ASSESSMENT OF COST CONTROL TECHNIQUES ON ROAD CONSTRUCTION PROJECT DELIVERY IN FCT ABUJA, NIGERIA

ABSTRACT

In construction industry the aim of project control is to ensure the projects finish on time, within budget and achieving other project objective. The advancement of technology in the last century has contributed to the increase in the number of complex construction projects that require proactive cost management. Cost control is an element of financial control since it supplements managerial control process in the organisation. Cost Management of road construction involves the application of engineering, financial and management practices to optimize the level of service outcome in return for the most cost-effective financial input. This study assessed the various cost control techniques used in road construction projects and its effect on project delivery. in addition, the study, identified the challenges of cost control techniques and examine the effectiveness of cost control technique. The preliminary data for this research was collected through a literature review and structured questionnaire and limited to construction firms. Mean Item Score (MIS) and Pearson correlation analysis were employed for data analysis. The preliminary analysis of data reveals six commonly used cost control techniques which include Cash Flow Analysis, Valuation of work in Progress, Cost Control, Materials Management, Budgetary Control and Cost Value Reconciliation. The findings further indicates that Cash Flow Analysis (CFA) (MIS=4.68) as the most effective cost control technique used in road construction project. Correlation analysis shows that all cost control techniques had strong relationship effect on road construction project delivery. The strength determinant relationship with the variables falls within the range of small, medium and large guidelines (r) value. The study concludes that cost control techniques have strong impact on road construction project delivery and also, 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. It is recommended that Quantity Surveyors should involve in road construction due to the smallest response of 3 giving 12% and construction firms should endeavour to send their employees to attend workshops, seminars and other training programs. This research work has been able to assess cost control techniques used in road construction project and their effectiveness of those techniques.

<center>**CHAPTER ONE**</center>

1.0   **INTRODUCTION**

1.1   **Background to the Study**

The construction Industry is an integral part of most global economies. Appallingly, it is seen as a threatening ambiance that will overall make shareholder who prioritise their interests above all (Holley and Farrow, 2012; Van Marrewijk *et al.,* 2014; Memon *et al.,* 2015; Osipova, 2015; Babic and Rebolj, 2016). 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. Moreover, the construction industry is dependent on different types of input such as human capital, financing and products from other industries (Murendeni and Clinton, 2018). Construction industry to a great extent is saddled with responsibility of the physical development and restructuring of the environment which make the built environment as a subset and most important to socio-economic development. Ling and Ang (2013); Aljohani *et al.* (2017) explained that, the project-oriented nature of the construction industry makes it unique and different from other business organisations due to its multi-faceted, complicated nature and the level of uncertainty it faces, an oversight in this view has only led to a higher-than-average failure rate compared to other businesses.

According to Aliu (2014), the built environment involves of Building, Civil and Heavy Engineering works. The construction industry has impact on the environment, economy, and society, explained by (Kucukvar and Tatari, 2013; Onat *et al.,* 2014). The construction industry is one of the most active sectors propelling the Nigerian economy (World Bank, 2013). It is so vital to the nation's economic development which is why it produces nearly 71% of the country's fixed capital formation and accounts for 1.4% of the nation's Gross Domestic Product (GDP) (World Bank, 2013). The construction sector is very important to the economy of any country.

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Nigerian economy is one of the ten fastest growing economies in the world and among the six fastest in Africa stated by (World Bank, 2013). The construction project can vary from extremely profitable to barely worth it and sometimes end up costing the contractor more than what he or she is getting paid to complete it. In construction organisation, the goal of project control is to ensure the projects finish on time, within budget and achieving other project activities. The construction industry has developed throughout the years with experiences from different countries that have experienced down and up periods in the construction related activities. According to Sanni and Hashim (2013) the advancement of technology in the last century has contributed to the increase in the number of complex construction projects that require proactive management. Sanni and Hashim (2013); Adjei *et al*. (2015) presumed that "cost control is a component of financial control since it complements administrative control measure in the organisation". Cost control ought to be viewed as a significant management instrument that remains essential to the endurance of a development company. According to Adjei *et al*. (2018), cost control practice is a process whereby the cost of the construction project is monitored, evaluated and compares the planned budgeted cost with the actual site cost for decisions to be made to bring the cost on track. The need to control cost is significant to wipe out the superfluous wastages of resources. It remains fundamental for the construction company to work a successful cost control technique throughout the implementation phase of project to retain the cost of the plan inside the construction preliminary estimates.

Many projects start with good ideas, huge investments and great efforts. However, most of them do not achieve much success. The fundamental aims of the construction industry which are to deliver project within scheduled time, acceptable cost, specified quality and safety of stakeholders have focused on the requirement for cost control that is viable. Clients practically in construction project are keen on getting fully utilitarian facilities finished in time, quality, cost and scope. A project is able to construct within the estimated time and budget, to the right

standards and scope is an excellent builder as stated by Opatunji (2018). 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. Construction work cost control remains part of the problematic undertakings in the present project cost management confronted by utmost construction company and have not completely made the most of its advantages. The practice of cost control is a required task for the survival and growth of every construction firm. The preparation of cost control helps construction industry to eliminate and/or reduce unnecessary wastage of resources in the execution of construction projects (Adjei *et al*., 2017; Bahaudin *et al*., 2012). Cost control is the process of monitoring; evaluating and comparing planned results with actual results to determine the status of the cost of the project, schedule and technical performance objectives of the project. According to Adjei *et al*. (2017); Adjei et al. (2015); Sanni and Hashim (2013) It is therefore important that, every construction company operates in an effective way by practicing cost control procedure during the post construction stage of the construction project, to keep the cost of executing the project within the budgeted cost as initially prepared and approved. When construction work begins, the budgeted cost of the construction project serves as the baseline for the contractor or whoever is undertaking cost control to use it to check and control the construction costs, explained by (Bahaudin *et al*., 2012).

The cost control principles are also expected to act as telltale or offer early warning system, notifications of possible budget difficulties at predetermined periods for corrective measures to be decided to solve the cost variances. Opatunji (2018) establish the cost control techniques used among construction Practitioners such as Budgetary control, Cash flow analysis, Earned value management, Cost reduction on site, Material management, Risk analysis, Cost planning, Work programmes, Valuation of work in progress few among others. In the opinion of Adjei *et al.* (2017) and Khamidi *et al.* (2011) the project Quantity Surveyor or the Cost Engineer

needs to apply the cost control techniques to develop a series of options for the other project members to consider and select one of the best options that fit within the approved budget limit. There exist high numbers of projects that fail to meet critical success factors like cost, quality and time over the years (Hamed *et al.,* 2015). Both private and public sectors in the construction industry have lost substantial amounts of money as a result of failed projects in cost, quality and time.

In the construction industry, very little study has been conducted on the challenges of cost control in any of construction organisation. Researchers such as Adjei *et al*. (2017); identified challenges of Cost Control Practice in the construction organisation with exceptionally limited literature review and Kirun and Varghese (2015); a literature review was carried out to identify major problems, the techniques used for identify the problem is Delphi techniques. In request to address this problem, this study is intended to assess the effect of cost control techniques used in road construction projects.

1.2 Statement of the Research Problem

Probably no business needs an effective cost control techniques more than road construction industry. Because road construction companies operate on such a small profit margin due to winning contracts have undoubtedly become fiercer; cost control cannot be overemphasized. On this note, cost management of road construction involves the application of engineering, financial and management practices to optimize the level of service outcome in return for the most cost-effective financial input (Malkoc, 2017). Opatunji (2018) carried out evaluation cost control techniques used in Nigeria but this research was emphasis on construction of building and the data collected was limited to Quantity Surveyors in Oyo state. Ahmad *et al*. (2012) conducted a research on assessment of practices in Malaysia, the research identified the cost control methods and procedures that construction practitioners in Malaysia are utilised.

Cooray *et al.* (2018) also evaluate the cost control techniques used on building construction projects in Sri Lanka, the research analysed the effect of cost control techniques identified with project delivery regarding the s building construction industry in Maldives. Adjei *et al.* (2017) the challenges of cost control practice in the construction sector, the research identified current challenges of project cost control practice in the construction firm. According to Anyanwu (2013) on project cost control in the Nigerian construction firm; the overall purpose of cost control and the management is to make sure that scant resources are used to the optimum advantages of the main parties to a construction contract.

It is born out of deficiencies in appropriate prediction of cost control techniques used in road construction project. The complexities and foreseen of most element of works in road construction project cannot overemphasise. This study therefore used the idea that, cost control techniques have become a predominant factor to be considered in the road construction projects because of ineffective cost and time control during the execution stage. The research would therefore, increase awareness amongst the construction firm.

1.3 Research Question

i.   What are the cost control techniques utilised in road construction project?

ii.   What are the challenges of cost control techniques utilised in road construction projects?

iii.   What is the effectiveness of cost control technique, utilised in road construction project?

iv.   What is the relationship between cost control techniques and road construction project delivery?

1.4 Aim and Objective of the Study

This study aimed at assessing the effect of cost control techniques used in road construction projects with a view to improve project delivery.

Considering the aim, the study addresses the following objectives:

i.   To identify cost control techniques used in road construction projects.

ii. To examine the challenges of cost control techniques used in road construction projects.

iii. To measure the effectiveness of cost control technique, used in road construction projects.

iv. To analyse relationship between cost control techniques and road construction project delivery.

1.5 Justification for the Study

In order to justify the gap of this study, the contributions of the following researchers cannot be overemphasised. Ahmad *et al.* (2012) identified the cost control methods and procedures utilised by the construction practitioners in Malaysia. Cooray *et al.* (2018) considered analysis of cost control techniques used on building construction projects and the research analysed the impact of cost control methods related to project delivery with respect to the building construction industry in Maldives. In another study, Adjei *et al*. (2017) noted the challenges of cost control practice in the construction industry, and identified the current challenges of project cost control practice in the construction industry. Anyanwu (2013) researched on the project cost control in the Nigerian construction industry, the overall aim of cost control and management is to make sure that scarce resources are utilized to the optimum benefits of the main parties to a construction contract. In another study, Opatunji (2018) evaluated cost control techniques used in Nigeria but the research focused on construction of building and the data collected was limited to Quantity Surveyors in Oyo state. In another investigation, Ayodele

and Alabi (2014) explored on the impact of cost control on building projects delivery in Nigeria. Kirun and Varghese (2015) researched the issue of project cost control in building projects and to comprehend the purposes for cost overrun; the utilization of Delphi method is to recognize the issues in controlling the project cost, recommend solutions for overcome these problems, and identifies lessons learned.

None of the previous researchers had evaluated and analysed the cost control techniques including the effect on road construction project delivery. Most of the literatures have documented failures in construction projects (Building). Thus, cost control techniques have become a dominant factor to be considered in the road construction projects due to unsuccessful cost and time control during the implementation stage. This study will however fill the gap by assessment of cost control techniques on road construction project delivery. The outcome of this research work would therefore, be beneficial to construction firm as their main aim is to minimize cost.

1.6 Scope of the study

The research concentrated on Quantity Surveyors/Cost Engineers/Civil Engineers working with construction firms. This study excludes the cost control techniques practised by contractors in the pre-construction, construction and post construction stage. It also excluded cost control procedures related to the accounting and financial management of the company. The project parties studied was civil engineering contractor involve in road construction.

The project parties examined was construction firms. involve in road construction. The research addressed road construction projects in Abuja-FCT only, Nigeria.

The study used construction firms that are registered with the Corporate Affairs Commission and the Federation of Construction Industry in Nigeria, also involved in road construction

works. Perversely only contractors of category "A" and "B" under the classification of contractors by The Bureau of Public Procurement (BPP) form the sampling frame, as only larger companies are financially capable of using any effective cost control techniques and also only highway road type was focused in which includes any public roads.

<div align="center">**CHAPTER TWO**</div>

2.0   **LITERATURE REVIEW**

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. 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**

The Organisation for Economic Co-operation and Development (OECD) describe a road as a line of communication using a steadied base other than air strip rail opens to public traffic, mainly for the use of road motor vehicles running on their own wheels which includes supportive structure, junctions, bridges, tunnels, crossings, interchanges, and toll road. Need for investment of road infrastructure and other public goods 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 The Evolving Roles of Professional Quantity Surveyor in Road Construction

The construction industry comprises of many stakeholders such as clients, design professional, construction professionals, and operational teams. The major professionals in the industry in terms of their initial contact with the client and involvement with the design and construction stages of the construction projects includes engineers (notably civil, electrical and mechanical), building engineers, quantity surveyors or cost estimators and architects. The civil engineers are concerned with public constructions like roads, dams, quays, shipyards, and bridges (Olanrewaju and Anahwe, 2015). The RICS (1971) emphasized that the distinctive

competencies or skills of the quantity surveyor (QS) are associated with measurement and valuation which provide the basis for the proper cost management of the construction project in the context of forecasting, analysing, planning, controlling and accounting (Dada and Jagboro, 2012). A quantity surveyor is a professional in the road construction who has the ability to analyse both cost components and practical physical construction works of a project in a successful way so as to be able to apply the results of his analysis in solving problems peculiar to each project (Timothy and Amos, 2016). Quantity surveyors are involved in various types of construction including mining, petrochemical plants and refineries construction and installations (Olanrewaju and Anahwe, 2015). The traditional role of QS on road construction mainly concerns cost management such as cost estimation, the advice at design stage, cost control, valuations, variations and final accounts.

2.4 Cost Management

2.4.1. Definition

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.

Professional Quantity Surveyor (PQS) are typically welcomed on board from project commencement through to settlement of conclusive accounts. PQS for the most part shift their expense related errands and responsibilities all through the project life span. A project's life cycle includes a few stages from project inception, to plan and design development, construction, and eventually handover of the completed work. Table 2.1: synopsises the centre objectives at each stage proposed by the Royal Institute of British Architects (RIBA).

Table 2.1 Core objectives by project stages

Design/Stage	Sequence	Core objectives
Phase/Stage 0	Strategic definition	Recognize owner's business case, key brief, and some other centre project prerequisites
Phase/Stage 1	Preparation and brief	Create project aims (e.g., project results, value and feasibility potentials, project spending plan, and different parameters); prepare beginning undertaking brief, viability studies, and site condition overview
Phase/Stage 2	Concept design	Prepare concept design; concede to modifications to educate and give final project brief; layout details and preliminary cost information alongside relevant project techniques according to design programme; issue last project brief
Phase/Stage 3	Advanced design	Get ready developed design; layout specifications, cost data, and project procedures as per design programme
Phase/Stage 4	Practical design	Get ready technical design as per design responsibility and project procedures to incorporate entirely engineering and services information, expert subcontractor design and details, according to design programme
Phase/Stage 5	Implementation	Off-site manufacturing and on-site construction in accordance with construction programme and resolution of design queries from site as they arise
Phase/Stage 6	Completion and Handover	Handover of building and conclusion of building contract
Phase/Stage 7	In use	Undertake in use services in accordance with schedule of services

Source: Adapted from Sinclair, 2013

Nearly all project phases cost management is taken on, at the same time as its activities can vary extensively. Drawing upon the pertinent descriptions drafted by the RIBA and the RICS, the life span of any cost management begins before expected time as cost estimate in the preparation stage, cost plan in the design stage, planning tendering documents, cost control all through the development stage, and post-tender estimate until the construction project achieves. Figure 2.1 further elaborates QS duties by following Plan of Work.

2.4.2 Cost planning

As a process, cost planning is difficult to define concisely. This difficulty exists because the cost planning process involves a diversity of procedures and techniques that are used simultaneously by the quantity surveyor (QS) or construction economist (Boussabaine, 2013). 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. Quantity surveyors (QSs) understand what items are of cost significance; where short cuts can be taken, and where detailed and long-drawn-out cost checks can be avoided.

2.4.3 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.* (2018) defines prevalent functional activities in road construction as the terminology used to portray components of roads. Ola (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, subgrade, 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 create through beginning or reasonable stages into bare essential, last, or convincing estimates, contingent upon the proportion of data known when the estimate is prepared. 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.   Selection from alternate investment

v.   Appropriation of funds

vi.   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.

2.4.4 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. It is a vital pre requisite to control but it is a tool needed by control rather than a substitute for it. 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.

2.5. Cost Control Techniques

The primary responsibility of project management is to control the cost of the project, time, performance and quality goals. Cost management is a one of the important tasks which drives project to a successful completion. This includes resource planning, cost budgeting, cost estimating and cost control. This cost management process can be enhanced through different software's, tools and techniques in order to control the costs. According to 'Project Management Book of Knowledge (PMBOK)' there are few techniques which would be useful 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 reduced 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); Burke (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),

    i.   Programme Evaluation and Review Techniques (PERT)

    ii.   Critical Path Method (CPM),

    iii.   To-Complete Performance Index (TCPI)

    iv.   Risk Analysis

    v.   Cost Value Reconciliation (CVR)

    vi.   Monte Carlo simulation

    vii.   Whole life costing

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).

2.5.1 Earn value management (EVM)

2.5.1.1 The evolving of EVM

Earned Value Management (EVM) is one of the most widely used techniques worldwide with which to assess a project's performance during its execution. Its application in project management has extended to important institutions like the National Aeronautics and Space Administration (NASA). 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.

2.5.2 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.

2.5.3 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.

2.5.4 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.

2.5.5 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.

2.5.6 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).

2.5.7 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).

2.5.8 Cash flow analysis

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.

2.5.9 Material management

RathinaKumar, *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.

2.6. 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, Quantity Surveyors and other stakeholders) and, finally, to the actual construction of the road by the contractor. 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

   v.   Postconstruction delivery phase

2.7. Challenges of Cost Control Techniques

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

2.7.1 Lack of reliability in cost management by project managers/project quantity surveyor

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).

2.7.2 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).

2.7.3 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).

2.7.4 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.

2.7.5 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).

2.7.6 Deficient PCC procedures and framework appropriate to the enterprise

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.

2.8. Other Challenges

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

v.   Wrong method of Cost estimating

vi.   Duration of the project

CHAPTER THREE

3.0　　　　　RESEARCH METHODOLOGY

3.1　　Research Design

Steen (2012) defined research design as a highly contextual and a key principle of a human cantered design process by involving users in one or many parts of the design process. Research design is a technique by which data can be collected and analysed in a way that combine aims can be achieved (Kothari, 2011). In fact, the research design is concept within which research is based; it includes collection of data, measurement and analysis of data. Designers have 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 examine various 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 may have on them. 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 the researcher and to whom the research results can be generalised.

The target population for this study comprised of Thirty (30) construction firms in Abuja 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 Abuja registered with and contained in the list of contractors complied by FOCI Nigeria.

3.3.1 Sampling technique

The processes the researcher uses when choosing his items from the sample, it consists of the of element that will form part of sample this mean that the sample size, sampling techniques before collection of data (Kothris, 2011). For the purpose of this research, the researcher identified the cost control techniques used on road construction works among the cost control techniques identified through literature review, this was carried out be allocation of pilot questionnaire to the construction firms. Watson (2001) makes justification by reporting that in a population of two hundred (200) or less, it is recommended that the census of everyone be carried out. But with large data population, sampling techniques is therefore recommended.

3.4 Method of Data Collection

Data as a set of values of qualitative or quantitative variables. Data is facts or figures from which conclusions can be drawn. Data collection plays a very crucial role in the statistical analysis. In research, there are different methods used to gather information, all of which fall into two categories, for example primary and secondary data (Douglas, 2015). 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) with the aid of SPSS statistical package. 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

Table 3.1: Procedures for analysing the research objectives

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
4	To analyse effect of cost control techniques on road construction project delivery.	Data Proforma Table	Correlation

Source: Researcher's, 2019

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 Points			Interpretations	
	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

Source: Shittu et al. (2015)

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.

$$\text{MIS} = \frac{\Sigma\, W}{N} \qquad\qquad (3.1)$$

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

3.5.3 Coefficient of correlation (r)

The decision rule here states that:

  i.   If r -1 or +1 this determines the direction of the relationship
 ii.   The strength of the relationship ranges from –1.00 to 1.00
iii.   A correlation of 0 indicates no relationship
 iv.   A correlation of 1.0 indicates a perfect positive correlation
  v.   A value of–1.0 indicates a perfect negative correlation

Suggestion guidelines range:

  i.   Small **r** =.10 to .29
 ii.   Medium **r** =.30 to .49
iii.   Large **r** =.50 to 1.0

CHAPTER FOUR

4.0   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 FCT Abuja, 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) with the aid of SPSS statistical package.

4.2   Demographic Information

Out of the 30 questionnaires administered to contractors in Abuja, 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**

Source: Researcher's Data Analysis (2020)

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**

Source: Researcher's Data Analysis (2020)

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**

Source: Researcher's Data Analysis (2020)

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**

Source: Researcher's Data Analysis (2020)

4.3   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**

Source: Researcher's Data Analysis (2020)

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/Project Quantity Surveyor ranked fourth (4th) with a mean score of 4.16, lowest bidding procurement method with a mean score of 4.12 ranked fifth (5th) while poor project site management was on the sixth (6th) rank with a mean score of 3.88.

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

Source: Researcher's Data Analysis (2020)

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

Source: Researcher's Data Analysis (2020)

4.6 Relationship Between Cost Control Techniques and Road Construction Project Delivery

4.6.1 Correlations between cash flow analysis (CFA) and valuation of work in progress (VWP)

Table 4.8 presents the correlation between cash flow analysis and valuation of work in progress with a view of effect on road construction project delivery. The Pearson Rank Order correlation (r) between "An estimated income analysis will empower the management to plan and control the financial operations accurately'' and "Its significantly important to obtain an accurate valuation of work in progress" is 0.147 at $P < 0.01$ significant. This signifies that "An estimated income analysis will empower the management to plan and control the financial operations accurately'' is positively related to "Its significantly important to obtain an accurate valuation of work in progress", with strong strength relationship. The coefficient of determination is 2% of the shared variance. Also, the Pearson Rank Order correlation (r) between "CFA assistances measure the profitability and financial position within budget" and "Performed consistently valuations give a very good measure of how you are undertaking cost comparison" is 0.217 at $P < 0.01$ significant. This means that "CFA assistances measure the profitability and financial position within budget" and "Performed consistently valuations give a very good measure of

how you are undertaking cost comparison" are strong positive relationship with coefficient of determination of 4.71 % of the shared variance.

The relationship between "It is feasible to show up at real benefit and Loss of the contract as it shows just the cash position" and "Did valuation of work in progress   provide a perspective on cost control of road construction" shows that Pearson Rank Order relationship (r) is 0.475 at P < 0.01 critical. This means that between "It is feasible to show up at real benefit and Loss of the contract as it shows just the cash position" and "Did valuation of work in progress provide a perspective on cost control of road construction" are strongly related. The coefficient of determination is 22.56 % of the shared variance. Also, the Pearson Rank Order correlation (r) between "CFA does not give total image of the financial situation of the project concern" and "Did valuation of work in progress tracks past work against a profit

analysis schedule" is 0.280 at P < 0.01 significant. This means that "CFA does not give total image of the financial situation of the project concern" and "Did valuation of work in progress tracks past work against a profit analysis schedule" are strong positive relationship with coefficient of determination of 7.84 % of the shared variance.

Table 4.8: Correlations between cash flow analysis (CFA) and valuation of work in progress (VWP)

		CFA 01	VWP 01	CFA 02	VWP 02	CFA 03	VWP 03	CFA 04	VWP 04
CFA 01	Pearson Correlation	1							
VWP 01	Pearson Correlation	.147	1						
CFA 02	Pearson Correlation	.332	.026	1					
VWP 02	Pearson Correlation	.201	.209	.217	1				
CFA 03	Pearson Correlation	.525	-.075	.268	.143	1			
VWP 03	Pearson Correlation	.505	.074	-.021	.170	.475	1		
CFA 04	Pearson Correlation	-.099	-.191	.093	.090	-.298	-.013	1	
VWP 04	Pearson Correlation	.462	.181	.471	-.127	.176	.465	.280	1

Correlation is significant at the 0.01 level (2-tailed).
Source: Researcher's Data Analysis (2020)

4.6.2 Correlations between cost value reconciliation (CVR) and material management (MM)

Table 4.9 presents the correlation between cost value reconciliation and material management with a view of effect on road construction project delivery. The Pearson Rank Order correlation (r) between "CVR monitors and measure actual expenditure against budgeted project expenditure'' and "MM helps to protect against waste and cost overrun" is 0. 131 at $P < 0.01$ significant. This signifies that "CVR monitors and measure actual expenditure against budgeted project expenditure'' is positively related to "MM helps to protect against waste and cost overrun", with strong strength relationship. The coefficient of determination is 1.72 % of the shared variance. Also, the Pearson Rank Order correlation (r) between "CVR minimising current overspend." and "MM maintain minimum of cost material purchasing" is 0.044 at $P < 0.01$ significant. This means that "CVR minimising current overspend" and "MM maintain minimum of cost material purchasing" are strong positive relationship with coefficient of determination of 0.1936 % of the shared variance.

The relationship between "CVR controlling ongoing overspend" and "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" shows that Pearson Rank Order relationship (r) is 0.209 at $P < 0.01$ critical. This means that between "CVR controlling ongoing overspend" and "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" are strongly related. The coefficient of determination is 4.37 % of the shared variance. Also, the Pearson Rank Order correlation (r) between "CVR more accurate management of future project pricing" and "Did MM ensure smooth production operations on site" is 0.143 at $P < 0.01$ significant. This means that "CVR more accurate management of future project pricing" and "Did MM ensure smooth production operations on site" are strong positive relationship with coefficient of determination of 2.50 % of the shared variance.

Table 4.9: Correlations between cost value reconciliation (CVR) and material management (MM)

		CVR 01	MM 01	CVR 02	MM 02	CVR 03	MM 03	CVR 04	MM 04
CVR 01	Pearson Correlation	1							
MM 01	Pearson Correlation	.131	1						
CVR 02	Pearson Correlation	.576	-.181	1					
MM 02	Pearson Correlation	.477	.558	.044	1				
CVR 03	Pearson Correlation	.518	.058	.803	.184	1			
MM 03	Pearson Correlation	.038	.191	.229	.386	.209	1		
CVR 04	Pearson Correlation	.329	.488	.006	.682	.095	.426	1	
MM 04	Pearson Correlation	.294	.167	.190	.014	.162	.256	.143	1

Correlation is significant at the 0.01 level (2-tailed).
Source: Researcher's Data Analysis (2020)

4..6.3 Correlations between budgetary control (BC) and cost planning (CP)

Table 4.10 presents the correlation between budgetary control and cost planning with a view of effect on road construction project delivery. The relationship between "BC is helpful in setting targets and achievement of the targets" and "Early cost checks guarantee preliminary estimate is more precise" shows that Pearson Rank Order relationship (r) is 0.270 at P < 0.01 critical. This means that between "BC is helpful in setting targets and achievement of the targets" and "Early cost checks guarantee preliminary estimate is more precise" are strongly related. The coefficient of determination is 7.29 % of the shared variance.

Also, the Pearson Rank Order correlation (r) between "BC is an effective tool for cost control in road construction" and "Rational appropriation of expenditure all through the design is accomplished" is 0.636 at P < 0.01 significant. This means that "BC is an effective tool for cost control in road construction" and "Rational appropriation of expenditure all through the design is accomplished" are strong positive relationship with coefficient of determination of 40.45% of the shared variance.

The Pearson Rank Order correlation (r) between "Effective BC results in cost control and cost reduction'' and "Cost planning gives essential information on the cost correlation between various projects" is -0.053 at P < 0.01 significant. This signifies that "Effective BC results in cost control and cost reduction' is negatively related to "Cost planning gives essential information on the cost correlation between various projects", with strong strength relationship. The coefficient of determination is 0.28 % of the shared variance.

Also, the Pearson Rank Order correlation (r) between "BC makes financial planning and control easy" and "Cost planning gives better possibility of contrasting various projects" is 0.701 at P < 0.01 significant. This means that "BC makes financial planning and control easy" and "Cost planning gives better possibility of contrasting various projects" are strong positive relationship with coefficient of determination of 49 % of the shared variance.

Table 4.10: Correlations between budgetary control (BC) and cost planning (CP)

		BC 01	CP 01	BC 02	CP 02	BC 03	CP 03	BC 04	CP 04
BC 01	Pearson Correlation	1							
CP 01	Pearson Correlation	.270	1						
BC 02	Pearson Correlation	.538	.511	1					
CP 02	Pearson Correlation	.440	.633	.636	1				
BC 03	Pearson Correlation	-.073	.193	.043	.014	1			
CP 03	Pearson Correlation	.153	.145	.506	.243	-.053	1		
BC 04:	Pearson Correlation	.530	.298	.597	.305	-.104	.388	1	
CP 04:	Pearson Correlation	.303	.241	.336	.181	.261	.567	.701	1

Correlation is significant at the 0.01 level (2-tailed).
Source: Researcher's Data Analysis (2020)

4.7 Summary of the Pearson Correlation Results

The summary of Correlation analysis was presented in Table 4.11. It shows that all cost control techniques had strong relationship effect on road construction project delivery. The determining the strength of the relationship with the variables falls within the range of minor, average and major guidelines (r) value. As per Suri and Verma (2010), the moderate relationship attained among the things was because of a strong internal consistency measurement portrayed by the research. Therefore, strong correlation portrays by the minor, average and major range guidelines (r) value strengthen the reliability test acquired in this investigation.

Table 4.11: Summary of the Pearson Correlation Results

Variable	Item	Correlation(r) (Strength of the Relationship)
Cash Flow Analysis (CFA)	An estimated income analysis will empower the management to plan and control the financial operations accurately	Strong (Small)
	CFA assistances measure the profitability and financial position within budget.	Strong (Small)
	It is feasible to show up at real benefit and Loss of the contract as it shows just the cash position	Strong (medium)
	It does not give total image of the financial situation of the project concern	Strong (Small)
Valuation of Work in Progress (VWP)	Its significantly important to obtain an accurate valuation of work in progress.	Strong (Small)
	Performed consistently valuations give a very good measure of how you are undertaking cost comparison	Strong (Small)
	Did valuation of work in progress provide a perspective on cost control of road construction.	Strong (medium)
	Did valuation of work in progress tracks past work against a profit analysis schedule	Strong (Small)
Cost value reconciliation (CVR)	CVR monitors and measure actual expenditure against budgeted project expenditure.	Strong (Small)
	CVR minimising current overspend.	Strong (Small)
	CVR controlling ongoing overspend.	Strong (Small)
	CVR more accurate management of future project pricing	Strong (Small)
Material Management (MM)	MM helps to protect against waste and cost overrun.	Strong (Small)
	MM maintain mi*nimum of cost material purchasing.	Strong (Small)
	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	Strong (Small)
	Did MM ensure smooth production operations on site.	Strong (Small)

Source: Researcher's Data Analysis (2020)

Table 4.11: Summary of the Pearson Correlation Results (Contn'd)

Variable	Item	Correlation(r) (Strength of the Relationship)
Cost Planning (CP)	Early cost checks guarantee preliminary estimate is more precise	Strong (Small)
	Rational appropriation of expenditure all through the design is accomplished	Strong (large)
	Cost planning gives essential information on the cost correlation between various projects	Strong (Small)
	Cost planning gives better possibility of contrasting various projects	Strong (Major)
Budgetary Control (BC)	BC is helpful in setting targets and achievement of the targets	Strong (Small)
	BC is an effective tool for cost control in road construction	Strong (large)
	Effective BC results in cost control and cost reduction.	Strong (large)
	BC makes financial planning and control easy.	Strong (large)

Source: Researcher's Data Analysis (2020)

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 Abuja. The retrieved data was analysed with the aid of descriptive statistics. The following are the discoveries made from the analysis carried out from the study:

i.   The 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.

iv. There was a strong, positive, negative and significant relationship between the cost control techniques with a view of effect on road construction project delivery.

CHAPTER FIVE

5.0   **CONCLUSION AND RECOMMENDATIONS**

5.1   Conclusion

From the study, the cost control techniques investigated, only 6(six) out of 19(nineteen) are used on average in the road construction project in Abuja, Nigeria. Few Quantity Surveyors (Cost Managers) are engaged with the critical cost management of road construction projects unlike building 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 affect 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 (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.   Quantity surveyors should involve in road construction due to the area of their discipline as cost expertise which they have better attitude towards using these techniques.

   ii. The cost manager, (for example the quantity surveyor trained explicitly for the 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.

iv. This will refresh and widen the necessary knowledge for controlling cost of their project.

5.3 Contribution to Knowledge

i. This research work has been able to assessed and identify the cost control techniques used in road construction project and their effectiveness of those techniques 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.

ii. Also, this research work examined the various challenges of cost control techniques and analysis the effect of 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.

iii. The outcome of this research work will be beneficial to quantity surveyors and road project managers 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 Abuja metropolis, 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 also analyzed which can serve as an area for further research.

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APPENDICES

APPENDIX A

QUESTIONAIRE

Department of Quantity Surveying,

School of Environmental Technology,

Federal University of Technology,

P.M.B. 65, Minna, Niger State.

Dear Respondent,

PILOT QUESTIONNAIRE ON ASSESSMENT OF COST CONTROL TECHNIQUES ON ROAD CONSTRUCTION PROJECT DELIVERY IN FCT ABUJA, NIGERIA.

My name is ALABI, Sunday Stephen, a Master student of Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology Minna, Niger 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.

If you have questions or observations at any time about the survey or procedures, please do not hesitate to contact me on: **0803-340-9254**, or my e-mail: alabisunday86@yahoo.com.

Thank you very much for your support.

ALABI, Sunday Stephen   .   Dr. M. O. Anifowose.

Department of Quantity Surveying,   Project Supervisor

Federal University of Technology Minna,

P.M B. 65, Minna.

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 these following best describe your discipline?

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

    (c) **Civil Engineer**.   [ ]   (d)   **Other,**   **please**

    specify………………………

5. Professional Membership?

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

    (c) **MNSE**.   [ ]   (d)   **Other,**   **please**

    specify………………………

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	

Thank you for the cooperation

APPENDIX B

QUESTIONAIRE

Department of Quantity Surveying,

School of Environmental Technology,

Federal University of Technology,

P.M.B. 65, Minna, Niger State.

Dear Respondent,

QUESTIONNAIRE ON ASSESSMENT OF COST CONTROL TECHNIQUES ON ROAD CONSTRUCTION PROJECT DELIVERY IN FCT ABUJA, NIGERIA.

My name is ALABI, Sunday Stephen, a Master student of Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology Minna, Niger 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.

If you have questions or observations at any time about the survey or procedures, please do not hesitate to contact me on: **0803-340-9254**, or my e-mail: alabisunday86@yahoo.com.

Thank you very much for your support.

ALABI, Sunday Stephen   .   Dr. M. O. Anifowose.

Department of Quantity Surveying,   Project Supervisor

Federal University of Technology Minna,

P.M B. 65, Minna.

SECTION A: GENERAL INFORMATION OF THE 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 these following bests describe your discipline?

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

   (c) **Civil Engineer**.   [ ]   (d)   **Other,   please**

   specify………………………

5. Professional Membership?

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

   (c) **MNSE**.   [ ]   (d)   **Other,   please**

   specify……………………….

SECTION B: Effectiveness of cost control technique, used in road construction projects.

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
6	CFA 01	Cash Flow Analysis (CFA)						
7	VWP 02	Valuation of Work in Progress (VWP)						
8	CVR 03	Cost value reconciliation (CVR)						
9	MM 04	Material Management (MM)						
10	CP 05	Cost Planning (CP)						
11	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
12	CFA 01	An estimated income analysis will empower the management to plan and control the financial operations accurately.						
13	CFA 02	CFA assistances measure the profitability and financial position within budget.						
14	CFA 03	It is feasible to show up at real benefit and Loss of the contract as it shows just the cash position						
15	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 [√] 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
16	VWP 01	Its significantly important to obtain an accurate valuation of work in progress.						
17	VWP 02	Performed consistently valuations give a very good measure of how you are undertaking cost comparison.						
18	VWP 03	Did valuation of work in progress provide a perspective on cost control of road construction.						
19	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
20	CVR 01	CVR monitors and measure actual expenditure against budgeted project expenditure.						
21	CVR 02	CFA minimising current overspend.						
22	CVR 03	CFA controlling ongoing overspend.						
23	CVR 04	CFA more accurate management of future project pricing.						

Material Management (MM);

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
24	MM 01	MM helps to protect against waste and cost overrun.						
25	MM 02	MM maintain minimum of cost material purchasing.						
26	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.						
27	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
28	CP 01	Early cost checks guarantee preliminary estimate is more precise.						
29	CP 02	Rational appropriation of expenditure all through the design is accomplished.						
30	CP 03	Cost planning gives essential information on the cost correlation between various projects.						
31	CP 04	Cost planning gives better possibility of contrasting various projects.						

Budgetary Control (BC);

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
32	BC 01	BC is helpful in setting targets and achievement of the targets.						
33	BC 02	BC is an effective tool for cost control in road construction.						
34	BC 03	Effective BC results in cost control and cost reduction.						
35	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
36	CCCT 01	Lack of reliability in cost management by Project Managers/Project Quantity Surveyor						
37	CCCT 02	Inadequate acquaintance on the utilisation of available tools and technology						
38	CCCT 03	Relinquishment of complicated approaches						
39	CCCT 04	Using outdated Approaches and Perceptions						
40	CCCT 05	Deficiency in financial dedication in projects						
31	CCCT 06	Deficient in PCC procedures and framework appropriate to the enterprise						
32	CCCT 07	Fluctuation in prices of Raw Materials						
33	CCCT 08	Poor Project Site Management.						
34	CCCT 09	Lowest bidding Procurement method						

35	CCCT 10	Wrong method of Cost estimating						
36	CCCT 11	Inappropriate Government Policy						
I. II. III	Specify others (if any):							

Thank you for the cooperation

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
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

Table 4.9: Correlations between Cash Flow Analysis (CFA) and Valuation of Work in Progress (VWP)

		CFA 01: - A projected cash flow analysis will enable the management to plan and control the financial operations properly	VWP 01: - Its significantly important to obtain an accurate valuation of work in progress	CFA 02: - CFA helps measure the profitability and financial position within budget	VWP 02: - Performed regularly, valuations provide a pretty good measure of how you're doing cost comparison	CFA 03: - It is possible to arrive at actual profit & Loss of the contract as it shows only the cash position	VWP 03: - Did valuation of work in progress provide a perspective on cost control of road construction	CFA 04: - It does not give complete picture of the financial position of the project concern	VWP 04: - Did valuation of work in progress tracks past work against a profit analysis schedule
CFA 01: - A projected cash flow analysis will enable the management to plan and control the financial operations properly	Pearson Correlation	1	.147	.332	.201	.525	.505	-.099	.462
	Sig. (2-tailed)		.484	.104	.334	.007	.010	.637	.020
	N	25	25	25	25	25	25	25	25
VWP 01: - Its significantly important to obtain an accurate valuation of work in progress	Pearson Correlation	.147	1	.026	.209	-.075	.074	-.191	.181
	Sig. (2-tailed)	.484		.903	.316	.720	.725	.361	.387
	N	25	25	25	25	25	25	25	25
CFA 02: - CFA helps measure the profitability and financial position within budget	Pearson Correlation	.332	.026	1	.217	.268	-.021	.093	.471
	Sig. (2-tailed)	.104	.903		.298	.196	.920	.659	.017
	N	25	25	25	25	25	25	25	25
VWP 02: - Performed regularly, valuations provide a pretty good measure of how you're doing cost comparison	Pearson Correlation	.201	.209	.217	1	.143	.170	.090	-.127
	Sig. (2-tailed)	.334	.316	.298		.496	.418	.667	.547
	N	25	25	25	25	25	25	25	25
CFA 03: - It is possible to arrive at actual profit & Loss of the contract as it shows only the cash position	Pearson Correlation	.525	-.075	.268	.143	1	.475*	-.298	.176
	Sig. (2-tailed)	.007	.720	.196	.496		.017	.148	.401
	N	25	25	25	25	25	25	25	25

Table 4.9: continues

VWP 03: - Did valuation of work in progress provide a perspective on cost control of road construction	**Pearson Correlation**	**.505**	**.074**	**-.021**	**.170**	**.475**	**1**	**-.013**	**.465**
	Sig. (2-tailed)	.010	.725	.920	.418	.017		.950	.019
	N	25	25	25	25	25	25	25	25
CFA 04: - It does not give complete picture of the financial position of the project concern	Pearson Correlation	-.099	-.191	.093	.090	-.298	-.013	1	.280
	Sig. (2-tailed)	.637	.361	.659	.667	.148	.950		.175
	N	25	25	25	25	25	25	25	25
VWP 04: - Did valuation of work in progress tracks past work against a profit analysis schedule	Pearson Correlation	.462	.181	.471	-.127	.176	.465	.280	1
	Sig. (2-tailed)	.020	.387	.017	.547	.401	.019	.175	
	N	25	25	25	25	25	25	25	25

Correlation is significant at the 0.01 level (2-tailed).

Table 4.10: Correlations between Cost Value Reconciliation (CVR) and Material Management (MM)

		CVR 01: - CVR monitors and measure actual expenditure against budgeted project expenditure	MM 01: - MM helps to protect against waste and cost overrun	CVR 02: - CVR minimising current overspend	MM 02: - MM maintain minimum of cost material purchasing	CVR 03: - CVR controlling ongoing overspend	MM 03: - Project controls cost coding structure must be in place at the beginning the project to avoid confusion later on in the project	CVR 04: - CVR more accurate management of future project pricing	MM 04: - Did MM ensure smooth production operations on site
CVR 01: - CVR monitors and measure actual expenditure against budgeted project expenditure	Pearson Correlation	1	.131	.576	.477	.518	.038	.329	.294
	Sig. (2-tailed)		.532	.003	.019	.008	.856	.109	.154
	N	25	25	25	24	25	25	25	25
MM 01: - MM helps to protect against waste and cost overrun	Pearson Correlation	.131	1	-.181	.558	.058	.191	.488	.167
	Sig. (2-tailed)	.532		.387	.005	.783	.359	.013	.425
	N	25	25	25	24	25	25	25	25
CVR 02: - CVR minimising current overspend	Pearson Correlation	.576	-.181	1	.044	.803	.229	.006	.190
	Sig. (2-tailed)	.003	.387		.837	.000	.270	.977	.363
	N	25	25	25	24	25	25	25	25
MM 02: - MM maintain minimum of cost material purchasing	Pearson Correlation	.477	.558	.044	1	.184	.386	.682	.014
	Sig. (2-tailed)	.019	.005	.837		.390	.062	.000	.947
	N	24	24	24	24	24	24	24	24
CVR 03: - CVR controlling ongoing overspend	Pearson Correlation	.518	.058	.803	.184	1	.209	.095	.162
	Sig. (2-tailed)	.008	.783	.000	.390		.316	.653	.438
	N	25	25	25	24	25	25	25	25

Table 4.10: continues

		.038	.191	.229	.386	.209	1	.426*	.256
MM 03: - Project controls cost coding structure must be in place at the beginning the project to avoid confusion later on in the project	Pearson Correlation	.038	.191	.229	.386	.209	1	.426*	.256
	Sig. (2-tailed)	.856	.359	.270	.062	.316		.034	.217
	N	25	25	25	24	25	25	25	25
CVR 04: - CVR more accurate management of future project pricing	Pearson Correlation	.329	.488	.006	.682	.095	.426	1	.143
	Sig. (2-tailed)	.109	.013	.977	.000	.653	.034		.495
	N	25	25	25	24	25	25	25	25
MM 04: - Did MM ensure smooth production operations on site	Pearson Correlation	.294	.167	.190	.014	.162	.256	.143	1
	Sig. (2-tailed)	.154	.425	.363	.947	.438	.217	.495	
	N	25	25	25	24	25	25	25	25

Correlation is significant at the 0.01 level (2-tailed).

Table 4.11: Correlations between Budgetary Control (BC) and Cost Planning (CP)

		BC 01: - BC is helpful in setting targets and achievement of the targets.	CP 01: - Early cost checks ensure preliminary estimate is more accurate.	BC 02: - BC is an effective tool for cost control in road construction.	CP 02: - Rational distribution of expenditure throughout the design is achieved.	BC 03: - Effective BC results in cost control and cost reduction.	CP 03: - Cost planning provides basic information on the cost comparison between different projects.	BC 04: - BC makes financial planning and control easy.	CP 04: - Cost planning provides better chance of comparing different projects.
BC 01: - BC is helpful in setting targets and achievement of the targets	Pearson Correlation	1	.270	.538	.440	-.073	.153	.530	.303
	Sig. (2-tailed)		.192	.006	.028	.729	.465	.006	.141
	N	25	25	25	25	25	25	25	25
CP 01: - Early cost checks ensure preliminary estimate is more accurate	Pearson Correlation	.270	1	.511	.633	.193	.145	.298	.241
	Sig. (2-tailed)	.192		.009	.001	.355	.488	.149	.245
	N	25	25	25	25	25	25	25	25
BC 02: - BC is an effective tool for cost control in road construction	Pearson Correlation	.538	.511	1	.636	.043	.506	.597	.336
	Sig. (2-tailed)	.006	.009		.001	.837	.010	.002	.101
	N	25	25	25	25	25	25	25	25
CP 02: - Rational distribution of expenditure throughout the design is achieved	Pearson Correlation	.440	.633	.636	1	.014	.243	.305	.181
	Sig. (2-tailed)	.028	.001	.001		.949	.242	.139	.386
	N	25	25	25	25	25	25	25	25
BC 03: - Effective BC results in cost control and cost reduction	Pearson Correlation	-.073	.193	.043	.014	1	-.053	-.104	.261
	Sig. (2-tailed)	.729	.355	.837	.949		.802	.619	.207
	N	25	25	25	25	25	25	25	25

Table 4.11: continues

CP 03: - Cost planning provides basic information on the cost comparison between different projects	**Pearson Correlation**	**.153**	**.145**	**.506**	**.243**	**-.053**	**1**	**.388**	**.567**
	Sig. (2-tailed)	.465	.488	.010	.242	.802		.056	.003
	N	25	25	25	25	25	25	25	25
BC 04: - BC makes financial planning and control easy	Pearson Correlation	.530	.298	.597	.305	-.104	.388	1	.701
	Sig. (2-tailed)	.006	.149	.002	.139	.619	.056		.000
	N	25	25	25	25	25	25	25	25
CP 04: - Cost planning provides better chance of comparing different projects	Pearson Correlation	.303	.241	.336	.181	.261	.567	.701	1
	Sig. (2-tailed)	.141	.245	.101	.386	.207	.003	.000	
	N	25	25	25	25	25	25	25	25

Correlation is significant at the 0.01 level (2-tailed).