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Application of Cost Control Techniques in Construction Projects Delivery

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ABSTRACT

Purpose: This research work deals on the application of cost control techniques in Construction project delivery. The need for the work arose as projects suffer from cost and time overruns due to factors stemming from poor cost control during at the design and execution stages of Construction projects.

Material and Methods: This study adopted an exploratory research design using a structured questionnaire as the primary instrument for data collection. The research was conducted in Rivers State, Nigeria, known for its robust infrastructure development and relevance to the construction sector. The study population comprised public and private contractors, including civil engineers and quantity surveyors. A random sampling technique was employed to select 50 contractors, considering time and financial constraints.

Findings: The analysis of the data obtained from the respondents identified cost control techniques that include schedules, budgeting, inspection, meetings, reports, records, monitoring & evaluations, as the commonly used techniques for cost control. The study also revealed that most project managers and contractors in Port Harcourt find it difficult in controlling project costs due to problems which include delays by clients to release fund as at when due, indecision, lack of materials and equipment, bad weather, overlapping of activities, unclear and incomplete drawings, making good defective works, and generally failure to control the productivity of resources. Others of paucity were due to theft and vandalism, interference by clients, high labor turnover, and insufficient knowledge on cost control techniques.

Implications to Theory, Practice and Policy : The study therefore recommends proper knowledge and application of cost control techniques, adequate management of the cost control techniques, good site organization and reporting and adequate supervision of Construction projects should be adopted and implemented.

Keywords: *Cost Control, Control Techniques, Construction Projects, Project Delivery*

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INTRODUCTION

1.1 Background Information

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

In general, most construction projects experience time delays and cost overruns during their implementation phase (Koushki and Kartam,2004). Numerous researchers, both in the developed and developing nations have also examined and identified the causes of time and cost overrun in the construction industry. Mansfield, Ugwu and Doran (1994), for example performed a comprehensive analysis of most important factors responsible for project delays and cost overrun in Nigerian construction projects. This analysis indicated poor contract management, financing and payment of completed works, change in site conditions, shortages of materials, design changes, subcontractors and nominated suppliers, other factors were price fluctuation inaccurate estimates, delays and additional works as factors responsible for project delays and cost overrun.

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

Time impacts are inevitable on construction projects, primarily because of the uniqueness of each project and the limited resources of time and money that can be spent on planning, executing and delivering the project. Time factors are inherent in all of project construction's undertakings. Construction projects have long been recognized as particularly cost, time and risk laden. Some of the time and cost factors associated with the construction process are predictable or identifiable; others may be totally unforeseen. The constructed project may not perform as anticipated because the owner may have unrealistic expectations regarding the delivery time of construction forcing contractors into unrealistic gambles, corner-cutting or commitments that may not be realistic (Frimpong 2003). Some of the cost control techniques applicable are Cost Value Reconciliation, Project Budget, Construction Cost Forecasting, Schedule Control, Earned Value Analysis**,** Variance Analysis.

1.2 Problem Statement

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

As mentioned by Van Der Westhuizen and Fitzgerald (2005), the presence of cost overruns can be a reason for project delays or possible project failures. However, this idea has been refuted by many authors who considered that project success depends on many other factors that should be assessed to conclude the success or failure of a project (Chan, *et al.*, 2004). Moreover, there have been many studies that suggest that the success of a project depends on the presence of certain critical factors which can also change depending on the objective to be met (Iyer and Jha, 2005). In other words, some authors ascertained that there are some critical success factors that help to improve cost performance and prevent cost overruns. Cost overrun can be linked to several challenges faced by the construction sector in Nigeria like inflation and escalating Costs of Construction materials, Shortage of Skilled Labor, Corruption and Fraud, tribalism and favoritism in contract procedures, Bad Road and Infrastructural decay.

1.3 Objectives of the Study

The major objective of this study is to examine various cost control techniques used in construction projects and the effect they have on project delivery. The specific objectives of the study are:

i. To identify cost control techniques frequently used by contractors in construction projects.
ii. To examine problems encountered by contractors in managing construction project cost.
iii. To determine the impact of costcontrol techniques on the duration of construction projects.

1.4 Research Questions

In-order to guide the study and achieve the above stated research objectives, the following research questions were structured:

i. What are the cost control techniques frequently used by contractors in construction projects delivery?
ii. What are the problems faced by contractors in controlling cost in the construction project delivery?
iii. What effects do cost control techniques have on the duration of construction projectsdelivery?

1.5 Research Hypotheses

The following research hypothesis were formulated to guide this research work:

i. Ho: Cost control problems do not lead to project delivery failures.
ii. Ho: Cost Control techniques do not affect construction projects delivery time and cost

1.6 Justification of the Study

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

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

1.7 Scope and Limitations of the Study

The study will cover some selected quantity surveyors from Port Harcourt. All findings and recommendations from the study may not reflect the true view of the traditional roles and changing roles of quantity surveyors as the researcher could not cover a wider area due to financial and time constraints.

LITERATURE REVIEW

2.1 Conceptual Framework

This chapter gives an insight into various studies conducted by outstanding researchers, as well as explained terminologies with regards to the impact of cost control techniques on construction project delivery. The chapter also gives a resume of the history and present status of the problem delineated by a concise review of previous studies into closely related problems.

2.2 Cost Management and Cost Control Techniques used in the Construction Industry

Cost management is an approach used to realize decisions made for planning, controlling and developing competitive strategies, and it is noteworthy to say that making a balance between this factor and other dimensions of competition such as quality and time is required. It is the control of costs through the formal process of budget development, monitoring, and adjustment to achieve the maximum amount of work at a specified level of quality where unknowns and uncertainty may cause costs to increase beyond acceptable levels (Frimpong, 2006). "A guide to the project management body of knowledge (PMBOK guide).") PMBOK 6thEdition) considers cost management as primarily concerned with the cost of resources needed to complete project activities and would be achieved through a process involving estimating, budgeting, and cost control.

Over the years, contractors developed several cost management strategies to assist them to record all financial transactions that occur as well as giving managers an indication of the progress and problems associated with a project (Davies, 2013). Some of the strategies, tools and techniques used by contractors to manage cost are discussed below.

Some of the roles of cost management techniques in achieving project goals are:

i. Align the project's resources, timetable, and scope with the available budget and the company's goals.
ii. Track and manage the project's progress and performance in relation to the baseline plan.
iii. Determine and address the risks and problems that could have an impact on the project's budget.
iv. Maximize resource utilization and reduce waste and inefficiencies
v. Improve the caliber and worth of the project's outputs and deliverables.
vi. Boost stakeholder confidence and Client’s satisfaction**.**

2.2.1 Cost Value Reconciliation

Cost Value Reconciliation is a measurement of the actual costs involved in a project as compared against the value of the works including profit to show a bottom line, in a similar way to a balance sheet for a company. They are typically used by contractors to measure profitability and are reported to the management team, usually around the time of interim valuation of the works completed to date, and again at completion of the final account. In the construction sector, cost value reconciliation, or CVR, is crucial since it helps guarantee that a project is finished on schedule, under budget, and with the anticipated profit margins. CVR enables contractors to monitor project progress on a regular basis and make sure they are not going over or under budget. Delays, rework, and cost overruns can be avoided by identifying

any possible hazards. For the project to be completed on time, contractors must also monitor its progress. A Cost Value Reconciliation can be performed by project managers once the actual costs have been documented. Finding any differences between the baseline budget and actual costs is part of this process.

2.2.2 Project Budget

"A guide to the project management body of knowledge (PMBOK guide).") PMBOK 6thEdition) Budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline. The key benefit of this process is that it determines the cost baseline against which project performance can be monitored and controlled. Overruns in particular cost categories signal the possibility of problems and give an indication of exactly what problems are being encountered. Expense oriented construction planning and control focuses upon the categories included in the final cost estimation. This focus is particularly relevant for projects with few activities and considerable repetition such as grading and paving roadways.

For control and monitoring purposes, the original detailed cost estimate is typically converted to a project budget, and the project budget is used subsequently as a guide for management. Specific items in the detailed cost estimate become job cost elements. Expenses incurred during a project are recorded in specific job cost accounts to be compared with the original cost estimates in each category. Thus, individual job cost accounts generally represent the basic unit for cost control. Alternatively, job cost accounts may be disaggregated or divided into work elements which are related both to scheduled activities and to cost accounts. Examples of budgeting software or tools commonly used in the construction industry are Archdes, ProjectSight, Jonas Construction Software, ProEst, Clear Estimates, Sage50, Xero

2.2.3 Construction Cost Forecasting

Forecasting is used to estimate what costs will be. Forecasts can never be completely accurate but can provide a good idea of what to expect if the appropriate techniques are used. Some forecasting techniques are less accurate than others but are used to start off planning. When more detailed data becomes available, more accurate forecasting techniques can be used (Chris Hamblin 2011).

An important aspect of cost forecasting is to understand the payment system for the project based on the contractual provisions, and accordingly retrieve information from the project schedule that will help map out the funds required during the course of the project. A systematic approach to cost forecasting that involves the following steps:

i. Contract analysis
ii. Analyzing project scope of work
iii. Analyzing project payment system
iv. Developing project Work Breakdown Structure
v. Developing project Cost Breakdown Structure
vi. Integrating project schedule with cost and resource data
vii. Identifying KPIs that will enable accurate cost forecasts
viii. Performing a cost forecast that considers optimistic, pessimistic, and most likely scenarios
ix. Formulation of risk mitigation plan
x. Periodic reviews of project risk register

2.2.4 Schedule Control

Control schedule is a process in project management that involves monitoring the status of activities related to a particular project. Aside from monitoring the status, it also involves updating of the project process as well as managing the changes to the schedule to achieve the plan. Another aspect of the control schedule process is that it manages the expectations of the stakeholders by means of giving them advice when work needs to be performed including the type of work and its duration. It is carried out throughout the entire project after the schedule has been developed until all the activities have been completed.

It is important to know the actual performance of the schedule. Any schedule baseline can be approved using the Perform Integrated Change Control process. With the control schedule process, it allows project managers to determine the status of the project schedule, conducting reviews, reprioritizing remaining work plan, determining that there is indeed a change of the project schedule and managing actual changes. “A guide to the project management body of knowledge (PMBOK guide).") PMBOK 6th Edition

2.2.5 Earned Value Analysis

Earned Value analysis is a method of performance measurement. Earned Value is a program management technique that uses “work in progress” to indicate what will happen to work in the future. Earned Value is an enhancement over traditional accounting progress measures. (Milind Padalkar, Saji Gopinath* Quantitative Methods & Operations Management Indian Institute of Kozhikode, Kerala, India)

Earned Value Management integrates project scope, time and cost through periodic measurements of actual cost and work completion. It views project progress in terms of cost as a function of time against a firm baseline set up at the start of the project. When the project is originally planned, it is divided into Work Breakdown Structure (WBS) and further sub-divided into work packages. These work packages are assessed for cost estimates and scheduled in a time sequence. Taken together, WBS, master schedule and cost budgets form the baseline, represented as a graph of planned costs over time. This is the planned value (PV). It simply tells how the costs will flow over time as planned. During the project execution, actual costs (AC) and the quantum of work completed are periodically noted. The work completion is pro-rated to equivalent monetary value based on the budgetary costs for the work packages completed (work-in-progress packages are assessed on % completion).

2.2.6 Variance Analysis

Variance analysis is a tool of budgetary control by evaluation of performance by means of variances between budgeted amount, planned amount or standard amount and the actual amount incurred/sold. Variance analysis can be carried out for both costs and revenues. (Balwani, Mukesh. (2014). Construction cost monitoring through variance analysis.) A method of gathering information for decision-making, variance analysis is a component of earned value management analysis. Simply put, a variance is the difference between what was anticipated and what actually occurred.

2.3 Factors Affecting Construction Cost and Time Performance

Chan and Kumaraswamy (2002) remarked that studies in various countries appear to have contributed significantly to the body of knowledge relating to time performance in construction projects over the past three decades, while Iyer and Jha (2005) remarked that project performance in term of cost is studied since 1960s. These studies range from theoretical work based on experience of researcher on one end to structured research work on the other end.

Moreover, Pheng and Chuan (2006) stated that there have been many past studies on project performance according to cost and time factors.

Chan and Kumaraswamy (1996) stated that a number of unexpected problems and changes from original design arise during the construction phase, leading to problems in cost and time performance.

Chan (2001) identified that the best predictor of average construction time performance of public sector projects in Malaysia is T = 269 C 0.32. This relationship can serve as a convenient tool for both project managers and clients to predict the average time required for delivery of a construction project. Kuprenas (2003) stated that process of a design team meeting frequency and the process of written reporting of design phase progress were found to be statistically significant in reducing design phase costs. Otherwise, the use of project manager training and a project management based organizational structure were found to be processes that do not create a statistically significant in reducing design phase costs.

Furthermore, the results indicate that cost is a poor predictor of time performance. Chan and Kumaraswamy (2002) proposed specific technological and managerial strategies to increase speed of construction and so to upgrade the construction time performance. It is remarked that effective communication, fast information transfer between project participants, the better selection and training of managers, and detailed construction programs with advanced available software can help to accelerate the performance. Jouini et al (2004) stated that managing speed in engineering, procurement and construction projects is a key factor in the competition between innovative firms. It is found that customers can consider time as a resource and, in that case, they will encourage the contractor to improve the time performance.

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

2.4 Factors Causing Project Cost Overruns

Since the 1980s various studies have investigated the causes for project cost overruns on construction projects. Kaming, Olomolaiye, Holt & Harris (1997), who studied 31 construction projects in Indonesia, found that from a contractor's point of view, cost overruns were mainly caused by "inaccuracy of material take-off", "increase in material costs" and "cost increase due to environmental restrictions". Studying the cost overruns and delays on groundwater projects in Ghana, Frimpong, Oluwoye& Crawford (2003) contractors found that "late monthly payments from clients" were the most important cost and time delay factors, with clients ranking "poor contractor performance" as the most important cost and time delay factor. Reviewing public sector construction projects in Nigeria, Dlakwa&Culpin (1990) found that the three main reasons for cost overruns are "fluctuations in material, labour and plant costs", "construction delays" and "inadequate pre-planning".

In another study on construction projects in Nigeria conducted by Okpala&Aniekwu (1988: 238), it was found that architects, consultants and clients agreed that 'shortage of materials', 'finance and payment of completed works' and 'poor contract management' were the most important causes of cost overruns. Mansfield, Ugwu& Doran (1994: 258) studied the performance of transportation infrastructure projects in Nigeria and concluded that 'material price fluctuations', 'inaccurate estimates', 'project delays' and 'additional work' contributed

most to cost overruns. In a fourth study on construction projects in Nigeria by Elinwa&Buba (1994), it was found that 'cost of materials', 'fraudulent practices' and 'fluctuations in materials prices' Baloyi &Bekker • Causes of construction cost and time overruns had the most significant impact on project costs. During extensive studies on construction project performance in European countries, Morris & Hough (1987) as well as Flyvbjerg, Bruzelius&Rothengatter (2003) found that 'fluctuations in material cost' and 'additional work' contributed most to cost overruns.

In reviewing the literature an approach and trend towards the type of questions and results could be observed. In calculating the number of times specific types of causes for cost overruns under each category were observed, the following can be concluded:

- The most significant factor causing cost overruns due to client action is 'additional work or changes to work'. This cause was listed as a major factor in five of the seven (71%) reviewed articles.
- From a contractor's perspective the most significant contributor to cost overruns is 'time delays', listed in three of the seven (43%) reviewed articles.
- The most significant factor for cost overruns is evident from external factors and that is 'material price changes. This factor was listed in six of the seven (86%) reviewed articles.

Other common factors listed among contractors, consultants and clients were 'poor estimates and material take-off' and 'delay in payments. It can be argued that the factors mentioned do not stand alone and that the ultimate cost overruns can be a result of multiple factors contributing to the final cause for cost overruns. For example, additional work requested by a client can result in a delay in ordering material which, in the meantime, was subject to price increases or shortages. The views of clients, contractors and consultants on reasons for cost overruns could also be conflicting with stakeholders defending their operating domain and 'shifting the blame'.

2.5 Factors Causing Construction Time Delays

Unfortunately, time delays on construction projects are more the norm than the exception. Supplementing their research on the causes for cost overruns, Kaming*et al.* (1997) found that 'design changes', 'materials shortage' and 'inadequate planning' were the most significant contributors to time delays on construction projects. Ogunlana et al (1996) investigated high rise buildings and categorized their findings into client/consultant related, contractor-related and external causes for time delays.

The weighted findings among these three categories indicated that 'material shortages', 'overstretching of technical personnel' and 'design changes' were the most important causes for project delays.

Assaf, Al-Khalil & Al-Hazmi (1995) used 56 questions in three categories, namely owner, architects/engineers, and contractors, to determine the main causes of delays on large building projects in Saudi Arabia. Their survey showed that contractors believed that 'preparation of shop drawings', 'delays in contractor's progress' and 'payment by owners' were the most important factors contributing to time delays. According to architects/engineers, 'cash flow', 'subcontractors' schedules' and 'slowness of owner decision-making' caused the most delays. Finally, owners believed 'design errors', 'excessive bureaucracy in project owner organization' and 'labor shortages' contributed most to time delays.

Walker (1995) surveyed Australian project representatives and found that the most important factors that affect time delays are 'the ability of the organization to manage risk', 'planning capabilities' and 'effective resource coordination'. Kumaraswamy & Chan (1998) studied time delays on Hong Kong projects and found that 'unforeseen ground conditions', 'poor site management' and 'slow speed of decision-making' were the most prominent causes of time delays. The results from a study of 130 public projects in

Jordan by Al-Momani (2000) indicated that 'poor design and negligence by the owner', 'change orders' and 'poor weather and site conditions' contributed most to delays. Al-Khalil & Al-Ghafly (1999) studied public utility projects in Saudi Arabia and found that contractors considered 'delay in claim settlement', 'slow decision-making' and 'delays in progress payments' as the most important delay factors. Owners believed that 'poor early planning', 'scope changes' and 'financial difficulties by the contractors' were the major causes of delay. The consultants somehow supported the owners' views by indicating 'financial difficulties by the contractor', 'improper contract knowledge' and 'ineffective planning' as the most significant delay factors.

Odeh &Battaineh (2002) used only two points of view, namely contractors and consultants, to determine the causes of project Baloyi &Bekker,causes of construction cost and time overruns delays in Jordan. The results showed that contractors believed that 'poor labor productivity', 'owner interference' and 'inadequate contractor experience' were the three most important causes of delays. The consultants, however, indicated 'inadequate contractor experience', 'late payment of completed work' and 'poor subcontracting' to be the main causes of delay. The inclusion of 'late payment of completed work' as a cause for delay referred to the result of late payment on continuing site activities and contractors halting work unless payment for completed work had been processed after the agreed date.

Studying the significant factors that cause delay of construction projects in Malaysia, Alaghbari, Kadir, Salim &Ernawati (2007) used four categories for analysis, namely contractor, consultant, owner and external. As far as causes related to contractor actions are concerned, 'financial problems', 'shortage of materials' and 'poor site management' were ranked among the top three. Owner causes included 'delayed payments', 'slow decision-making' and 'contract scope changes. The top three consultant causes were 'poor supervision', 'slowness to give instructions' and 'lack of experience'.

Finally, external causes of delay included 'shortage of materials', 'poor site conditions' and 'lack of equipment and tools in the market'. Faridi& El-Sayegh (2006) studied project delays in the United Arab Emirates and found that the three main causes of project delays were 'preparation and approval of drawings', 'inadequate early planning of the project' and 'slowness of owner's decision-making processes.

2.6 Summary of literature review and research gap

Since Engineering and architectural designs poses cost management problems in Nigeria and clients have not been able to pull value from projects handled by contractors. In most cases, projects are abandoned due to inability to control cost.

Studies conducted on construction project delivery and its relationship to cost control techniques reveal that determining project success varies with every project and perspectives (Davies, 2013), there is no established framework or specific criterion for judging construction project success which makes it difficult to measure (Griffin and Page, 1996; Chen et al, 2010; Hughes, Tippet and Thomas, 2003; Schenhar et al, 2003).

Studies confirm that, optimally integrating a PDS and the efforts of project management from the start, delivers expected project outcomes, particularly the achievement of "sustainability goals" (Mollaoglu-Korkmaz, Swarup & Riley, 2011p. 71). Way (2005) in his "framework of soft landings", introduces a systematic way of ensuring sustainability of projects by integrating feedback of "continual assessment" of project design into the operation phase (Way, 2005; BSRIA, 2009 p.8). Therefore, in theory, regardless of the PDS adopted, positive project outcomes should be achieved when projects participants ensure effective project management practices (De Wit, 1988).

Before selecting a project delivery method, you probably will have a basic understanding of why and what you are building. However, having a firm understanding of the foundations of your project before selecting a delivery method will aid your final decision. In general, start comparing the criteria that are most important to your project's success:

- Design: what the final project will look like and how it will function
- Budgeting and Cost Estimating
- Risks: exposure to danger, financial loss and harm to the brand
- Schedule: a timetable for completion and payments
- Owner Expertise: company's experience in similar projects.

2.6.1 Design

You might have a basic idea of how your project will look, but it's important to visualize both the general design and functionality of your building. How do you want your campus and floorplan to flow? Are you looking for innovative designs and complex over form and function? Buildability will depend, in part, on the kind of design and construction team you choose. Also, think about unique features of your construction site, including existing landscaping and the overall look of adjacent properties.

2.6.2 Budgeting and Cost Estimating

Set budget as soon as possible, then discuss it with potential design and construction team members to learn whether the figure is realistic. During this process, consider how much wiggle room is available for change orders, most likely an inevitable occurrence once a project is underway and can be costly if not well planned. When estimating budget, remember that your architect and contractor likely will build some construction software costs into their budgets. Keep in mind that while these tools might be an upfront cost, they are designed to speed up delivery and reduce costs. Cost estimation and budgeting are essential tools for planning in the construction industry and play a central role in both preconstruction and construction phases of a project. Best practices dictate a total project budget should be developed as early as possible in a project

There are two ways to properly evaluate the construction cost of the project at this early phase. The first is to retain a professional cost estimator to prepare the Schematic Design construction estimate. The second that is to engage a suitable general contractor early to perform preconstruction services, for which preparing budgets is a key deliverable. In either method the professional cost estimator or general contractor develops a project cost model by carefully going through the SD drawings, scope narrative and asking detailed construction questions of the project architect and team in order to fully understand the intended scope of the project. Evaluate potential contractors by their honesty and transparency in their budget projections.

Remember, what matters most is not what a contractor budgets based on the pre-construction set of drawings, but the eventual complete construction cost when the contractor turns over the keys. Therefore, we gravitate to general contractors who are honest and transparent in the construction bidding process, preparing budgets and conservative in their projections. This is much better than a contractor who over-promises and under-delivers, providing unachievable budgets early in order to get the job. If you are an owner, beware of people who tell you what they think you want to hear. Projects generally cost more than you think and take longer to accomplish. The construction manager's job is to ensure the contractor's pricing is thorough and conservative so that you can make sound economic decisions.

2.6.3 Risks

Too many construction risks can result in increased costs and even project failure. Therefore, a thorough risk evaluation should be conducted before a project begins. One key question to answer regarding risk concerns is who will be liable for design problems that result in dangers during and beyond construction? Additionally, if you're considering a project delivery method in which your in-house team will be heavily involved in administering the project, consider your responsibility for reducing gaps in construction services and stages.

2.6.4 Schedule

Accurately estimating a construction schedule is crucial for project performance. Keep in mind that schedule and cost are closely tied to each other; speeding up construction translates to increased costs. What kind of timing is necessary to meet your expected schedule and costs? Sometimes owners require the ability to fast-track construction before all drawings and support plans, such as engineering documents, are complete. Furthermore, sometimes schedules are estimated too ambitiously, setting up a project for an inevitable overrun and unhappy stakeholder. Regardless, it's much easier to avoid disputes and claims if plans are firmly in place before breaking ground

2.6.5 Owner Expertise

Finally, consider your company's level of familiarity with construction, especially a project similar regarding scope and size, as well as how many staff members are capable of helping to oversee the process. Be aware that some construction delays are caused by bottlenecks at the owner level. Ensuring that the project has the right amount of personnel, in addition to having the expertise, will set the project up for smooth sailing and success. While extensive expertise is not critical to a project's success, it will certainly help indicate what type of delivery method is needed.

MATERIAL AND METHODS

3.1 Research Design

According to Asika (2009), research designs are often referred to as the structuring of investigation aimed at identifying variables and their relationships to one another. In this study, questionnaire serves as useful guide to the effort of generating data for this study. The questionnaire is a survey method and it is exploratory research.

3.2 Area of the Study

The study area for this research is River's state in southern Nigeria. The choice of Rivers state as the study area is because since the creation of the state, it has enjoyed the benefits of being the fulcrum of the southern part of the country and being the treasure base of the country. Rivers state is built with many roads, estates, government establishments, IOC's, all kinds of private developments, schools, hospitals, theaters, shopping malls, hotels to mention a few. All these

infrastructures are the handiwork of construction. As such there cannot be a better place to obtain data for this study.

3.3 Population of the Study

The population of study consists of public and private contractors involving civil engineers and quantity surveyors in Rivers State.

3.4 Sample of the Study

Random sampling technique was used in selecting 50 contractors from the entire population. This was chosen due to the financial strength of the researcher coupled with time constraints.

3.5 Instrument for Data Collection

These are the tools or methods used in getting data from respondents. In this study, questionnaires and interview are research instruments used. Questionnaire is the main research instrument used for the study to gather necessary data from the sample respondents. The questionnaire is structured type and provides answers to the research questions and hypotheses therein. This instrument is divided and limited into two sections; Section A and B. Section A deals with the personal data of the respondents while Section B contains research statement postulated in line with the research question and hypothesis in chapter one. Options or alternatives are provided for each respondent to pick or tick one of the options.

3.6 Reliability and Validity of Instrument

Reliability means the accuracy of precision of a measuring instrument while validity means the extent to which the research instrument measures what it is supposed to measure. In order to determine the reliability and validity of the study, the test-retest method was used. To have a valid instrument, the questions in the questionnaire will be free from ambiguity (i.e the questions will not be too complex). To have reliable instrument, the questionnaire will be followed with interview of sample of respondents to know whether their view on the subject.

3.7 Techniques of Data Analysis

Having gathered the data through the administration of questionnaire, the collected data will be coded, tabulated, and analysed according to the research question and hypothesis.

In order to analyse the data collected effectively and efficiently for easy management and accuracy, the simple percentage method was the analytical tools used for this research project and a sample size of two hundred (200) will be represented by 100% for easy analysis of the responses. Also, Chi-square statistical analytical method will be used in the research work chi-square as a statistical technique is used in testing of hypothesis so as to predict what the relationship between two variables should be. It is used in drawing and reaching conclusion by collecting the observed values from the questionnaire administered to respondents, testing the degree of freedom and carrying out a decision in determining the critical value of the hypothesis.

The formula being

$$X^2 = \frac{(F0-FE)^2}{FE}$$

Where O = Observed Frequency

E = Expected Frequency

The X^2 value obtained from the formula is compared with the value of tabulated X^2 for a given significance level and degree of freedom.

FINDINGS

4.1 Presentation of Data and Analysis

Table 1 Age Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-30	5	10.0	10.0	10.0
	31-60	40	80.0	80.0	90.0
	61 and above	5	10.0	10.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2023

Table 1 shows the age distribution of the respondents. 5 respondents representing 10% fall between the ages of 18-30 years, 40 respondents representing 80% fall between ages 31-60, while 5 respondents representing 10% are 61 years and above.

This shows that majority of the respondents are between the ages 31 to 60 years as indicated above.

Table 2 Gender Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	45	90	92.0	92.0
	Female	5	10	8.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2023

Table 2 shows the gender distribution of the respondents used for the study. 46 respondents making 92% are male, while the remaining 4 respondents representing 8% are female. This clearly shows that male respondents are the majority for the study.

Table 3: Category of Contractors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public Sector	1	2.0	2.0	2.0
	Private sector	49	98.0	98.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 3 clearly shows the category of contractors used for the study. Respondent representing 2% works for the public sector, while the remaining 49 respondents representing 98% are private contractors/surveyors. This clearly shows that majority of the respondents used for the study are contractors/quantity surveyors who work in the private sector i.e they own their own firms.

Table 4: Educational Background of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	OND	1	2.0	2.0	2.0
	HND/BSC	41	82.0	82.0	84.0
	Masters	3	6.0	6.0	90.0
	PhD	1	2.0	2.0	92.0
	Professional	4	8.0	8.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 4 shows educational background of the respondents. 1 respondent representing 2% is an OND holder, 41 respondents representing 82% are HND/B.Sc. Holders, 3 respondents representing 6% are Masters holders, another respondent representing 2% is a Doctorate Degree holder, while the remaining 4 respondents own various professional degrees and diplomas in their various capacities.

This strongly suggests that the respondents are well educated as majority own degree awards from tertiary institutions and professional bodies in Nigeria. This goes ahead to validate the qualification of the selected respondents for this study as they will give accurate and un-biased insights into cost control techniques and project delivery in Nigeria.

Table 5 Years of Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5 Years	3	6.0	6.0	6.0
	6-10 Years	44	88.0	88.0	94.0
	11-30 Years	3	6.0	6.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 5 shows the years of working experience of the respondents. 3 respondents representing 6% have worked between 1 to 5 years, 44 respondents representing 88% have gotten 6-10 years of experience, while the remaining 3 respondents representing 6% have gotten 11-30 years of working experience.

This goes ahead to further validate the suitability of the selected respondents for the study, as majority have gained wealth of experience in the construction industry.

Table 6: Have you Successful Embarked and Delivered a Construction Project Successfully?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	100.0	100.0	100.0

Source: Field Survey, May 2020

Table 6 seeks to find out the failure-success ratio of the respondents in terms of successful construction projects carried out. All 50 respondents representing 100% indicated that they have successfully carried out a construction project in the various fields of work.

Table 7 If 'Yes' are you Aware of the Various Cost Control Techniques Used in Construction Projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	100.0	100.0	100.0

Source: Field Survey, May 2020

Table 7 shows responses gotten when the respondents were asked about their level of awareness on the various cost control techniques used in the construction industry. All respondents who indicated earlier on that they have successfully undertaken a construction project indicated that they are aware of the various cost control techniques used in the construction industry. This also shows the qualification of the respondents for this study as all of the respondents are well embraced with the various cost control techniques.

Table 8 If 'Yes' Do You Apply these Techniques when Undertaking a Construction Project?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	70.0	70.0	70.0

Source: Field Survey, May 2020

Table 8 shows the application of cost control techniques by the respondents. All the 50 respondents representing 70% indicated that they apply cost control techniques when embarking on a construction project.

Table 9 Who is Responsible for the Development of these Cost Control Techniques?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quantity Surveyor	41	82.0	82.0	82.0
	Accountant	8	16.0	16.0	98.0
	Project manager	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

Source: Field Survey, May 2020

Table 9 shows the individual or agency responsible for the development of the cost control plans. 41 respondents representing 82% indicated that the quantity surveyor is responsible for the development and implementation of a cost control plan, while 8 respondents representing 16% indicated the accountant, while the remaining 1 respondent representing 2% indicated that the project manager is responsible for cost control techniques and plans.This clearly shows that the quantity surveyor is the major individual responsible for the development and implementation of a cost control technique/plan for a construction project as indicated by the respondents.

Table 10 Cost Control Techniques Adopted

		Responses	
		N	**Percent**
Valid	Budget and Cash Forecasting	50	37.9%
	variance Analysis	16	12.1%
	Cost Value Reconciliation	32	24.2%
	Earned Value Analysis	7	5.3%
	Cost Scheduling	27	20.5%
Total		132	100.0%

Source: Field Survey, May 2020

Table 10 shows the various cost control techniques employed by the respondents for the study in a multiple response format (Since two or more cost control techniques could be adopted by a respondent). All 50 respondents representing 100% of the total population/case have employed the budget and cash forecasting techniques, 16 respondents in the same population/case representing 32% have adopted the Variance analysis cost control technique, 32 respondents representing 64% have adopted the Cost value reconciliation technique, while another 7 have adopted the Earned Value Analysis technique, another 27 respondents have adopted the Cost scheduling technique.

This clearly shows that majority of the respondents apply the budget and forecast cost control techniques when undertaking construction projects.

Table 11 As a Contractor do You Encounter Problem(S) when Managing the Cost of Construction?

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	50	100.0	100.0	100.0

Source: Field Survey, May 2020

Table 11 shows responses from respondents when asked if the encounter cost control problems during the construction project phase. Al the respondents representing 100% indicated that they encounter cost control problems when embarking on a construction project.

Table 12: Which of these Problems are Mostly Encountered by Contractors?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Labour Related Problems	7	14.0	14.0	14.0
	Cost Estimate Problems	13	26.0	26.0	40.0
	Variations in Cost	13	26.0	26.0	66.0
	Design Errors	13	26.0	26.0	92.0
	Material Related Problems	4	8.0	8.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 12 shows cost control challenges/problems encountered by the respondents used for the study. 7 respondents representing 14 % have labour cost related problems, 13 respondents representing 26% have cost estimates problems, 13 respondents representing 26% have variation in cost problems, another 13 respondents representing 26% have design error problems, while the remaining 4 respondents representing 8% have materials related problems.

Table 13: Cost Control Problems Encountered in the Construction Process

		Responses		
		N	Percent	Percent of Cases
Valid	Labour Related problems	15	30%	300.0%
	Cost Estimate problems	15	30%	30.0%
	Design Error	10	20%	20%
	Cost Control System problems	5	10%	10%
	Cost Scheduling	5	10%	10%
Total		**50**	**100.0%**	**100%**

Source: Field Survey, May 2020

Table 13 shows multiple responses on the cost control problems the respondents encounter during the construction project process. All the respondents representing 15 of the population/case indicated labour related problems and cost estimation problems. 10 of the same population indicated design error, 5 respondents indicated Cost Control System problem, while others numbering 5 indicated Cost scheduling as a problem.

Table 14 Can Cost Control Problems Lead to Construction Projects Delivery Failure?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	49	98.0	98.0	98.0
	Agree	1	2.0	2.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 14 shows the effect of the identified problems in table 12 above on the delivery of a construction project. 49 respondents representing 98% indicated that final cost is affected, while the remaining respondent representing 2% indicated that final cost is not affected. This

implies that cost related problems encountered during construction projects add up to the final cost of a construction project.

Table 15 Do Cost Control Techniques Affect Delivery of a Construction Project?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	32	64.0	64.0	64.0
	Agree	17	34.0	34.0	98.0
	Neutral	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

Source: Field Survey, May 2020

Table 15 shows the effect of cost control techniques on the construction project. 32 respondents representing 64% strongly agree that cost control techniques affect the construction project, 17 respondents representing 34% agree, while the remaining respondent representing 2% was neutral on the subject matter. This implies that there is a strong relationship between cost control techniques and the construction project delivery as majority of the respondents strongly agree that cost control techniques employed for a construction project can affect its delivery.

Table 16 What Major Components Facilitate a Construction Project?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Labour	25	50.0	50.0	50.0
	Material	17	34.0	34.0	84.0
	Organization	5	10.0	10.0	94.0
	Stakeholders	3	6.0	6.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 16 highlights the major components that facilitate a construction project. 25 respondents representing 50% indicated labour, 17 respondents representing 34% indicated materials, 5 respondents representing 10% indicated the organization, while the remaining 3 respondents representing 6% indicated the stakeholders.

Table 17 Are Cost Control Techniques Applied within these Components?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	100.0	100.0	100.0

Source: Field Survey, May 2020

Table 17 shows responses on whether cost control techniques are being applied in the construction component. All 50 respondents indicated “Yes”.

Table 18 Have Cost Control Techniques Affected Labor?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	49	98.0	98.0	98.0
	No	1	2.0	2.0	100.0
	Total	**50**	**100.0**	**100.0**	

Source: Field Survey, May 2020

Table 18 shows the effect of cost control technique on labor. 49 respondents indicated that cost control technique has effect on labor, while the remaining respondent representing 2% indicated otherwise.

Table 19 How have Labor been Affected?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Money is adequately budgeted for wages and salaries	22	44.0	44.9	44.9
	Wages are paid on time	14	28.0	28.6	73.5
	Workers are paid early, hence motivation for work is increased and project delivered on time	13	26.0	26.5	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Source: Field Survey, May 2020

Table 19 shows the various ways in which labour has been been affected by cost control techniques. 22 respondents representing 44% indicated that money is adequately budgeted for wages and salaries, 14 respondents representing 28% indicated that Wages are paid on time, 13 respondents representing 26% indicated that Workers are paid early, hence motivation for work is increased and project delivered on time.

Table 20 Have Material been Affected?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	100.0	100.0	100.0

Source: Field Survey, May 2020

Table 20 shows the effect of cost control technique on labor. All 50 respondents indicated that cost control technique has effect on Materials management.

Table 21 How have Material for Construction been Affected?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quality Materials are sourced for at cheaper prices	23	46.0	46.9	46.9
	Needed materials are adequately budgeted for	14	28.0	28.6	75.5
	wastages are minimized	12	24.0	24.5	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Source: Field Survey, May 2020

Table 21 highlights the effect of cost control techniques on materials management in the construction project. 23 respondents representing 46% indicated that quality materials are sourced at cheaper prices, 14 respondents representing 28% indicated that needed materials are adequately budgeted for, while the remaining 1 respondent indicated that wastages are minimized. One respondent failed to answer this question.

4. 2 Tests of Hypotheses

Having given a careful analysis of the responses, the hypothesis earlier formulated in chapter one of this study are approached using chi-square at 0.05 (5%) level of significance.

Hypothesis One

i. HO_1: Cost control problems do not lead to project delivery failures.

Hi: Cost control problems do lead to project delivery failures.

Question 1 Cost Control Problems Lead to Construction Project Delivery Failure

Variables	0	E	0-E	$(0-E)^2$	$(0-E^2)/E$
Strongly Agree	49	10	39	1521	152.1
Agree	1	10	-9	81	8.1
Neutral	0	10	-10	100	10.0
Disagree	0	10	-10	100	10.0
Strongly Disagree	0	10	-10	100	10.0
Total	50				190.2

From the value, X^2C= 190.2, X^2T at 0.05 with df=4 is 9.49

Decision

Since the test statistics X^2C= 190.2 is greater than the actual value X^2T = 9.49, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted which states that Cost Control problems lead to construction project delivery failures.

Hypothesis Two

ii. **Ho_2:** Cost Control techniques affect construction delivery timing and cost.

Hi: Cost Control techniques do not affect construction delivery timing and cost.

Question 2 Cost Control Technique Affect the Final Cost and Time of a Construction Project

Variables	0	E	0-E	$(0-E)^2$	$(0-E^2)/E$
Strongly Agree	32	10	22	484	48.4
Agree	17	10	7	49	4.9
Neutral	1	10	-10	100	10.0
Disagree	0	10	-10	100	10.0
Strongly Disagree	0	10	-10	100	10.0
Total	50				83.3

From the value, X^2C= 83.3, X^2T at 0.05 with df=4 is 9.49

Decision

Since the test statistics X^2C= 83.3 is greater than the actual value X^2T = 9.49, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted which states that Cost Control techniques affect cost and time of a construction project.

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study observed that in most cases, contractors' efforts to manage projects costs are centered on management of project resources. This resource-centric strategy premised on materials, plant and labor resources management is founded on the principle that resources consumption stimulates building project costs. Statistical analysis performed through chi-square test at 95% shows that: cost reports, cost estimating and budgeting, variance analysis, cost value reconciliation and resources management are the significant factors employed by contractors to manage costs on construction projects in Nigeria. However, despite the existence of these strategies, most contractors admit that their projects would, in most cases, end with a cost overrun. This may be inferentially explained by a host of challenges affecting cost management practice.

Whereas several challenges were observed with respect to cost management, it is labor related challenges, materials related challenges and organizational problems that impact significantly on cost management practice. The study also observed that the cost management process in Nigeria, like in other developing countries in Africa and elsewhere is still dominated by the traditional paper-based system or 'prematurely' developed automated systems of managing project cost information. In a nutshell, the problem in Nigeria is not about having the strategies to manage costs but relates to 'flawed' implementation. The findings of this research suggest that the strategies instituted to manage project cost and, the challenges to such practice are not significantly different from the ones in other developing countries.

The construction industry is a key industry to economic growth of any nation providing shelter for economic and social activities including on-site and off-site infrastructure to facilitate the smooth functioning of these activities. The industry does not only touch on the lives of virtually everyone daily; it occupies a fundamental national position in many national economies – hence the importance of this research. The study aimed at examining the impact of cost control techniques on construction projects and the challenges contractors face when implementing these cost control techniques.

5.2 Recommendations

To improve on the effectiveness of contractors' cost management strategies in Nigeria, the research recommends that contractors pay particular attention to problem areas that significantly affect cost management (labour, material and organisational related challenges), engagement of experienced cost management personnel or upgrading of staff's professional ingenuity through conventional training, refresher courses or participation in seminars; and regular review of cost management systems and strategies. The industry can also take advantage of advancement in ICTS to automate their cost information management systems. This study has provided baseline information on the strategies used to manage project cost and related challenges; however, further research is needed to assess the effectiveness of these strategies to manage project cost.

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