity Surveyors						
2	CCCT 02	Inadequate acquaintance on the utilisation of available tools and technology						
3	CCCT 03	Relinquishment of complicated approaches						
4	CCCT 04	Using outdated Approaches and Perceptions						
5	CCCT 05	Deficiency in financial dedication in projects						

6	CCCT 06	Deficient in PCC procedures and framework appropriate to the enterprise						
7	CCCT 07	Fluctuation in prices of Raw Materials						
8	CCCT 08	Poor Project Site Management.						
9	CCCT 09	Lowest bidding Procurement method						
10	CCCT 10	Wrong method of Cost estimating						
11	CCCT 11	Inappropriate Government Policy						
I	Specify others (if any):							

APPENDIX B

Table 4.1: Years of Experience

Years of Experience	Frequency	Percent
5 -10 years	4	16.
10-15 years	12	48
15 years & above	9	36
Total	**25**	**100**

Table 4.2: Level of Education

Level of Education	Frequency	Percent
HND	0	0
BSc/BTech	3	12
MSc/MTech	22	88
PhD	0	0
Total	**25**	**100**

Table 4.3: Discipline of Respondents

Discipline of the Respondents	Frequency	Percent
Quantity Surveyor	3	12
Project Manager	7	28
Civil Engineer	15	60
Other, please specify	0	0
Total	**25**	**100**

Table 4.4: Professional Membership

Professional Membership	Frequency	Percent
None	0	0
MNIQS	3	12
MNSE	22	88

	Frequency	Percent
Other, please specify	0	0
Total	**25**	**100**

Table 4.5: Cost Control Technique(s) Used in Road Construction Projects.

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 (BC)	3	12
Cost Planning (CP)	3	12
Total	**25**	**100**

Table 4.7: Challenges of the Cost Control Techniques Used in Road Construction Projects

S/No	Challenges of Cost Control Techniques	MIS	Rank	Remark
1	Inadequate acquaintance on the utilisation of available tools and technology	4.36	1st	Agreed
2	Deficiency in financial dedication in projects	4.24	2nd	Agreed
3	Fluctuation in prices of Raw Materials	4.20	3rd	Agreed
4	Lack of reliability in cost management by Project 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 outdated Approaches and Perceptions	3.84	7th	Agreed
8	Inappropriate Government Policy	3.80	8th	Agreed
9	Deficient in PCC procedures and framework appropriate to the enterprise	3.72	9th	Agreed
10	Wrong method of Cost estimating	3.68	10th	Agreed

| 11 | Relinquishment of complicated approaches | 3.64 | 11th | Agreed |

Table 4.8: Effectiveness of Cost Control Technique Used in Road Construction

S/No	Effectiveness of Cost Control Technique Used in Road Construction	MIS	Rank	Remark
1	Cash Flow Analysis (CFA)	4.68	1st	Very Effective
2	Cost Value Reconciliation (CVR)	4.20	2nd	Effective
3	Valuation of Work in Progress (VWP)	3.96	3rd	Effective
4	Material Management (MM)	3.36	4th	Fairly Effective
5	Budgetary Control (BC)	2.80	5th	Fairly Effective
6	Cost Planning (CP)	2.50	6th	Fairly Effective

APPENDICE   C

LIST OF TERMS

1.   **Construction:** In the fields of civil engineering, construction is a process that consists of the building or assembling of infrastructure. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager, design engineer, construction engineer .

2.   **Deliverable:** Deliverable is a term used in project management to describe a tangible or intangible object produced as a result of the project that is intended to be delivered to a customer (either internal or external). A deliverable could be a report, a document, a server upgrade or any other building block of an overall highway project.

3.   **Project management:** this is the discipline of planning, organizing, motivating, and controlling resources to achieve specific goals. A project is a temporary endeavour with a defined beginning and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value.

4.   **Time:** This is a dimension in which events can be ordered from the past through the present into the future, and also the measure of durations of events and the intervals between them.

5.   **Cost:** A cost is the value of money that has been used up to produce, construct/purchase something, and hence is not available for use anymore. In business, the cost may be one of acquisition, in which case the amount of money expended to acquire it is counted as cost.

6.   **Cost overrun:** occurs when the final cost of the project exceeds the original contract value at the time of completion.

7.   **Good cost performance project:** Project in which the cost overrun of the project does not exceed 10 percent of the initial budget.

8.   **Poor cost performance project:** Project in which the cost overrun of the project exceeds 10 percent of the initial budget.

9.   **Mean item score (MIS) or Average**: Sum of the values divided by number of respondents

1O. Project change control (PCC): Project change control protects your project from risks and will ensure it stays on track for delivery even when things change during the projects life cycle.

11. Member National Society of Engineers (MNSE)

12. Member Nigerian Institute of Quantity Surveyors (MNIQS)

13. Cash Flow Analysis (CFA)

14. Cost Value Reconciliation (CVR)